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ПЕРСПЕКТИВНІ НАУКОВІ НАПРЯМИ ДОСЛІДЖЕНЬ ЗА ТЕМАТИКОЮ «ВІЙСЬКОВО-МОРСЬКІ СИЛИ»

Науково-аналітична записка

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Перспективні наукові напрями досліджень за тематикою «Військово-Морські Сили»: науково-аналітична записка / Т.В. Писаренко, Т.К. Кваша, О.Ф.Паладченко, І.В.Молчанова. – Київ: УкрІНТЕІ, 2025. – 117 с.

Викладено результати дослідження перспективних світових наукових напрямів досліджень за тематикою «Військово-Морські Сили» на основі даних бази Web of Science Core Collection (WoS) за 2019-2024 рр. Дослідження здійснено з метою можливого врахування отриманих результатів при розробленні та прийнятті відповідних рішень щодо наукових і технологічних напрямів досліджень, технічного переоснащення, модернізації та реформування оборонно-промислового комплексу України.

Розраховано на представників органів державної влади, наукових працівників, інженерних кадрів, викладачів закладів вищої освіти, аспірантів і студентів відповідних спеціальностей.

ЗМІСТ

ВСТУП

Україна – морська держава, яка має найбільшу серед держав Азово-Чорноморського басейну довжину морського узбережжя.

Перетворення України на потужну морську і річкову державу, розбудова військово-морського потенціалу, достатнього для стримування потенційних агресорів з морських та річкових напрямків, відновлення й розвиток морського і річкового потенціалу України є одним із пріоритетів морської безпеки України як невід'ємної складової забезпечення національної безпеки України.

Серед цілей України у справі забезпечення морської безпеки - підвищення спроможності складових сектору безпеки і оборони України, зокрема Військово-Морських Сил Збройних Сил України та Морської охорони Державної прикордонної служби України для ефективної протидії агресії та адекватного реагування на інші загрози морській безпеці України, їх усунення або мінімізації.

Стратегією морської безпеки України визначено такі важливі завдання:

- побудова збалансованих Військово-Морських Сил з усіма родами військ (сил), які будуть спроможні забезпечити гарантоване виконання завдань, як під час відбиття збройної агресії з морського напрямку, так і в мирний час;
- нарощування спроможностей сил безпеки і сил оборони шляхом оснащення морськими безекіпажними апаратами (системами, комплексами) різних класів та морськими безпілотними літальними апаратами (комплексами) різного призначення;
- інноваційний розвиток наукового і виробничого потенціалу оборонно-промислового комплексу України для забезпечення потреб морського та річкового секторів[1].

Військово-Морські Сили Збройних Сил України – це вид Збройних Сил України, який відповідно до чинного законодавства виконує покладені на нього завдання щодо оборони України, захисту її суверенітету, територіальної цілісності та недоторканності.[2]

До основних складових Військово-Морських Сил (ВМС) входять: бойові кораблі, підводні човни, авіаносці, мінно-тральні кораблі, безпілотні морські системи та берегова артилерія.

Бойові кораблі – багатоцільові кораблі, ракетні катери, артилерійські, десантні кораблі, що здатні самостійно та у взаємодії з іншими родами сил

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[1] Стратегія морської безпеки України. Затверджено Указом Президента України від 17 липня 2024 року №468/2024. URL : https://zakon.rada.gov.ua/laws/show/468/2024#n5

[2] Положення про корабельну службу у Військово-Морських Силах Збройних Сил України. Затверджено Наказом Міністра оборони України 25.11.2003 N 415. Зареєстровано в Міністерстві юстиції України 17 грудня 2003 р. за N 1170/8491. URL : https://zakon.rada.gov.ua/laws/show/z1170-03#Text

флоту виконувати різні завдання. Вони можуть бути озброєні ракетною, артилерійською, торпедною зброєю та засобами протиповітряної оборони.

Підводні човни – атомні та дизель-електричні підводні човни, які виконують різноманітні завдання, включаючи протичовнову боротьбу. Оснащені сучасним озброєнням, які здатні наносити удари ракетами по берегових об'єктах противника, знищувати його бойові надводні кораблі та підводні човни, а також транспорт із військами і вантажем.

Авіаносці – великі військові кораблі, які слугують мобільною авіабазою, призначеною для перевезення та запуску літальних апаратів. Вони мають злітно-посадкову палубу, ангари для зберігання літаків та допоміжні засоби для їх обслуговування, заправки та управління польотами. Авіаносці є ключовими елементами ударних груп і дозволяють військово-морським силам швидко концентрувати значні сили в будь-якій точці світу.

Мінно-тральні кораблі – військові кораблі спеціального призначення, головним завданням яких є пошук, виявлення та знищення морських мін, а також забезпечення безпеки судноплавства. До них належать тральщики та мисливці за мінами. Тральщики проходять мінні поля, знищуючи міни за допомогою спеціальних пристроїв – тралів. Мисливці за мінами виявляють і знешкоджують поодинокі міни, використовуючи сонари та дистанційно керовані апарати.

Безпілотні морські системи – керовані дистанційно апарати, які діють на морі без екіпажу на борту, включаючи надводні та підводні дрони. Вони використовуються для розвідки, штурмових операцій, мінування та інших завдань завдяки своїй багатофункціональності та здатності долати великі відстані.

Берегова артилерія – різновид морської артилерії (нарівні з корабельною артилерією), призначений для захисту військово-морських баз, торговельних портів, промислових і адміністративних центрів, розташованих в прибережному районі, найважливіших ділянок узбережжя та островів від нападу противника з моря. Крім того, на берегову артилерію покладається завдання оборони проток і вузин, щоб не допустити прохід ними кораблів противника, а також захист оборонних мінних загороджень, прибережних комунікацій і завдання з протидесантної оборони [3].

Дослідження наукометричної активності щодо напрямів розвитку Військово-Морських Сил у світі проведено станом на вересень 2025 р. на платформі бази даних Web of Science (WoS) із використанням БД WoS Core Collection за тематикою «Військово-Морські Сили» для публікацій,

[3] Тактика військово-морських сил. Авторський колектив: керівник колективу – кандидат військоих наук, Харитонов О.Л. / Навчальний посібник // Інститут військово-морських сил. Одеса, 2017. URL https://ivms.mil.gov.ua/wp-content/uploads/2020/10/%D0%9F%D0%BE%D1%81%D1%96%D0%B1%D0%BD%D0%B8%D0%BA-%D0%A2%D0%90%D0%9A%D0%A2%D0%98%D0%9A%D0%90-%D0%92%D0%9C%D0%A1-2017.pdf

інформація яких не становить державну таємницю. Аналіз наявної інформації виконаний щодо складових Військово-Морських Сил на основі таких критеріїв пошуку: розширений пошук; усі мови; усі типи документів; з 2019 по 2024 рік.

Мета дослідження – визначити перспективні напрями розвитку наукового дослідження за тематикою «Військово-Морські Сили» та її складовими для можливого врахування отриманих результатів при розробленні та прийнятті відповідних рішень щодо наукових і технологічних напрямів досліджень, технічного переоснащення, модернізації та реформування оборонно-промислового комплексу України.

1. Наукометрична активність за складовими Військово-Морських Сил та галузями досліджень

Загальна кількість публікацій за 2019-2024 рр. за вказаною тематикою у світі становила 5505 одиниць.

У 2024 р. *кількість публікацій* склала 1094 одиниці, що у 1,4 разу більше цього ж показника за 2019 р. Публікаційна активність у світі за вказаною тематикою у період 2019-2024 рр. щорічно зростала в межах 806-1094 одиниць.

Кількість цитувань публікацій за визначений період становила 46424 од., щорічно зростаючи з 496 у 2019 р. до 17307 у 2024 р., тобто збільшилася майже у 34,9 разу.

Частка публікацій від вибірки *в розрізі складових* військово-морських сил склала:

- «Бойові кораблі» – 10,4% (від загальної кількості відібраних публікацій);
- «Підводні човни» – 3,9%;
- «Авіаносці» – 3,1%;
- «Мінно-тральні кораблі» – 7,2%;
- «Безпілотні морські системи» – 73,8%;
- «Берегова артилерія» – 1,6%.

За результатами дослідження протягом 2019-2024 рр. за вказаною тематикою було виокремлено 7 *галузей досліджень*:

- інженерія – 30,5% (від загальної кількості відібраних публікацій);
- океанографія – 23,5%;
- інформатика – 16,7%;
- система автоматизованого управління – 14,2%;
- телекомунікації – 7,1%.
- інструменти – 5,1%;
- матеріалознавство – 2,9%.

Найвищі індекси цитування у 2019-2024 рр. відмічені за такими галузями дослідження: «Інженерія» – 4503,7%, «Океанографія» – 4451,9% та «Системи автоматизованого управління» – 4423,6% (рис. 1).

Рис. 1 Індекси цитування у світі за галузями дослідження тематики «Військово-Морські Сили», 2019-2024 рр., %

Джерело: розроблено авторами на основі даних бази Web of Science

1.1 Наукометрична активність за складовою Військово-Морських Сил «Бойові кораблі»

У табл. 1 наведена наукометрична активність за складовою Військово-Морських Сил *«Бойові кораблі»* в розрізі галузей дослідження.

Таблиця 1 - Тенденції наукометричної активності у світі за складовою Військово-Морських Сил «Бойові кораблі» в розрізі галузей дослідження, 2019-2024 рр.

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
Інженерія	Китай, США, Республіка Корея	UNITED STATES NAVY (США), WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), KOREA MARITIME OCEAN UNIVERSITY (Республіка Корея)	137,5	8900,0	**68,7**

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
Океанографія	Китай, США, Республіка Корея	WUHAN UNIVERSITY OF TECHNOLOGY (Китай), UNITED STATES NAVY (США), KOREA MARITIME OCEAN UNIVERSITY (Республіка Корея)	220,0	8800,0	**8,2**
Інформатика	Китай, Республіка Корея, США	NORTHWESTERN POLYTECHNICAL UNIVERSITY (Китай), WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), KOREA NATL DEF UNIV (Республіка Корея), UNITED STATES NAVY (США)	166,7	7100,0	**8,2**
Системи автоматизованого управління	Китай, Республіка Корея, США	WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), KOREA INSTITUTE OF MACHINERY MATERIALS KIMM (Республіка Корея), PUSAN NATIONAL UNIVERSITY (Республіка Корея), UNITED STATES NAVAL ACADEMY (США),	400,0	1300,0	**5,1**
Телекомунікації	Китай, Республіка Корея, Велика Британія	WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), ETRI ELECT TELECOMMUN RES INST (Республіка Корея), CRANFIELD UNIVERSITY (Велика Британія)	500,0	1700,0	**2,8**
Інструменти	Китай, Велика Британія, Бельгія	JINAN UNIVERSITY (Китай), UNIVERSITY OF LIVERPOOL (Велика Британія), UNIVERSITY OF WARWICK (Велика Британія), GHENT UNIVERSITY (Бельгія)	400,0	2600,0	**1,2**
Матеріалознавство	Китай, Франція, Польща	HARBIN ENGINEERING UNIVERSITY (Китай), CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (Франція), NICOLAUS COPERNICUS UNIVERSITY (Польща)	550,0	1218,2	**5,8**

Джерело: розроблено авторами на основі даних бази Web of Science

Найбільша частка кількості публікацій від загальної кількості публікацій за складовою «Бойові кораблі» належить галузі дослідження «Інженерія» – 68,7%, найменша – галузі дослідження «Інструменти» – 1,2%. У трійку світових країн-лідерів за кількістю публікацій входять Китай, Республіка Корея, США.

Найвищий індекс публікацій 2024/2019 рр. має галузь дослідження «Матеріалознавство» – 550,0%; найвищий індекс цитування 2024/2019 рр. – «Інженерія» – 8900,0,%.

1.2 Наукометрична активність за складовою Військово-Морських Сил «Підводні човни»

За складовою Військово-Морських Сил «*Підводні човни*» наукометрична активність у розрізі галузей дослідження представлена у табл.2.

Таблиця 2 - Тенденції наукометричної активності у світі за складовою Військово-Морських Сил «Підводні човни» в розрізі галузей дослідження за 2019-2024 рр.

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
Інженерія	Китай, США, Індія	HARBIN ENGINEERING UNIVERSITY (Китай), WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), UNITED STATES NAVY(США), HINDUSTAN INSTITUTE OF TECHNOLOGY SCIENCE (Індія)	216,7	2000,0	**56,7**
Океанографія	Китай, Норвегія, США	UNIVERSITETET I STAVANGER (Норвегія), HARBIN ENGINEERING UNIVERSITY (Китай), SHANGHAI JIAO TONG UNIVERSITY (Китай), OREGON STATE UNIVERSITY (США)	250,0	4600,0	**10,1**
Інформатика	Китай, США, Італія	NATIONAL UNIVERSITY OF DEFENSE TECHNOLOGY CHINA (Китай), NORTHEASTERN UNIVERSITY CHINA (Китай), CORNELL UNIVERSITY (США), LEONARDO SPA (Італія)	350,0	1175,0	**12,9**
Системи автоматизованого управління	Китай, Німеччина, Італія	BEIJING HIWING SCI TECHNOL INFORMAT INST (Китай), FRAUNHOFER IOSB (Німеччина), LEONARDO SPA (Італія)	200,0	700,0	**2,3**
Телекомуні-кації	Китай, Індія, Італія	GUANGZHOU UNIVERSITY (Китай), CENT UNIV BILASPUR (Індія), MBDA ITALY (Італія)	600,0	850,0	**7,4**
Інструменти	Китай, Канада, Російська Федерація	HARBIN INSTITUTE OF TECHNOLOGY (Китай), DEF RES DEV CANADA ATLANTIC (Канада), YAROSLAV THE WISE NOVGOROD STATE	300,0	2100,0	**3,2**

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
		UNIVERSITY (Російська Федерація)			
Матеріало-знавство	Китай, Канада, Республіка Корея	HARBIN INSTITUTE OF TECHNOLOGY (Китай), ROYAL MILITARY COLLEGE CANADA (Канада), SEJONG UNIVERSITY (Республіка Корея)	500,0	4550,0	**7,4**

Джерело: розроблено авторами на основі даних Web of Science

Найбільша частка кількості публікацій від загальної кількості публікацій за складовою «Підводні човни» належить галузі дослідження «Інженерія» – 56,7%, найменша – галузі дослідження «Системи автоматизованого управління» – 2,3%. У трійку світових країн-лідерів за кількістю публікацій входять Китай, США, Індія.

Найвищий індекс публікацій 2024/2019 рр. має галузь «Телекомунікації» – 600,0%; найвищий індекс цитування 2024/2019 рр. – «Океанографія» – 4600,0%.

1.3 Наукометрична активність за складовою Військово-Морських Сил «Авіаносці»

За складовою Військово-Морських Сил «*Авіаносці*» наукометрична активність у розрізі галузей дослідження представлена у табл. 3.

Таблиця 3 - Тенденції наукометричної активності у світі за складовою Військово-Морських Сил «Авіаносці» в розрізі галузей дослідження, 2019-2024 рр.

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
Інженерія	Китай, США, Індія	INDIAN INSTITUTE OF TECHNOLOGY SYSTEM IIT SYSTEM (Індія), BEIHANG UNIVERSITY (Китай), UNITED STATES NAVY (США)	137,5	1633,3	**65,3**
Океанографія	Іспанія, США, Китай	UNIVERSIDAD POLITECNICA DE MADRID (Іспанія), RUTGERS UNIVERSITY NEW BRUNSWICK (США), NATIONAL UNIVERSITY OF DEFENSE TECHNOLOGY CHINA (Китай)	133,3	533,3	**7,6**
Інформатика	Китай, Індія, Республіка Корея	BEIHANG UNIVERSITY (Китай), AP SHAH INST TECHNOL (Індія), SEOUL	600,0	2900,0	**8,8**

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
		NATIONAL UNIVERSITY SNU (Республіка Корея)			
Системи автоматизованого управління	Китай, Індія, США	AP SHAH INST TECHNOL (Індія), BEIHANG UNIVERSITY (Китай), UNIVERSITY OF CALIFORNIA SYSTEM (США)	133,3	2700,0	**5,9**
Телекомунікації	Китай, Російська Федерація, США	BEIHANG UNIVERSITY (Китай), MOSCOW AUTOMOBILE ROAD CONSTRUCTION STATE TECHNICAL UNIVERSITY MADI (Російська Федерація), UNIVERSITY OF NEW ORLEANS (США)	400,0	1200,0	**8,2**
Інструменти	Китай, США	JIANGSU UNIVERSITY OF SCIENCE TECHNOLOGY (Китай), ZHEJIANG UNIVERSITY (Китай), RUTGERS UNIVERSITY NEW BRUNSWICK (США)	100,0	500,0	**1,8**
Матеріалознавство	Китай, Індія, Республіка Корея	BEIHANG UNIVERSITY (Китай), SMR EAST COAST COLL ENGN TECHNOL (Індія), YONSEI UNIVERSITY (Республіка Корея)	200,0	2800,0	**2,4**

Джерело: розроблено авторами на основі даних Web of Science

Найбільша частка кількості публікацій від загальної кількості публікацій за складовою «Авіаносці» належить галузі дослідження «Інженерія» – 65,3%, найменша – галузі дослідження «Інструменти» – 1,8 %. У трійку світових країн-лідерів за кількістю публікацій входять Китай, США, Індія.

Найвищий індекс публікацій 2024/2019 рр. має галузь «Інформатика» – 600,0%; найвищий індекс цитування 2024/2019 рр. – також «Інформатика» – 2900,0%.

1.4 Наукометрична активність за складовою Військово-Морських Сил «Мінно-тральні кораблі»

За складовою Військово-Морських Сил «*Мінно-тральні кораблі*» наукометрична активність у розрізі галузей дослідження представлена у табл.4.

Таблиця 4 - Тенденції наукометричної активності у світі за складовою Військово-Морських Сил «Мінно-тральні кораблі» в розрізі галузей дослідження, 2019-2024 рр.

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
Інженерія	США, Італія, Китай	UNITED STATES NAVY (США), ISTITUTO DI INGEGNERIA DEL MARE INM CNR (Італія), HARBIN ENGINEERING UNIVERSITY (Китай)	126,7	2144,4	**75,9**
Океанографія	США, Італія, Китай	ISTITUTO DI INGEGNERIA DEL MARE INM CNR (Італія), UNIVERSITY OF MICHIGAN (США), DALIAN MARITIME UNIVERSITY (Китай)	250,0	5900,0	**6,0**
Інформатика	США, Китай, Франція	GEORGIA INSTITUTE OF TECHNOLOGY (США), CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (Франція), BEIJING UNIVERSITY OF POSTS TELECOMMUNICATIONS (Китай)	250,0	2050,0	**11,8**
Системи автоматизованого управління	США, Ірак, Румунія	GEORGE WASHINGTON UNIVERSITY (США), AMERICAN UNIVERSITY OF IRAQ SULAIMANI (Ірак), DUNAREA DE JOS UNIVERSITY GALATI (Румунія)	200,0	1100,0	**1,0**
Телекомунікації	Китай, Іспанія, Італія	CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS CSIC (Іспанія), UNIVERSIDAD POLITECNICA DE MADRID (Іспанія), BEIHANG UNIVERSITY (Китай), UNIVERSITY OF TRENTO (Італія)	300,0	425,0	**2,3**
Інструменти	Китай, Румунія, Республіка Корея	MARINE DESIGN RESEARCH INSTITUTE OF CHINA MARIC (Китай), JIANGSU UNIVERSITY OF SCIENCE TECHNOLOGY (Китай), DUNAREA DE JOS UNIVERSITY GALATI (Румунія), KYUNGPOOK NATIONAL UNIVERSITY KNU (Республіка Корея)	100,0	900,0	**1,0**
Матеріалознавство	Китай, Індія, Республіка Корея	DALIAN INSTITUTE OF CHEMICAL PHYSICS CAS (Китай), INDIAN INSTITUTE OF TECHNOLOGY IIT JODHPUR (Індія), KYUNG HEE UNIVERSITY (Республіка Корея)	150,0	6300,0	**2,0**

Джерело: розроблено авторами на основі даних Web of Science

Найбільша частка кількості публікацій від загальної кількості публікацій за складовою «Мінно-тральні кораблі» належить галузі дослідження «Інженерія» – 75,9%, найменша – галузям дослідження «Системи автоматизованого управління» та «Інструменти» – по 1,0 %. У трійку світових країн-лідерів за кількістю публікацій входять США, Італія, Китай.

Найвищий індекс публікацій 2024/2019 рр. має галузь «Телекомунікації» – 300,0%; найвищий індекс цитування 2024/2019 рр. – «Матеріалознавство» – 6300,0%.

1.5 Наукометрична активність за складовою Військово-Морських Сил «Безпілотні морські системи»

За складовою Військово-Морських Сил «*Безпілотні морські системи*» наукометрична активність у розрізі галузей дослідження представлена у табл.5.

Таблиця 5 - Тенденції наукометричної активності у світі за складовою Військово-Морських Сил «Безпілотні морські системи» в розрізі галузей дослідження, 2019-2024 рр.

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
Інженерія	Китай, США, Республіка Корея	HARBIN ENGINEERING UNIVERSITY (Китай), DALIAN MARITIME UNIVERSITY (Китай), UNITED STATES NAVY (США), KOREA MARITIME OCEAN UNIVERSITY (Республіка Корея)	164,1	4627,5	**44,2**
Океанографія	Китай, США, Велика Британія	HARBIN ENGINEERING UNIVERSITY (Китай), STATE UNIVERSITY SYSTEM OF FLORIDA(США), UNIVERSITY OF SOUTHAMPTON (Велика Британія)	218,2	4411,9	**19,5**
Інформатика	Китай, США, Республіка Корея	DALIAN MARITIME UNIVERSITY (Китай), HARBIN ENGINEERING UNIVERSITY (Китай), MASSACHUSETTS INSTITUTE OF TECHNOLOGY MIT (США), UNITED STATES NAVY (США), KOREA ADVANCED INSTITUTE OF SCIENCE TECHNOLOGY KAIST (Республіка Корея)	162,0	3164,1	**12,8**
Системи автоматизованого управління	Китай, США, Індія	DALIAN MARITIME UNIVERSITY (Китай), HARBIN ENGINEERING UNIVERSITY (Китай),	166,7	4440,7	**12,0**

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
		VIRGINIA POLYTECHNIC INSTITUTE STATE UNIVERSITY (США), INDIAN INSTITUTE OF TECHNOLOGY SYSTEM IIT SYSTEM (Індія)			
Телекомуні-кації	Китай, США, Республіка Корея	HARBIN ENGINEERING UNIVERSITY (Китай), TSINGHUA UNIVERSITY (Китай), UNIVERSITY OF HOUSTON SYSTEM (США), KYUNG HEE UNIVERSITY (Республіка Корея)	217,1	2483,1	**5,5**
Інструменти	Китай, США, Республіка Корея	HARBIN ENGINEERING UNIVERSITY (Китай), PURDUE UNIVERSITY IN INDIANAPOLIS (США), KOREA MARITIME OCEAN UNIVERSITY (Республіка Корея)	224,2	3585,3	**4,3**
Матеріало-знавство	Китай, США, Республіка Корея	DALIAN MARITIME UNIVERSITY (Китай), BALL STATE UNIVERSITY (США), KOREA INSTITUTE OF OCEAN SCIENCE TECHNOLOGY KIOST (Республіка Корея), KOREA MARITIME OCEAN UNIVERSITY (Республіка Корея)	200,0	2361,5	**1,7**

Джерело: розроблено авторами на основі даних Web of Science

Найбільша частка кількості публікацій від загальної кількості публікацій за складовою «Безпілотні морські системи» належить галузі дослідження «Інженерія» – 44,2%, найменша – галузі дослідження «Матеріалознавство» – 1,7 %. У трійку світових країн-лідерів за кількістю публікацій входять Китай, США, Республіка Корея.

Найвищий індекс публікацій 2024/2019 рр. має галузь «Інструменти» – 224,2%; найвищий індекс цитування 2024/2019 рр. – галузь «Інженерія» – 4627,5%.

1.6 Наукометрична активність за складовою Військово-Морських Сил «Берегова артилерія»

За складовою Військово-Морських Сил «*Берегова артилерія*» наукометрична активність у розрізі галузей дослідження представлена у табл.6.

Таблиця 6 - Тенденції наукометричної активності у світі за складовою Військово-Морських Сил «Берегова артилерія» в розрізі галузей дослідження, 2019-2024 рр.

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
Інженерія	Китай, Республіка Корея, Велика Британія	WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), BEIJING INSTITUTE OF TECHNOLOGY (Китай), KOREA ADVANCED INSTITUTE OF SCIENCE TECHNOLOGY KAIST (Республіка Корея), CRANFIELD UNIVERSITY (Велика Британія)	300,0	6000,0	**45,2**
Океанографія	Китай, Велика Британія, Республіка Корея	HARBIN ENGINEERING UNIVERSITY (Китай), CRANFIELD UNIVERSITY (Велика Британія), KOREA ADVANCED INSTITUTE OF SCIENCE TECHNOLOGY KAIST (Республіка Корея)	100,0	200,0	**2,4**
Інформатика	Китай, Велика Британія, Республіка Корея	WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), CRANFIELD UNIVERSITY (Велика Британія), INHA UNIVERSITY (Республіка Корея)	600,0	1400,0	**19,1**
Системи автоматизованого управління	Китай, Республіка Корея, Велика Британія	NORTHWESTERN POLYTECHNICAL UNIVERSITY (Китай), WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), AGENCY OF DEFENSE DEVELOPMENT ADD REPUBLIC OF KOREA (Республіка Корея), CRANFIELD UNIVERSITY (Велика Британія)	700,0	1900,0	**20,2**
Телекомунікації	Китай, Велика Британія, Туреччина	WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), CRANFIELD UNIVERSITY (Велика Британія), GAZI UNIVERSITY (Туреччина)	200,0	600,0	**8,3**
Інструменти	Китай, Республіка Корея, Велика Британія	HARBIN ENGINEERING UNIVERSITY (Китай), INHA UNIVERSITY (Республіка Корея), CRANFIELD UNIVERSITY (Велика Британія)	100,0	100,0	**2,4**
Матеріалознавство	Китай, Велика Британія, Республіка Корея	WUHAN NAVAL UNIVERSITY OF ENGINEERING (Китай), CRANFIELD UNIVERSITY (Велика Британія), INHA	100,0	500,0	**2,4**

Галузі дослідження	Країни з найбільшою кількістю публікацій	Організації з найбільшою кількістю публікацій	Індекс публікацій (2024/2019 рр.), %	Індекс цитування (2024/2019 рр.), %	Частка публікацій від загальної кількості публікації галузі дослідження, %
		UNIVERSITY (Республіка Корея)			

Джерело: розроблено авторами на основі даних Web of Science

Найбільша частка кількості публікацій від загальної кількості публікацій за складовою «Берегова артилерія» належить галузі дослідження «Інженерія» – 45,2%, найменша – галузям дослідження «Океанографія», «Інструменти» та «Матеріалознавство» – по 2,4%. У трійку світових країн-лідерів за кількістю публікацій входять Китай, Республіка Корея, Велика Британія.

Найвищий індекс публікацій 2024/2019 рр. має галузь «Системи автоматизованого управління» – 700,0%; найвищий індекс цитування 2024/2019 рр. має галузь «Інженерія» – 6000,0%.

ВИСНОВКИ

1. Дослідження публікаційної активності за період 2019-2024 рр. дало можливість визначити перспективні напрями розвитку складових в галузях дослідження за тематикою «Військово-Морські Сили» та її складовими відповідно:

– *Бойові кораблі* – у галузях досліджень «Океанографія», «Інструменти», «Телекомунікації», «Системи автоматизованого управління», «Матеріалознавство»;

– *Підводні човни* – у галузях досліджень «Океанографія», «Матеріалознавство», «Інструменти», «Інженерія», «Інформатика», «Телекомунікації», «Системи автоматизованого управління»;

– *Авіаносці* – у галузях досліджень «Інформатика», «Матеріалознавство», «Телекомунікації»;

– *Мінно-тральні кораблі* – у галузях досліджень «Океанографія», «Інформатика», «Системи автоматизованого управління», «Телекомунікації»;

– *Безпілотні морські системи* – у галузях досліджень «Океанографія», «Інструменти», «Телекомунікації», «Матеріалознавство»;

– *Берегова артилерія* – у галузях досліджень «Інженерія», «Системи автоматизованого управління», «Інформатика», «Телекомунікації».

2. У сфері «Військово-Морські Сили» найбільше публікацій спостерігається за галуззю науки «Інженерія», на другому місці галузь «Океанографія», на третьому – «Інформатика».

Найбільший вплив/найбільший інтерес викликають публікації за галузями «Інженерія», «Океанографія» та «Системи автоматизованого управління».

3. У розрізі складових сфери «Військово-Морські Сили»:

- найбільше публікацій / найбільша частка досліджень спостерігається за складовими «Безпілотні морські системи» – 4063 од. або 73,8% від загальної кількості відібраних публікацій, «Бойові кораблі» – 573 од. або 10,4%, «Мінно-тральні кораблі» – 396 од. або 7,2%;

- найбільший інтерес для наукового середовища має тематика за складовою «Бойові кораблі» з найвищим індексом цитування – 8900,0% («Інженерія»), («Океанографія» – 8800,0% та «Інформатика» – 7100,0%).

При цьому за всіма складовими Військово-Морських Сил здійснюються дослідження за галуззю «Телекомунікації», на другому місті за популярністю знаходяться галузі «Океанографія», «Системи автоматизованого управління» та «Матеріалознавство».

4. Отже, за складовими сфери «Військово-Морські Сили» з найвищими частками публікацій найбільш популярними є дослідження за галуззю науки «Інженерія» (складова «Безпілотні морські системи»), а найбільш впливовими/цитованими – публікації за галузями «Інженерія», «Океанографія» та «Інформатика» (складова «Бойові кораблі»). Крім того, популярними галузями є «Телекомунікації» та «Матеріалознавство».

5. Тематичне спрямування найбільш цитованих публікацій в означених галузях у сфері «Військово-Морські Сили»:

«Інженерія» – виявлення несправностей у морських корабельних енергетичних системах і постійного струму; придушення інфрачервоного випромінювання; виявлення пошкоджень від підводного вибуху в ближній зоні; ізогеометричний підхід до аналізу динамічної реакції двовикривленої магнітоелектропружної композитної пологої оболонки, що піддається вибуховому навантаженню;

«Океанографія» – дослідження реакції відкритої плавучої тонкої конструкції на підводну вибухову бульбашку; пошкодження балки корпусу в умовах руйнування вибухової бульбашки; моделювання турбулентності, турбулентного повітряного сліду корабля; прогнозування реакцій підкріплених плит, що піддаються підводному вибуху, на основі машинного навчання; керування підводним роботом для очищення корпусу корабля;

«Інформатика» – дослідження інтерактивної прихованої атаки на голосові помічники з використанням ультразвукових хвиль; методи глибокого навчання для розпізнавання цілей на кораблях з використанням оптичних даних дистанційного зондування; еволюційна квантова нейронна архітектура для покращення квантової нейронної мережі; ШІ для ідентифікації типу та зброї військових кораблів; електричний надводний бойовий корабель;

«Телекомунікації» – система автоматичного розпізнавання та ідентифікації типу/класу військових кораблів, у т.ч. на основі щільності шуму та

покращеної згорткової нейронної мережі; нечітке керування безпілотними надводними апаратами; гнучкі антени; захищені оптичні мережі; технології зв'язку на підводних човнах, у т.ч. підводні бездротові оптичні системи зв'язку; передача даних на основі стільникової кластеризації; робот-розвідник підводних мін; адаптивні підводні мережі; заглушення радіолокаторів; моделювання бою протикорабельних ракет та зовнішніх пасивних перешкод; Інтернет речей;

«Матеріалознавство» – графенові нанопластини; карбонізовані волокна люфи; пористий вуглець, легований азотом; сталь, зокрема корабельна; покриття сталі матеріалами з танталом; покриття з оксиду графену; сплави з титаном, міддю та латунню; броня з алюмінієвих сплавів; композити – волокно-армовані пластикові; полімерні, армовані волокнами; з кремнієм, магнієм, літієм (C/C-SiC та MgH2-LiH), вольфрамом; біонічні вуглецево-армовані пластикові композити, гофровані сендвіч-структури з металевою піною. А також технічний текстиль, 3D-друк.

6. Визначені перспективні напрями розвитку наукового дослідження за тематикою «Військово-Морські Сили» та її складовими у разі потреби можна використати при розробленні та прийнятті відповідних рішень щодо наукових і технологічних напрямів досліджень, технічного переоснащення, модернізації та реформування оборонно-промислового комплексу України.

Додаток А

Перелік публікацій з найбільшою кількістю цитування за тематикою «Військово-Морські Сили» (2019-2024 рр.)

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
БОЙОВІ КОРАБЛІ				
Інженерія				
1	Короткочасне перетворення Фур'є: кластерний аналіз для моніторингу імпульсного навантаження постійного струму та виявлення несправностей у морських корабельних енергетичних системах	STFT Cluster Analysis for DC Pulsed Load Monitoring and Fault Detection on Naval Shipboard Power Systems. Maqsood, A.; Oslebo, D.; Corzine, K.; Parsa, L.; Ma, Y. IEEE TRANSACTIONS ON TRANSPORTATION ELECTRIFICATION. 2020. Volume 6. Issue 2. Page 821-831.	Current trends in Naval shipboard power system architecture indicate that the electrification of future warships is inevitable, and it will be equipped with loads that draw periodic pulsed currents from the dc microgrid or have large transients while switching state. In order to monitor the operation of those loads, solely time-based features are not enough as they do not provide sufficiently unique information to differentiate various transient stages of the load profile. The focus of more recent research has been on extracting time-frequency features. However, no comprehensive solution exists that could work for any general load profile. The proposed load monitoring and fault detection method presented in this article outlines a data clustering-based approach to extract unique feature vectors from short-time Fourier transform analysis for any pulsed load. These features can then be used to identify various events in the load transient as well as shunt faults and series arcing faults. Implementation and performance of the scheme for several load profiles and fault scenarios are included.	https://www.webofscience.com/wos/woscc/full-record/WOS:000545438200039
2	Чисельний аналіз захоплення повітря та температури на виході реального масштабу конічного пристрою придушення інфрачервоного випромінювання	Numerical analysis of air entrainment and exit temperature of a real scale conical infrared suppression (IRS) device. Ganguly, VR; Dash, SK. INTERNATIONAL JOURNAL OF THERMAL SCIENCES. 2020. Volume 156.	A numerical analysis has been performed on a real-scale infrared suppression device to estimate the air entrainment and corresponding temperature drop of the exhaust gases flowing through it. The analysis of the IRS device is done for the exhaust of a gas turbine plant installed on a naval warship. The operational data used in the analysis has been taken from LM2500 series gas turbine from GE. The numerical method solves the three dimensional, incompressible Navier-Stokes equations, the mass continuity equation and the two-equation based eddy viscosity model for the turbulent k-epsilon equations along with the energy equation in the flow field. The effect of using different number of nozzles at the gas turbine exit on the air entrainment and the exit plume temperature has been discussed. The results show that the maximum air entrainment and minimum plume temperature can be	https://www.webofscience.com/wos/woscc/full-record/WOS:000621410600017

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			achieved by using four to six numbers of nozzles. The air entrainment and the exit plume temperature are also affected by the pitch circle diameter of the nozzle placement. The maximum air entrainment and minimum exit temperature is achieved at a pitch circle diameter of 1.6 m. The air entrainment considerably increases with the nozzle-exit Reynolds number (Re). The higher Reynolds number also ensures the minimum plume temperature at the exit of IRS device. Air entrainment gradually reduces with the nozzle protrusion. The highest entrainment is observed when the nozzles are flush with the bottom plane of the IRS device. However, the nozzle protrusion does not affect the exit plume temperature significantly. The funnel overlap height adversely affects the performance of the IRS device i.e. the air entrainment continuously decreases with increasing funnel overlap height. Moreover, increasing funnel overlap also causes the exit plume temperature to rise considerably.	
3	Виявлення несправностей постійного струму та моніторинг імпульсного навантаження за допомогою автоенкодерів довгої короткочасної пам'яті з вейвлет-перетворенням	DC Fault Detection and Pulsed Load Monitoring Using Wavelet Transform-Fed LSTM Autoencoders. Ma, Y.; Oslebo, D.; Maqsood, A.; Corzine, K. IEEE JOURNAL OF EMERGING AND SELECTED TOPICS IN POWER ELECTRONICS. 2021. Volume 9. Issue 6. Page 7078-7087.	The extensive deployment of power electronics loads in naval ship power systems indicates the ship electrification is inevitable in future trends. Next-generation warships require high-power density weapons drawing pulse power from the dc grid. A particularly concerning issue is that these pulse loads draw large currents in short periods of time, similar to fault behavior, and maybe indiscernible from a fault. This article proposed a novel machine learning-based algorithm-long short-term memory (LSTM) recurrent neural network (RNN)-based autoencoder (AE) networks to detect dc faults and monitor load conditions applied to naval pulse loads. The novel load monitoring solution presented herein can be applied to any load profile that exhibits repetitive transients during normal operation. The frequency-domain features of the load current are extracted under wavelet transform for the network training to set the network weights and biases. Once the network training is completed, the LSTM RNN-based AE will produce both signal classification and signal reconstruction of the pulse load based on wavelet features of input current. Any faults should yield large reconstruction errors for protective action. Finally, the method is demonstrated in experimental results.	https://www.webofscience.com/wos/woscc/full-record/WOS:000724514500058
4	Характеристики пошкодження від провисання балки корпусу з трапецієподібним поперечним перерізом, що піддавалася підводному вибуху в ближній зоні	Sagging damage characteristics of hull girder with trapezoidal cross- section subjected to near-field underwater explosion. Li, HT; Zheng, XY; Zhang, C.; Mei, ZY; Bai, XF; Liu, K.	To investigate the overall damage characteristics and failure modes of a warship subjected to an un-derwater non-contact near-field explosion, a hull girder with a trapezoidal cross-section was designed, manufactured, and tested. The design criteria and parameters were determined according to the simi-larity criterion. Dynamic responses of the girder freely floating on water were obtained under varying conditions, including stand-off distance, charge mass, and position of	https://www.webofscience.com/wos/woscc/full-record/WOS:000971620300001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		DEFENCE TECHNOLOGY. 2023. Volume 21. Page 1-13.	attack. Damage morphologies of the girder model were obtained. Based on our analysis, basic conditions for sagging damage of the hull girder are proposed. The aim of this study was to determine an efficient method of attack resulting in the most severe damage to the ship hull. The experimental results show that the girder mainly exhibits a first-order response when the first wet frequency of the girder is close to the frequency of the explosion bubble pulsation. The largest deformation was observed when the underwater explosion occurred directly below the midspan of the girder compared to other explosions of the same intensity at different attack positions. When the ratio of stand-off to maximum bubble radius (lambda) satisfies 0.7 <= lambda<2, the bubble mainly causes sagging damage instead of hogging. As lambda decreases (1 <= lambda<2), the sagging damage increases under the same charge mass. However, as lambda decreases further (0.7 <= lambda<1), the sagging deformation decreases. This is likely due to the impact of the liquid jet formed by the collapsing bubble, which causes the girder deformation to shift from sagging back to hogging deformation. The initial shock wave excites the high-frequency response of the girder structure but contributes very little to the overall velocity and displacement. However, bubble pulsation typically causes a low-frequency response, which will affect the velocity and displacement of the girder. The low-pressure region of the flow field formed by bubble pulsation and resonant coupling between the girder and the bubble are the predominant causes of damage to the overall girder structure.	
5	Ізогеометричний підхід до аналізу динамічної реакції двовикривленої магнітоелектропружної композитної пологої оболонки, що піддається вибуховому навантаженню	An isogeometric analysis approach for dynamic response of doubly-curved magneto electro elastic composite shallow shell subjected to blast loading. Tu, PH; Ke, TV; Trai, VK; Hoai, L. DEFENCE TECHNOLOGY. 2024. Volume 41. Page 159-180.	For the first time, the isogeometric analysis (IGA) approach is used to model and analyze free and forced vibrations of doubly-curved magneto-electro-elastic (MEE) composite shallow shell resting on the viscoPasternak foundation in a hygro-temperature environment. The doubly-curved MEE shallow shell types include spherical shallow shell, cylindrical shallow shell, saddle shallow shell, and elliptical shallow shell subjected to blast load are investigated. The Maxwell equation and electromagnetic boundary conditions are used to determine the vary of the electric and magnetic potentials. The MEE shallow shell's equations of motion are derived from Hamilton's principle and refined higher-order shear theory. Then, the IGA method is used to derive the laws of natural frequencies and dynamic responses of the shell under various boundary conditions. The accuracy of the model and method is verified through reliable numerical comparisons. Aside from this, the impact of the input parameters on the free and forced vibration of the doubly-curved MEE shallow shell is examined	https://www.webofscience.com/wos/woscc/full-record/WOS:001359081000001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			in detail. These results may be useful in the design and manufacture of military structures such as warships, fighter aircraft, drones and missiles.	
Океанографія				
1	Експериментальне та числове дослідження динамічної реакції спрощеної відкритої плавучої тонкої конструкції, що піддається впливу підводної вибухової бульбашки	Experimental and numerical investigation on the dynamic response of a simplified open floating slender structure subjected to underwater explosion bubble. Gan, Ню; Liu, LT; Yao, XL; Wang, JX; Wu, WB. OCEAN ENGINEERING. 2021. Volume 219, 108308.	A simplified open floating slender structure is used to investigate the dynamic behaviors of the warship in this paper. The deformation and damage mechanisms of the simplified open floating slender structure subjected to the underwater explosion are studied using the experiment and the Coupled Eulerian-Lagrangian (CEL) method. Firstly, a validation for the CEL method is carried out, where the numerical results agree well with the results in experiment. Subsequently, in order to analyze the deformation and damage characteristics of the simplified open floating slender structure subjected to the underwater explosion, a series of cases for different detonation distances and different charge weights are carried out. In the cases, the results indicate that the deformation and damage of the simplified open floating slender structure are mainly induced by the bubble, and the damage induced by the shock wave is not obvious. For small charge weight and large detonation distance, the whipping motion is the main deformation form of the simplified open floating slender structure. When the charge weight increases or the detonation distance decreases to a critical value, the simplified floating slender structure is damaged in a longitudinal bending mode with a plastic hinge generated in the middle region.	https://www.webofscience.com/wos/woscc/full-record/WOS:000604928100054
2	Дослідження загальних характеристик пошкодження балки корпусу в умовах руйнування вибухової бульбашки	Research on overall damage characteristics of a hull girder under explosion bubble collapse. Gan, N.; Yao, XL; Liu, LT; Xiao, W.; Wang, XL. OCEAN ENGINEERING. 2019. Volume 188, 106315.	The deformation mechanism of warships subjected to underwater explosion is very important to the survivability assessment of warships. Therefore, in this study the deformation mechanism of a hull girder similar to a real warship structure subjected to underwater explosion loads has been investigated experimentally and numerically. In addition, the non-spherical effect of underwater explosion bubble is considered. The experiment is conducted in a water pool of underwater explosion, and the numerical calculation is carried out through the Coupled Eulerian-Lagrangian (CEL) algorithm. Then the validation of the method is conducted and numerical results agree well with the experimental results. After that, the detailed discussions on the overall damage characteristics of a hull girder under explosion bubble collapse are implemented. Finally, a series of cases are conducted to investigate the response of the hull girder under different underwater explosion conditions. By analyzing the experimental and numerical results, conclusions can be drawn that with detonation distances decrease, the deformation form of the hull girder converts rigid-body motion to whipping and a plastic hinge generates. When the charge weights are	https://www.webofscience.com/wos/woscc/full-record/WOS:000490045500057

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			in a certain range, the dynamic responses of the hull girder are similar for different charge weights with same dimensionless distance.	
3	Порівняльна оцінка моделювання турбулентності за допомогою нестаціонарних рівнянь Нав'є-Стокса усереднених за Рейнольдсом, масштабно-адаптивного моделювання та моделювання окремого вихору для прогнозування характеристик повітряного сліду від масивно відокремлених кораблів	Comparative assessment of URANS, SAS and DES turbulence modeling in the predictions of massively separated ship airwake characteristics. Shukla, S.; Singh, SN; Sinha, SS; Vijayakumar, R. OCEAN ENGINEERING. 2021. Volume 229, 108954.	An early assessment of the ship airwake characteristics is one of the most challenging tasks associated with the designing of vessels. The design of warship superstructures has traditionally followed the basic polyhedron shape (box type structures) to achieve the desired stealth capability. However, presence of such a box shape bluff superstructure generates massively separated airwake over the ship helodeck region. This airwake results into complex flow phenomena which carry strong velocity gradients in space and time, along with widely varying turbulence length scales. Under such conditions, the launch and recovery of a shipboard helicopter operations are very hazardous. Thus, an accurate assessment of the resultant ship airwake flow phenomena at early design stages is desirable. We present a comparative time-accurate assessment study in order to gain a better understanding of the capability of the Unsteady Reynolds-Averaged Navier-Stokes (URANS), the Scale-Adaptive Simulation (SAS) and the Detached Eddy Simulation (DES) turbulence models in predicting turbulent ship airwake characteristics. Detailed comparisons are conducted with respect to the in-house experimental data. Results show that the DES and SAS produce nearly similar trends of the mean flow properties when compared to the experimental results. However, comparisons of velocity spectra indicate that SAS can resolve the dominant large-scale turbulent flow structures with less computational burden. Further, this study also attempts to compare the variation of mean flow quantities with steady RANS approach in order to quantify the percentage variation between the predictions of the steady and unsteady turbulence modelling approach.	https://www.webofscience.com/wos/woscc/full-record/WOS:000648525500025
4	Прогнозування реакцій підкріплених плит, що піддаються підводному вибуху, на основі машинного навчання	Predictions of the responses of stiffened plates subjected to underwater explosion based on machine learning. Kong, XS; Gao, H.; Jin, ZY; Zheng, C.; Wang, YW. OCEAN ENGINEERING. 2023. Volume 283, 115216.	Underwater explosions can cause significant damage to ship structures, and quickly assessing the extent of the damage is crucial for improving warship combat capability. This paper proposes the use of machine learning algorithms to rapidly assess the damage of stiffened plates subjected to underwater explosions. The algorithms use structural responses of the plates obtained by numerical simulations, which are benchmarked by experimental results, as a database. Fractures and plastic deformations are both taken into consideration. The support vector machine algorithm is used to determine the criterion for fractures or plastic deformations, while a back propagation neural network model and a support vector regression model are both used to predict the plastic deformation and fracture area of the plates. The support vector machine model accurately classified different cases of	https://www.webofscience.com/wos/woscc/full-record/WOS:001032660700001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			fractures or plastic deformation with a training accuracy of 99.4%. The back propagation neural network model has regression values of 0.99 for predicting fractures and 0.97 for predicting plastic deformation, both of which are higher than those predicted by the support vector regression model (0.96 for the prediction of fracture and 0.90 for the prediction of plastic deformation). Therefore, the back propagation neural network model provides a more accurate assessment of damage to stiffened plates subjected to underwater explosions and can be used for rapid assessment.	
5	Проектування та керування підводним роботом для очищення корпусу корабля	Design and climbing control of an underwater robot for ship hull cleaning. Chen, LP; Cui, RX; Yan, WS; Xu, H.; Zhao, HY; Li, HQ. OCEAN ENGINEERING. 2023. Volume 274, 114024.	Underwater robot has significant potential to clean the fouling on the ship hull. The design of robotic solution as well as control scheme is, however, still challenging. The use of negative pressure and magnetic adsorption technologies in cleaning robots will severely limit their utility in rough hulls and warships. Here we propose an underwater cleaning robot that driven by six thrusters and two crawler belts. The key advantage of our robot is that thrusters can provide enough and reliable adhesive forces to adapt to more common hulls. Furthermore, we present a climbing controller to track the planned coverage path that can guide the robot covering the ship hull without repetition and omission. The difficulties lie in two aspects: inconsistency between two crawler belts and inaccurate depth measurement that caused by changing wave near the water surface. Here we use velocities of crawler belts and pitch angle of the robot to replace the inaccurate depth measurement, and then design a consensus-based sliding mode controller to relieve the inherent inconsistency for tracking the coverage path accurately. Finally, field experimental results on giant ship verify the effectiveness of the presented robotic solution and controller.	https://www.webofscience.com/wos/woscc/full-record/WOS:000948933400001
Інформатика				
1	SurfingAttack: Інтерактивна прихована атака на голосові помічники з використанням ультразвукових хвиль	SurfingAttack: Interactive Hidden Attack on Voice Assistants Using Ultrasonic Guided Waves. Yan, QB; Liu, KH; Zhou, Q.; Guo, HQ; Zhang, N. 27TH ANNUAL NETWORK AND DISTRIBUTED SYSTEM SECURITY SYMPOSIUM. 2020.	With recent advances in artificial intelligence and natural language processing, voice has become a primary method for human-computer interaction. It has enabled game-changing new technologies in both commercial sectors and military sectors, such as Siri, Alexa, Google Assistant, and voice-controlled naval warships. Recently, researchers have demonstrated that these voice assistant systems are susceptible to signal injection at the inaudible frequencies. To date, most of the existing works focus primarily on delivering a single command via line-of-sight ultrasound speaker or extending the range of this attack via speaker array. However, besides air, sound waves also propagate through other materials where vibration is possible. In this work, we aim to understand the characteristics of this new genre of attack in the	https://www.webofscience.com/wos/woscc/full-record/WOS:000680742600029

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			context of different transmission media. Furthermore, by leveraging the unique properties of acoustic transmission in solid materials, we design a new attack called SurfingAttack that would enable multiple rounds of interactions between the voice-controlled device and the attacker over a longer distance and without the need to be in line-of-sight. By completing the interaction loop of inaudible sound attack, SurfingAttack enables new attack scenarios, such as hijacking a mobile Short Message Service (SMS) passcode, making ghost fraud calls without owners' knowledge, etc. To accomplish SurfingAttack, we have solved several major challenges. First, the signal has been specially designed to allow omni-directional transmission for performing effective attacks over a solid medium. Second, the new attack enables multi-round interaction without alerting the legitimate user at the scene, which is challenging since the device is designed to interact with users in physical proximity rather than sensors. To mitigate this newly discovered threat, we also provide discussions and experimental results on potential countermeasures to defend against this new threat.	
2	Порівняння двох методів глибокого навчання для розпізнавання цілей на кораблях з використанням оптичних даних дистанційного зондування	Comparison of two deep learning methods for ship target recognition with optical remotely sensed data. Zhang, DJ; Zhan, J.; Tan, LF; Gao, YH; Zupan, R. (Zupan, Robert). NEURAL COMPUTING & APPLICATIONS. 2021. Volume 33. Issue 10. Page 4639-4649.	As an important part of modern marine monitoring systems, ship target identification has important significance in maintaining marine rights and monitoring maritime traffic. With the development of artificial intelligence technology, image detection and recognition based on deep learning methods have become the most popular and practical method. In this paper, two deep learning algorithms, the Mask R-CNN algorithm and the Faster R-CNN algorithm, are used to build ship target feature extraction and recognition models based on deep convolutional neural networks. The established models were compared and analyzed to verify the feasibility of target detection algorithms. In this study, 5748 remote sensing maps were selected as the dataset for experiments, and two algorithms were used to classify and extract warships and civilian ships. Experiments showed that for the accuracy of ship identification, Mask R-CNN and Faster R-CNN reached 95.21% and 92.76%, respectively. These results demonstrated that the Mask R-CNN algorithm achieves pixel-level segmentation. Compared with the Faster R-CNN algorithm, the obtained target detection effect is more accurate, and the performance in target detection and classification is better, which reflects the great advantage of pixel-level recognition.	https://www.webofscience.com/wos/woscc/full-record/WOS:000562658200005
3	EQNAS: Еволюційна квантова нейронна архітектура для пошуку класифікації зображень	EQNAS: Evolutionary Quantum Neural Architecture Search for Image Classification.	Quantum neural network (QNN) is a neural network model based on the principles of quantum mechanics. The advantages of faster computing speed, higher memory capacity, smaller network size and elimination of catastrophic amnesia make it a new idea to solve the	https://www.webofscience.com/wos/woscc/full-record/WOS:001091817600001

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		Li, YY; Liu, RJ; Hao, XB; Shang, RH; Zhao, PX; Jiao, LC. NEURAL NETWORKS. 2023. Volume 168. Page 471-483.	problem of training massive data that is difficult for classical neural networks. However, the quantum circuit of QNN are artificially designed with high circuit complexity and low precision in classification tasks. In this paper, a neural architecture search method EQNAS is proposed to improve QNN. First, initializing the quantum population after image quantum encoding. The next step is observing the quantum population and evaluating the fitness. The last is updating the quantum population. Quantum rotation gate update, quantum circuit construction and entirety interference crossover are specific operations. The last two steps need to be carried out iteratively until a satisfactory fitness is achieved. After a lot of experiments on the searched quantum neural networks, the feasibility and effectiveness of the algorithm proposed in this paper are proved, and the searched QNN is obviously better than the original algorithm. The classification accuracy on the mnist dataset and the warship dataset not only increased by 5.31% and 4.52%, respectively, but also reduced the parameters by 21.88% and 31.25% respectively. Code will be available at https://gitee.com/Pcyslist/models/tree/master/research/cv/EQNAS, and https://github.com/Pcyslist/EQNAS.	
4	Легка маска RCNN для виявлення та сегментації бойових кораблів	Lightweight Mask RCNN for Warship Detection and Segmentation. Park, J.; Moon, H. IEEE ACCESS. 2022. Volume 10. Page 24936-24944.	As the term X(Everything)+AI indicates, AI is applied in every aspect of current societies. Likewise, the military requirements for AI are increasing as well. AIs that automatically detect and classify objects are required for surveillance and reconnaissance. Especially in terms of naval operation, identifying types of warships and recognizing mounted armaments have significance as the first step of the operation. This study is the proposal of an AI model that can identify warships' type and weapon by analyzing video information taken on sea, and evaluate threat priority and response level. The proposed model is based on Mask RCNN, the Image Segmentation model, but was designed in a lightweight version, so that it could be used on a platform of the vessel where the use of high performing computers is limited. To lightweight the model, the former backbone was replaced with MobileNetV2, and the convolution operation of the RPN was replaced with Depthwise Separable Convolution operation, which operates respectively in each channel. The lightweight Mask RCNN model showed 64% lower number of parameters compared to the base model. However, its mAP, the classification accuracy, was similar with the base model.	https://www.webofscience.com/wos/woscc/full-record/WOS:000766546100001
5	Методологія раннього проектування багатоцільового	Early-Stage design methodology for a multirole electric propelled surface combatant ship.	Modern Navies are facing a scenario in which the technology is changing at a fast pace, deeply affecting the expected missions their ships have to cope with. Not only new weapon systems and sensors,	https://www.webofscience.com/wos/woscc/full-

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
	електричного надводного бойового корабля	Vicenzutti, A.; Trincas, G.; Bucci, V.; Sulligoi, G.; Lipardi, G. IEEE ELECTRIC SHIP TECHNOLOGIES SYMPOSIUM: EMERGING TECHNOLOGIES FOR FUTURE ELECTRIC SHIPS. 2019. Page 97-105.	but also new subsystems and new threats call for the design of new ships. However, integrating these new elements into an existing ship is impossible, being it not designed to support them. Likewise, adapting an existing ship design is difficult as well, being the hull form not suited either for providing the required performance level or for accommodating the increased payload. Therefore, to face the actual evolutionary trend in naval ships, a new design strategy has to be adopted. In this paper, a multi-attribute design making approach to the concept design is depicted, able to exploit the capabilities of modern Information Technology tools. As an application example, a first simplified run of the process is shown, regarding the design of a multirole destroyer.	record/WOS:000591846900014
Системи автоматизованого управління				
1	Проектування децентралізованої активної системи придушення збурень для газової турбіни	Decentralized active disturbance rejection control design for the gas turbine. Shi, GJ; Wu, ZL; He, T.; Li, DH; Ding, YJ; Liu, SM. MEASUREMENT & CONTROL. 2020. Volume 53. Issue 9-10. Page 1589-1601.	As a clean energy engine, the gas turbine is widely used for the generation of the power plant and the propulsion of the warship. Its control is becoming more and more challenging for the reason that internal coupling exists and the load command changes frequently and extensively. However, advanced controllers are difficult to implement on the distributed control system and conventional proportional-integral-derivative controllers are unable to handle with aforementioned challenges. To solve this problem, this article designs a decentralized active disturbance rejection control for the power and exhaust temperature of the gas turbine. Simulation results illustrate that the decentralized active disturbance rejection control is able to obtain satisfactory tracking and disturbance rejection performance with strong robustness. Eventually, a numerical simulation is carried out which shows advantages of active disturbance rejection control in the control of power and exhaust temperature when the gas turbine is under variable working condition. This successful application of decentralized active disturbance rejection control to the gas turbine indicates its promising prospect of field tests in future power industry with increasing demand on integrating more renewable energy into the grid.	https://www.webofscience.com/wos/woscc/full-record/WOS:000614552900004
2	Підхід заснований на трансферному навчанні до повторної ідентифікації морських бойових кораблів	A transfer learning-based approach to maritime warships re-identification. Zeng, GM; Wang, RJ; Yu, WN; Lin, AH; Li, HH; Shang, YF. ENGINEERING APPLICATIONS OF	Marine vessel re-identification technology is an important component of intelligent shipping systems and an important part of the visual perception tasks required for marine surveillance. However, unlike the situation on land, the maritime environment is complex and volatile, and ships are prone to different degrees of swaying. Warships, as a class of ships, are characterized by fewer image samples and high similarity, and it is more difficult to re-identify warships at sea. Therefore, this paper proposes a dynamic alignment re-identification network model	https://www.webofscience.com/wos/woscc/full-record/WOS:001043747800001

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		ARTIFICIAL INTELLIGENCE. 2023. Volume 125, 106696.	incorporating transfer learning methods. Various types of ships are used as source domain data to assist the network in learning the target domain warships so as to improve the recognition accuracy of warships. At the same time, the swaying situation of warships at sea is simulated and tested to improve the recognition difficulty so as to cope with the impact caused by complex sea conditions. The effect of different types of ships as transfer objects is also discussed. The experimental results show that the improved algorithm improves the mean average accuracy (mAP) by 10.2% and the first hit rate (Rank1) by 4.9% on average.	
3	Метод оцінки загроз протиповітряної оборони з'єднань бойових кораблів на основі авторегресивно - динамічно покращеного методу для визначення порядку переваги за подібністю до ідеального рішення	Threat evaluation method of warships formation air defense based on AR(*p*)-DITOPSIS. Sun, HW; Xie, XF. JOURNAL OF SYSTEMS ENGINEERING AND ELECTRONICS. 2019. Volume 30. Issue 2. Page 297-307.	For the target threat evaluation of warships formation air defense, the sample data are frequently insufficient and even incomplete. The existing evaluation methods rely too much on expertise and are difficult to carry out for the dynamic evaluation on time series. In order to solve these problems, a threat evaluation method based on the AR(p) (auto regressive (AR))-dynamic improved technique for order preference by similarity to ideal solution (DITOPSIS) method is proposed. The AR(p) model is adopted to predict the missing data on the time series. Then, the entropy weight method is applied to solve each index weight at the objective point. Kullback-Leibler divergence (KLD) is used to improve the traditional TOPSIS, and to carry out the target threat evaluation. The Poisson distribution is used to assign the weight value. Simulation results show that the improved AR(p)-DITOPSIS threat evaluation method can synthetically take into account the target threat degree in time series and is more suitable for the threat evaluation under the condition of missing the target data than the traditional TOPSIS method.	https://www.webofscience.com/wos/woscc/full-record/WOS:000466585300009
4	Розробка автономної системи відновлення трубопроводів військово-морських кораблів з використанням багатоетапного алгоритму керування	Development of Autonomous Recovery System for Pipeline of Naval Ships by Using a Multistage Control Algorithm. Jung, BC; Moon, SJ; Lee, SH; Lee, H.; Park, JW; Shin, YH. IEEE-ASME TRANSACTIONS ON MECHATRONICS. 2022. Volume 27. Issue 2. Page 1150-1161.	Pipeline systems in naval ships with special combat purposes (such as warships) are frequently exposed to the risk of damage. It is necessary to detect and isolate such unexpected damage quickly via an autonomous recovery system in the pipelines to ensure the ship's survivability. This recovery system employs an autonomously controlled valve, which consists of a valve body, two pressure sensors, an actuator to open/close the valve, and a controller equipped with damage detection capability and a control algorithm. To enhance the reliability of the autonomous recovery system, this study first proposes a multistage control algorithm that can comprehensively consider the various damage scenarios in a naval ship and then suggests the design procedure for the autonomous piping system based on support vector machine (SVM). To design the suggested algorithm, a simulation model for the 1-D real-time flow analysis is first established, and its	https://www.webofscience.com/wos/woscc/full-record/WOS:000782804300052

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			results for possible damage scenarios are used as training data for the SVM with the valve operation information for recovery of the piping system and to minimize the damaged area. A performance comparison of the representative control algorithms for the autonomous piping system is conducted via flow simulations under three representative damage scenarios. Finally, a real-scale testbed of the firemain in a naval ship is designed and constructed, and the effectiveness of the algorithm is demonstrated through experiments.	
5	Аналіз ремонтопридатності та комплексна компромісна модернізація обладнання військово-морських кораблів на основі методу організації ранжування переваг для розширеної оцінки	Maintainability analysis and comprehensive tradeoff of naval ships equipment based on PROMETHEE method. Zheng, SS; Chen, GF; Zhang, YJ. JOURNAL OF CONTROL AND DECISION. 2024. Volume 11. Issue 3. Page 375-384.	The comprehensive trade-off among reliability, maintainability, availability and life cycle cost should be solved in the overall design of warship equipment. Maintainability analysis and comprehensive trade-off of naval ships equipment based on the PROMETHEE method are proposed. In the method, the evaluation model of alternatives set is formed through the analysis of maintainability-related factors, the determination of target attribute and related attribute weight of alternatives, the selection of attribute priority function and threshold. And carry out calculation and analysis, form the ranking of alternatives. Combined with the calculation and analysis of specific examples, the evaluation results of six groups of alternatives are obtained, and the optimal scheme is determined. The research provides an effective theoretical basis for maintainability analysis and comprehensive trade-off of system overall design. It guides the implementation and decision of the project. It's suitable for the comprehensive trade-off problem of multi-objective relationships to find the optimal solution.	https://www.webofscience.com/wos/woscc/full-record/WOS:000914093900001
Телекомунікації				
1	Адаптивна компенсація гнучкої антени з шкірним покриттям і вбудованою волоконною решіткою Брегга	Adaptive Compensation of Flexible Skin Antenna With Embedded Fiber Bragg Grating. Zhou, JZ; Kang, L.; Tang, BF; Tang, B.; Huang, J.; Wang, CS. IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION. 2019. Volume 67. Issue 7. Page 4385-4396.	Skin antenna can be installed in the structural surface of an aircraft, warship, or armored vehicle. The radiation pattern is inevitably degraded due to the antenna surface deformations caused by external loads in service. This paper proposes a new skin antenna named smart skin antenna that consists of an antenna array, a protective layer (facesheet and honeycomb core), and a sensing layer with fiber Bragg grating (FBG) sensors. The shape of a deformed skin antenna was calculated using a strain-displacement transformation according to the measured strains from limited FBG sensors. Moreover, a strain-electromagnetic coupling model between the phase compensation values and the measured strains was derived for the first time to adaptively compensate the deterioration of radiation patterns caused by various flexible deformations. An 8 x 4 skin antenna prototype at 5.8 GHz was fabricated, and some experiments were carried out. The	https://www.webofscience.com/wos/woscc/full-record/WOS:000474599200008

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			measured results demonstrate that the proposed compensation method can effectively correct the deterioration of radiation patterns.	
2	Дослідження складу системи ідентифікації типу / класу корабля на основі зображень	A Study on the Composition of Image-Based Ship-type/class Identification System. Lee, J.; Nam, DW; Lee, J.; Moon, S.; Oh, A.; Yoo, W. 22ND INTERNATIONAL CONFERENCE ON ADVANCED COMMUNICATION TECHNOLOGY: DIGITAL SECURITY GLOBAL AGENDA FOR SAFE SOCIETY. 2020. Page 203-206.	Ships, coastal posts, and control centers need to verify the information, location, and speed of nearby vessels for various purposes, such as traffic control or maritime warfare. In the field of defense where accurate information on nearby ships is important, radar is used to acquire location information on nearby ships. However, the selection of the opponent's position as well as the high-value units must be more important and prioritized, and image-based warship type/class identification techniques are required in naval warfare. This paper presents a detailed method for system construction that supports detailed identification of warship type/class through structural analysis. Through the development of the proposed system, reliable warship identification can be used for tactical applications in the defense field, thereby contributing to the enhancement of defense capabilities.	https://www.webofscience.com/wos/woscc/full-record/WOS:000576739100039
3	Вилучення та розпізнавання формування бойових кораблів на основі просторової кластеризації додатків на основі щільності з шумом та покращеною згортковою нейронною мережею	Warship formation extraction and recognition based on density-based spatial clustering of applications with noise and improved convolutional neural network. He, HT; Wu, L.; Hu, XJ. IET RADAR SONAR AND NAVIGATION. 2022. Volume 16. Issue 12. Page 1912-1923.	Formation recognition is a significant focus of maritime target recognition. Automatic formation extraction and recognition facilitate autonomous decision-making. However, few studies have explored formation extraction prior to recognition. This paper introduces a density-based spatial clustering of applications with noise (DBSCAN) method based on Gaussian kernel to extract formation targets. On this basis, a depthwise separable convolutional neural network (DSCNN) method is proposed for formation recognition. A track simulation system is established to form a track dataset containing three different proportions of clutter, and the formation extraction method is examined using track dataset. Subsequently, the image dataset with eight different types of formation is formulated, on the basis of various detection errors, the DSCNN method for formation recognition is compared with several typical deep learning methods. As exposed in experimental results, the DBSCAN method based on Gaussian kernel can guarantee accurate extraction of formation targets subject to different proportions of clutter. Hence, it is greatly robust and capable of effective formation extraction. Under different radar detection errors, the formation recognition accuracy of DSCNN is 91.5%-99.5%, which achieves performance improvement by up to 12.5% compared with other deep learning methods. The combination of DBSCAN and DSCNN can well realise formation extraction and recognition with different proportions of clutter in tracks and various radar detection errors.	https://www.webofscience.com/wos/woscc/full-record/WOS:000843538400001
4	Оцінка ефективності мереж, стійких до збоїв зв’язку, для	Performance Evaluation of Disruption Tolerant Networks on	Disruption tolerant networks (DTN) are an evolution of mobile adhoc networks (MANET) working in scenarios where nodes are sparsely	https://www.webofscience.com/wos/woscc/full-

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	тактичних повідомлень бойових кораблів з метою забезпечення безпеки передачі даних	Warships' Tactical Messages for Secure Transmissions. Falcao, D.; Salles, R.; Maranhao, P. JOURNAL OF COMMUNICATIONS AND NETWORKS. 2021. Volume 23. Issue 6. Page 473-487.	distributed, with low density, connections are intermittent and end-to-end infrastructure is not accessible. Therefore, DTNs are recommended for high latency applications that can last from hours to days. The maritime scenario has characteristics that would justify the use of DTN networks, but the concern with data security is also a relevant aspect in such scenarios. Thus, this paper proposes to evaluate the DTN approach in the maritime Scenario involving warships and helicopters, for sending tactical messages, taking into considera-tion security aspects at the perimeters where contacts occur. We set up a simulation experiment to compare the performance of Epidemic, Spray and Wait, and Direct Delivery protocols in three scenarios with different sizes. We also propose the application of discriminant analysis as a classification technique to select secure connections to improve the security of the DTN architecture.	record/WOS:000740359500006
5	Система автоматичного розпізнавання військових кораблів: набір даних, представлення ознак та аналіз класифікації	Automatic Warship Recognition System: Dataset, Feature Representation and Classification Analysis. Kara, YA. 27TH SIGNAL PROCESSING AND COMMUNICATIONS APPLICATIONS CONFERENCE. IEEE. 2019.	Classification of warships plays a critical role particularly in crises and war times. While there are several studies in the literature regarding classification of civilian ship types, warship classification task is yet far from maturity, which are significantly more similar to each other compared to civilian ships. In this study, we present a dataset and propose a system that employs automatic classification of warships based on their optical images. Histogram of Oriented Gradients (HOG) features extracted from ship images were investigated after several preprocessing steps which are then used in classification with Support Vector Machines (SVM). A dataset is composed based on images of particularly similar 9 warship classes that exist in the Turkish Navy and it has been shown that the proposed approach reaches 83:8% classification accuracy.	https://www.webofscience.com/wos/woscc/full-record/WOS:000518994300134
Інструменти				
1	Огляд: Досягнення в сфері поглиначів радіочастотних та мікрохвильових хвиль на основі метаматеріалів	A review: Advancement in metamaterial based RF and microwave absorbers. Jorwal, S.; Dubey, A.; Gupta, R.; Agarwal, S. SENSORS AND ACTUATORS A-PHYSICAL. 2023. Volume 354, 114283.	Microwave absorbers (MAs) are specially designed structures which dissipate an incident electromagnetic (EM) wave by converting it into thermal energy and thereby prevents reflection and/ or transmission. The MAs are extensively in demand due to their property to reduce the electromagnetic wave interference (EMI) and to enhance electromagnetic shielding (EMS). MAs are also used in potential military applications as a stealth technology to design stealth aircrafts, warships and army clothing etc. due to the reduction of radar cross section (RCS) of the defense equipment by the absorber coating. In this review work, study of metamaterial-based MAs, their characteristics viz. left-handed material property, permittivity and permeability have been discussed in detail. Metamaterials (MMs) or artificial materials that play a significant role in reducing the size and thickness of MAs	https://www.webofscience.com/wos/woscc/full-record/WOS:000999656800001

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			depending upon the frequency of operation. In this work, theoretical background of MM-based absorbers detailing the effect of permittivity and permeability on absorber performance has also been discussed. Different applications of absorbers are elaborately covered in this paper. Furthermore, frequency selective surface (FSS) which is a two-dimensional array has the capability to reflect or transmit EM wave completely or partially depending upon the nature of FSS. Therefore, distinct categories of FSS-based absorbers are discussed according to the frequency of operation, bandwidth and material specification where the effect of different design parameters is also critically analyzed. The objective of this review paper is to provide an exhaustive study of the unique attributes of MAs having a diverse range of applications for frequencies ranging from microwave, terahertz upto optical frequency domain. This review paper is certainly a vital tool for researchers to accurately understand, explore and work on MA design and selection as per user defined specific frequency and applications.	
2	Порівняння похибки компаса бортового стандартного гірокомпаса, волоконно-оптичного гірокомпаса та супутникового компаса	The Compass Error Comparison of an Onboard Standard Gyrocompass, Fiber-Optic Gyrocompass (FOG) and Satellite Compass. Jaskólski, K.; Felski, A.; Piskur, P. SENSORS. 2019. Volume 19. Issue 8, 1942.	The aim of the presented research was to analyze the accuracy indications of three types of compass systems for the purposes of meeting warship modernization requirements. The authors of this paper have made an attempt to compare the accuracy of an onboard standard gyrocompass, a fiber-optic gyrocompass (FOG) and a satellite compass in real shipping circumstances. The research was carried out in the Gulf of Gdansk area, during the preparation of hydrographic surveys on stable courses. Three heading recordings have been taken into consideration. The helmsman's operation and vessel inertia were analyzed and removed according to a spectrum analysis. Transient characteristics and the spectrum analysis (based on the Fourier transform theory and headings descriptions in the frequency domain) are presented. Data, processed using a band-stop finite impulse response (FIR) filter to reduce low-frequency heading distortions, are presented for further analyses. The statistics of errors of the compasses investigated, as well as the spectrum of these errors, are also presented. Based on accuracy measurements, the possibility of using the most accurate heading data as the input signal to the automatic ship control system was considered.	https://www.webofscience.com/wos/woscc/full-record/WOS:000467644500196
3	Інтегрована морська навігація в режимі реального часу PPP-B2b/SINS на основі BDS-3	Real-time marine PPP-B2b/SINS integrated navigation based on BDS-3. Li, M.; Chai, HZ. MEASUREMENT SCIENCE	The BeiDou-3 global navigation satellite system was operated successfully in July 2020. It broadcasts precise point positioning (PPP)-B2b signals and provides real-time PPP services free of charge, which greatly meets the navigation needs of real-time users, especially warship navigation. This paper first introduces the PPP-B2b real-time positioning model, and then expounds the two-velocity	https://www.webofscience.com/wos/woscc/full-record/WOS:001023835300001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		AND TECHNOLOGY. 2023. Volume 34. Issue 10, 105113.	measurement algorithm of Doppler and carrier phase time difference. Next, it combs the extended Kalman filter (EKF) and factor graph optimization (FGO) integrated navigation algorithm in detail, and finally comprehensively evaluates the real-time integrated navigation performance of PPP-B2b/strapdown inertial navigation system (SINS) through the measured data at sea. The experimental results show that the real-time dynamic positioning accuracy of PPP-B2b can reach the decimeter level, and the positioning accuracy is not significantly improved when integrated with SINS. Furthermore, dynamic alignment experiments results show after adding time-differenced carrier phase and Doppler velocimetry information, the convergence accuracy of yaw misalignment angle has been greatly improved. The accuracy of the EKF algorithm is 16.7% higher than that of the FGO algorithm after the convergence of the yaw angle error.	
4	Декодування розумових зусиль у квазіреалістичному сценарії: дослідження доцільності мультимодального об'єднання та класифікації даних	Decoding Mental Effort in a Quasi-Realistic Scenario: A Feasibility Study on Multimodal Data Fusion and Classification. Gado, S.; Lingelbach, K.; Wirzberger, M.; Vukelic, M. SENSORS. 2023. Volume 23. Issue 14, 6546.	Humans' performance varies due to the mental resources that are available to successfully pursue a task. To monitor users' current cognitive resources in naturalistic scenarios, it is essential to not only measure demands induced by the task itself but also consider situational and environmental influences. We conducted a multimodal study with 18 participants (nine female, M = 25.9 with SD = 3.8 years). In this study, we recorded respiratory, ocular, cardiac, and brain activity using functional near-infrared spectroscopy (fNIRS) while participants performed an adapted version of the warship commander task with concurrent emotional speech distraction. We tested the feasibility of decoding the experienced mental effort with a multimodal machine learning architecture. The architecture comprised feature engineering, model optimisation, and model selection to combine multimodal measurements in a cross-subject classification. Our approach reduces possible overfitting and reliably distinguishes two different levels of mental effort. These findings contribute to the prediction of different states of mental effort and pave the way toward generalised state monitoring across individuals in realistic applications.	https://www.webofscience.com/wos/woscc/full-record/WOS:001036486700001
5	Підхід до системи виявлення несправностей для оптимізації запасних частин обладнання бойових кораблів на основі експлуатаційних параметрів	A Fault-Detection System Approach for the Optimization of Warship Equipment Replacement Parts Based on Operation Parameters. Michelena, A.; López, V.; López, FL; Arce, E.; García, JM; Suárez-García, A.; Espinosa, GG; Calvo-Rolle, JL; Quintián,	Systems engineering plays a key role in the naval sector, focusing on how to design, integrate, and manage complex systems throughout their life cycle; it is therefore difficult to conceive functional warships without it. To this end, specialized information systems for logistical support and the sustainability of material solutions are essential to ensure proper provisioning and to know the operational status of the frigate. However, based on an architecture composed of a set of logistics applications, this information system may require highly qualified operators with a deep knowledge of the behavior of onboard	https://www.webofscience.com/wos/woscc/full-record/WOS:000970248300001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		H. SENSORS. 2023. Volume 23. Issue 7, 3389.	systems to manage it properly. In this regard, failure detection systems have been postulated as one of the main cutting-edge methods to address the challenge, employing intelligent techniques for observing anomalies in the normal behavior of systems without the need for expert knowledge. In this paper, the study is concerned to the scope of the Spanish navy, where a complex information system structure is responsible for ensuring the correct maintenance and provisioning of the vessels. In such context, we hereby suggest a comparison between different one-class techniques, such as statistical models, geometric boundaries, or dimensional reduction to face anomaly detection in specific subsystems of a warship, with the prospect of applying it to the whole ship.	
Матеріалознавство				
1	Синергетичний ефект графенової нанопластини та карбонізованого волокна люфи на ефективність електромагнітного екранування композитів на основі поліефір-ефір-кетону	Synergistic effect of graphene nanoplate and carbonized loofah fiber on the electromagnetic shielding effectiveness of PEEK-based composites. Li, ST; Li, WC; Nie, J.; Liu, DY; Sui, GX. CARBON. 2019. Volume 143. Page 154-161.	Graphene nanoplate (GNP)/carbonized loofah fiber (CLF)/polyether-ether-ketone (PEEK) composites were fabricated by compressive moulding technology. A three-dimensional multi-interface conductive network of CLF and GNP within the matrix was observed under scanning electron microscope. The combination of CLF and GNP improve the electromagnetic shielding performance of composites in the X-band region. The average total shielding effectiveness of the composite reached 27.1 dB at the addition of 9 wt% CLF. The electromagnetic shielding performance of the composites is significantly improved due to the gradual formation of the conductive network structured with CLF and GNP. The shielding mechanism of composites is dominated by absorption, due to the contribution of absorption to shielding effectiveness is much greater than that of the reflection. Furthermore, the composites exhibit prominent mechanical property and thermal stability, which the compressive strength and modulus of GNP/ CLF/PEEK composite with 3 wt% CLF loading reaches 114.6 MPa and 0.71 GPa and the temperature of all composites reaches 550 degrees C at 10% mass loss. The results indicate that the composite material shows potential applications in extremely harsh environments such as aerospace, warships, and special devices as structural and functional integrated materials.	https://www.webofscience.com/wos/woscc/full-record/WOS:000456710500017
2	Титан у литих сплавах Cu-Sn - огляд	Titanium in Cast Cu-Sn Alloys-A Review. Manu, K.; Jezierski, J.; Ganesh, MRS; Shankar, KV; Narayanan, SA. MATERIALS, 2021. Volume 14. Issue 16, 4587.	The article reviews the progress made on bronze alloys processed through various casting techniques, and focuses on enhancements in the microstructural characteristics, hardness, tensile properties, and tribological behaviour of Cu-Sn and Cu-Sn-Ti alloys. Copper and its alloys have found several applications in the fields of automobiles, marine and machine tools specifically for propellers in submarines, bearings, and bushings. It has also been reported that bronze alloys are	https://www.webofscience.com/wos/woscc/full-record/WOS:000689400400001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			especially used as an anti-wear and friction-reducing material to make high performance bearings for roller cone cock bits and warships for defence purposes. In these applications, properties like tensile strength, yield strength, fatigue strength, elongation, hardness, impact strength, wear resistance, and corrosion resistance are very important; however, these bronze alloys possess only moderate hardness, which results in low wear resistance, thereby limiting the application of these alloys in the automobile industry. The major factor that influences the properties of bronze alloys is the microstructure. Morphological changes in these bronze alloys are achieved through different manufacturing techniques, such as casting, heat treatment, and alloy addition, which enhance the mechanical, tribological, and corrosion characteristics. Alloying of Ti to cast Cu-Sn is very effective in changing the microstructure of bronze alloys. Reinforcing the bronze matrix with several ceramic particles and surface modifications also improves the properties of bronze alloys. The present article reviews the techniques involved in changing the microstructure and enhancing the mechanical and tribological behaviours of cast Cu-Sn and Cu-Sn-Ti alloys. Moreover, this article also reviews the industrial applications and future scope of these cast alloys in the automobile and marine industries.	
3	Експериментальний та числовий аналіз динамічної реакції сендвіч-панелі з градуйованого полівінілхлоридного вспіненого матеріалу під ударним навантаженням	Experimental and numerical analysis of dynamic response of graded PVC foam sandwich panel under impact load. Yang, LP; Li, XY; Yang, LH; Lu, J.; Wang, ZY; Yang, JS. MECHANICS OF ADVANCED MATERIALS AND STRUCTURES. 2022. Volume 29. Issue 26. Page 5567-5578.	Polyvinyl chloride (PVC) foam sandwich panels have a wide application prospect in the field of warship impact protection due to the low moisture absorption, low density, excellent energy consumption and chemical resistance of PVC foam. The dynamic response of layered density-graded PVC foam sandwich panel under impact load was experimentally and numerically investigated here. A three-layer PVC foam sandwich specimen was designed and fabricated. The graded strategy of foam core was achieved by setting various foam layers with different densities. A large-diameter split-Hopkinson pressure bar device was used to perform the experimental study. The effect of density-graded strategy of foam core on the transmitted force, transmitted impulse and energy absorption were discussed. The software ANSYS/LS-DYNA was used to simulate the dynamic impact test of the foam sandwich structure. The simulation results are in good agreement with the experimental results. The results reveal that, the order of the core layer of density-graded sandwich panel has little effect on the impact resistance of the structure, while the impact resistance can be improved by increasing the density difference between foam layers. The uniform configuration UD has the largest impact force and the most specific energy absorption, while the large gradient configuration large gradient configuration has the smallest	https://www.webofscience.com/wos/woscc/full-record/WOS:000681250400001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			transmitted impulse under various impact velocities of the projectile. Thus, large gradient configuration has better protection effect.	
4	Моделювання в'язкопружної когезійної зони для руйнування II типу між паливом та ізоляцією	Viscoelastic cohesive zone modeling for mode II fracture between propellant and insulation. Cui, HR. INTERNATIONAL JOURNAL OF ADHESION AND ADHESIVES. 2022. Volume 114, 103118.	The performance of debonding interface between the solid propellant and insulation in the solid rocket motor which on the warship is a function of time that depends on the time regime chosen to elicit it. In this paper, a new time dependent cohesive zone model (CZM) is introduced with N Maxwell models which are connected in parallel and let the input, time independent traction transform into the time dependent one. Stretch test with constant velocity, cyclic loading and relaxation test were applied in a simple 2D cohesive element. The acquisition of the model parameters was introduced by Single lap-joints (SLJ) test. A semi-section of vertical storage motor was modeled and analyzed considering the debonding interface between the solid propellant and insulation under a set of regular and irregular waves. The introduced time dependent CZM and the results of the integrity analysis are useful and meaningful for further research on vertical storage solid rocket motor.	https://www.webofscience.com/wos/woscc/full-record/WOS:000775636300005
5	Дослідження вібраційної поведінки тертя пари кільце-колодка з гумового матеріалу підшипника з водним змащенням в особливих умовах експлуатації	Research on the Vibration Behavior of Ring-Block Friction Pair Made of Materials of Water-Lubricated Rubber Bearing under Special Operating Conditions. Zhang, ZJ; Zhou, GW; Li, P.; Du, LL; He, M. APPLIED SCIENCES-BASEL. 2023. Volume 13. Issue 13, 7676.	A water-lubricated rubber bearing (WLRB) is prone to generate frictional vibration noise under special operating conditions, which seriously affects the acoustic stealth performance of warships and threatens their navigation safety. Meanwhile, the main factor affecting the frictional vibration behavior of a WLRB is the materials of the friction pair. Therefore, this work selects a friction pair composed of a copper ring and a rubber block as the research object and studies the frictional vibration behavior of the ring-block friction pair under low-speed and starting conditions. The real friction coefficient curve is used to establish a transient dynamic finite element analysis model for the ring-block friction pair. The effects of the load, friction coefficient, and Young's modulus on the frictional vibration behavior under special operating conditions are studied. The analysis's results show that the frequency of the medium-high frequency friction-induced vibration disappears under low-speed operating conditions when the friction coefficient is below 0.1. During the startup process, even if the friction coefficient is very low, the medium-high frequency friction-induced vibration still exists. The research results provide ideas for future theoretical research and guidance suggestions for engineering practice.	https://www.webofscience.com/wos/woscc/full-record/WOS:001028207200001
ПІДВОДНІ ЧОВНИ				
Інженерія				

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
1	Кремнієва фотонно-електронна нейронна мережа для компенсації нелінійності волокон	A silicon photonic-electronic neural network for fibre nonlinearity compensation. Huang, CR; Fujisawa, S.; de Lima, TF; Tait, AN; Blow, EC; Tian, Y.; Bilodeau, S.; Jha, A.; Yaman, F.; Peng, HT. NATURE ELECTRONICS. 2021. Volume 4. Issue 11. Page 837-844.	In optical communication systems, fibre nonlinearity is the major obstacle in increasing the transmission capacity. Typically, digital signal processing techniques and hardware are used to deal with optical communication signals, but increasing speed and computational complexity create challenges for such approaches. Highly parallel, ultrafast neural networks using photonic devices have the potential to ease the requirements placed on digital signal processing circuits by processing the optical signals in the analogue domain. Here we report a silicon photonic-electronic neural network for solving fibre nonlinearity compensation in submarine optical-fibre transmission systems. Our approach uses a photonic neural network based on wavelength-division multiplexing built on a silicon photonic platform compatible with complementary metal-oxide-semiconductor technology. We show that the platform can be used to compensate for optical fibre nonlinearities and improve the quality factor of the signal in a 10,080 km submarine fibre communication system. The Q-factor improvement is comparable to that of a software-based neural network implemented on a workstation assisted with a 32-bit graphic processing unit. A neural network platform that incorporates photonic components can be used to predict optical fibre nonlinearities and improve the signal quality of submarine fibre communications.	https://www.webofscience.com/wos/woscc/full-record/WOS:000721449500005
2	Експерименти та обчислювальна гідродинаміка для сліду за гвинтом типового підводного човна, що працює поблизу поверхні	Experiments and CFD for the propeller wake of a generic submarine operating near the surface. Wang, LZ; Martin, JE; Felli, M.; Carrica, PM. OCEAN ENGINEERING. 2020. Volume 206, 107304.	An experimental and computational fluid dynamics (EFD and CFD) study of the appended notional submarine DARPA Suboff fitted with the 7-bladed E1658 propeller and operating near the free surface is presented. The flow measurements were taken using particle image velocimetry with a multi-camera configuration in the Large Free Surface Cavitation Channel at INM. Single-phase level set numerical simulations with an overset approach were performed for three advance coefficients (J = 0.5, 0.65, 0.82) at three shaft depths (z/D = 1, 1.5, 2). The results reveal that the presence of the hull and the interaction with the free surface strongly affect the inflow and wake of the propeller, producing higher local advance coefficient and blade loads near the surface. Strong free surface fluctuations at small shaft depth also cause instability and breakdown of the propeller tip vortices in the near field. CFD simulations show elliptic instability before vortex breakdown. Comparison between CFD with EFD shows that CFD matches overall trends well, mainly for the phase-averaged flow field, but underpredicts wake fluctuations and thus displays more coherent phase-averaged vorticity. In addition, CFD results also underpredict tip vortex strength and predicts vortex instabilities farther downstream from the propeller plane due to the unresolved upstream turbulence.	https://www.webofscience.com/wos/woscc/full-record/WOS:000532834200018

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
3	Чисельне дослідження механізму зниження шуму зубчастої задньої кромки, встановленої на повітропроводі насосного струменя	Numerical investigation on noise reduction mechanism of serrated trailing edge installed on a pump jet duct. Sun, Y.; Liu, W.; Li, TY. OCEAN ENGINEERING. 2019. Volume 191, 106489.	For ships, the stealth performance is an important indicator of its vitality. It is extremely important to study the noise reduction of ship propulsions. In this work, pump-jet propulsion with a DARPA Suboff submarine was taken as the investigated object. The trailing edge of its duct was transformed with some serrations, and its noise reduction effect was studied. Large Eddy Simulation (LES) method was utilized to predict the hydrodynamic performance of the pump-jet propulsion. Then the FW-H acoustic model was added into the noise performance simulation after the flow stabilization. After the installation of the serrated trailing edge, the propulsion Sound Pressure Level (SPL) changes were observed. According to the contributions of different parts to the noise intensity and the vortex field changes, the noise reduction effect was analyzed. The results indicate that not only the propulsion noise radiation but also the noise reduction effect is directional. Due to the larger noise contribution of the duct, the serrated trailing edge has a better effect in the radial direction. In addition,the circumferential correlation of the duct vortex is broken by the serrations, the large vortices are divided into several small ones, and the vortex diffusion is accelerated.	https://www.webofscience.com/wos/woscc/full-record/WOS:000502888100028
4	Самохідний рух типового підводного човна поблизу поверхні у спокійній воді та за умов хвиль	Near-surface self propulsion of a generic submarine in calm water and waves. Carrica, PM; Kim, Y.; Martin, JE. OCEAN ENGINEERING. 2019. Volume 183. Page 87-105.	We present a study of the response of the generic Joubert BB2 geometry self-propelled near the free surface, using a dynamic overset methodology with discretized propeller and control surfaces. A grid study was performed for sail top depth 0.702 m. Even keel simulations at depths ranging from -6.9 m to 40 m were conducted in calm water and regular waves representative of sea state 2 to 7. An autopilot acting on sail and tail planes, ballast and trim tanks was used to simulate controlled self-propulsion at several depths in calm water and waves. The even keel study shows that near surface operation causes considerable vertical forces and pitching moments, and an increase in required propeller thrust to achieve self-propulsion, decreasing efficiency. The boat responds to waves mainly through the added mass forces produced by the wave-induced velocity field, causing an exponential decay of the wave influence with depth and with decreasing wave amplitude. In controlled free running simulations very near the surface the boat responds to the forces observed in even keel, requiring compensation through the trim tanks to prevent high bow down pitch. Hull/free surface interaction causes fluctuations in the wake, resulting in a broadband response of propeller thrust.	https://www.webofscience.com/wos/woscc/full-record/WOS:000479025700007
5	Експериментальне дослідження переходу режимів змащування	Experimental research on the interface lubrication regimes	This paper aims to experimentally investigate the influences of surface topography and operating conditions on lubrication regimes transition of water lubricated bearing in submarine. Simulations are also	https://www.webofscience.com/wos/woscc/full-

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
	інтерфейсу підшипника, що змащується водою	transition of water lubricated bearing. Xie, ZL; Liu, HL. MECHANICAL SYSTEMS AND SIGNAL PROCESSING. 2020. Volume 136, 106522.	performed under the same settings and operating conditions. The calculated and experimental results agree well. Effects of surface roughness, external loads, radial clearances, the acceleration and deceleration process on the lubrication regimes transition are further investigated. Characteristic parameters of the lubrication regimes transition are summarized. Reasonable explanations are given to illustrate the results as well as the relative errors. It has certain guiding significance for further step investigation on influences of surface topography on lubrication regimes transition of such bearings.	record/WOS:000529083600049
Океанографія				
1	Чисельні дослідження поведінки великих деформацій кільцеподібно підкріпленої циліндричної оболонки, що піддається підводному вибуху	Numerical investigations on the large deformation behaviour of ring stiffened cylindrical shell subjected to underwater explosion. Praba, RPS; Ramajeyathilagam, K. APPLIED OCEAN RESEARCH. 2020. Volume 101. 102262.	Ring stiffened cylindrical shells find wide applications in marine vehicles such as submersibles, submarine, autonomous underwater vehicles (AUV) and torpedoes. The structures used for military applications are susceptible to shock loadings from an underwater explosion. It is imperative to understand the shock damage mechanism of such structures to design for survivability. The problem is quite complex involving explosive-fluid interaction, fluid-structure interaction, material, geometric nonlinearity and strain rate effects. In this paper, an attempt has been made to study the shock response of a ring stiffened cylindrical shell of length 1000 mm, diameter 600 mm and thickness 6 mm shock tested using small explosive charge of 70 gm PEK I. The numerical study is performed using LS-DYNA finite element code considering the fluid-structure interaction, strain rate effects, geometric and material nonlinearity. The stiffened cylinder under consideration is modelled using Belytschko-Tsay shell element and the fluid and explosive using Eulerian solid element. The explosive is modelled using JWL equation of state, the fluid using Gruneisen equation of state and the stiffened cylinder fluid interaction using ALE coupling. The permanent deformation obtained from the numerical study compares well with experimental results within 5% accuracy. Subsequently, parametric investigation has been carried out for various charge weights with different cylindrical shell thickness and the results of permanent deformation, effective plastic strain are presented.	https://www.webofscience.com/wos/woscc/full-record/WOS:000564660000004
2	Експериментальний аналіз вібрацій, викликаних тертям у підшипниках з водяним змащенням у підводній рушійній установці підводного човна	Experimental analysis on friction-induced vibration of water-lubricated bearings in a submarine propulsion system. Qin, HL; Yang, C.; Zhu, HF; Li, XF; Li, ZX; Xu, X. OCEAN	Abnormal vibration and noise, originated from friction and wear, are often found in water-lubricated stern-tube bearings, which seriously threatens the safety and concealment of underwater vehicles. In order to better understand the friction-induced vibration in water-lubricated stern-tube bearings, friction pairs of rubber specimens matched with ZQSn10-2 brass were tested on the water-lubricated bearing test rig SBB-100. A high-speed camera was used to track the micro images that	https://www.webofscience.com/wos/woscc/full-record/WOS:000528188500014

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		ENGINEERING. 2020. Volume 203, 107239.	focused on of the rubber layer vibration motion, while a machine vision technique also was employed to extract the friction-induced vibration of the test bearings. The experimental analysis results demonstrate that the bearing vibration was mainly induced by stick-slip. Furthermore, the orthogonal experiment method was used to distinguish the key factors that induce the bearing vibration among rotating speed, contact pressure, rubber layer hardness and thickness, and lubrication condition. The analysis results indicate that the importance of factors is sorted in the order of lubrication condition, contact pressure, hardness and thickness of rubber layers. In normal lubrication condition, the intensity of friction-induced vibration of the rubber bearings can be reduced by increasing the hardness of the rubber layer, decreasing the contact pressure, and the thickness of the rubber layer.	
3	Чисельне дослідження структур потоку навколо моделі DARPA SUBOFF	Numerical investigation of flow structures around the DARPA SUBOFF model. Qu, Y.; Wu, Q.; Zhao, X.; Huang, BA; Fu, XY; Wang, GY. OCEAN ENGINEERING. 2021. Volume 239, 109866.	A large eddy simulation (LES) of a fully appended SUBOFF model was performed by the Boundary Data Immersion Method (BDIM) with the Reynolds number of 1.2 x 10(7). Numerical simulation is carried out through Fortran-based code and the geometric structure used in this paper is an idealized submarine (DARPA SUBOFF, with appendages). The computational uniformly distributed orthogonal grids consist of approximately 108 million nodes and are used to capture all essential flow structures. The pressure coefficients and streamwise velocity distribution obtained by the large-eddy simulation (LES) are in good agreement with the experimental data. The objective of this paper is to evaluate the ability of BDIM to predict the flow over axisymmetric hull, to investigate the evolution of the junction and tip flows on the body of the SUBOFF. Three different types of large-scale vortex structures were found around the sail, including horseshoe vortex, hairpin vortex and necklace vortex. The different vortex identification methods, namely, omega criterion, Q criterion and Liutex method, are used to capture and analyze the formation mechanism of various vortex structures. Meanwhile, by extracting the rotation and shear relative parameter epsilon around the sail, it can be found that the rotation is dominant in the vortex distribution profile.	https://www.webofscience.com/wos/woscc/full-record/WOS:000702829300004
4	Чисельне дослідження кавітаційного шуму верхівково-вихрових гвинтів підводних човнів з використанням гібридного обчислювального гідроакустичного підходу	Numerical investigation of tip-vortex cavitation noise of submarine propellers using hybrid computational hydro-acoustic approach. Ku, G.; Cho, J.; Cheong, C.; Seol, H. OCEAN	In this study, the hybrid computational hydro-acoustics (CHA) method is applied to predict hydrodynamic noise due to tip vortex cavitation (TVC) of underwater submarine propellers. The hybrid CHA approach consists of two sequential methods: Delayed Detached Eddy Simulation (DDES) technique with adaptive mesh refinement method and the Ffowcs Williams and Hawkings (FW-H) equation. The former is utilized for accurate prediction of TVC of underwater propellers, and the latter is used for efficient prediction of hydro-acoustic pressure due	https://www.webofscience.com/wos/woscc/full-record/WOS:000696708900001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		ENGINEERING. 2021. Volume 238, 109693.	to cavitating flow. The target submarine and propeller are the DARPA suboff submarine and two high skew propellers with skew angles of 17 and 38 degrees. The propellers are designed to investigate the effects of skew angle on TVC and its noise. The corresponding experiments are performed in the Large Cavitation Tunnel (LCT) of the Korea Research Institute of Ships and Ocean Engineering (KRISO). The two preliminary simulations are carried out to confirm the close reproduction of the experimental conditions in the main simulations. First, the flow through the LCT test section is simulated to confirm the accurate reproduction of the wall boundary layer. Its validity is confirmed by comparing the predicted boundary layer profiles with the measured results. Second, the flow over the DARPA suboff submarine without a propeller in the LCT test section is simulated to confirm the accurate prediction of the inflow distortion originating from the boundary layer flow of the submarine body. Its validity is also confirmed by comparing the predicted nominal wake field with the measured one. After the close reproduction of these two effects is confirmed, the cavitating flow of the propellers installed to the DARPA suboff submarine body is simulated by using the DDES technique combined with adaptive mesh refinement, and the TVC noise is predicted by applying the quadrupole-corrected FW-H equation to the surfaces enclosing the propellers. The predicted TVC of the propeller closely follows the measured one. The numerical and experimental results capture the TVC induced by the wake flows due to the submarine body's rudders and sail. The predicted hydro-acoustic pressure spectra due to the propellers' cavitating flow also show excellent agreements with the predicted ones. Besides, both the numerical and experimental results confirm that the lower noise is generated by the propeller with a higher skew angle.	
5	Виявлення несправностей на основі спостереження для підводних двигунів з магнітним зв'язком та їх застосування у підводних човнах типу «Цзяолун»	Observer-based fault detection for magnetic coupling underwater thrusters with applications in jiaolong HOV. Chu, ZZ; Chen, YS; Zhu, DQ; Zhang, MJ. OCEAN ENGINEERING. 2020. Volume 210, 107570.	This study proposed an observer-based fault detection method for magnetic coupling underwater thrusters. To improve the accuracy of a thruster system model, a modeling identification method based on local recurrent neural networks was proposed, which can be described using state space equation. The algorithm for selecting model parameters was obtained by constructing a nonlinear constrained optimization model. Based on an identification model, a sliding mode observer was developed and employed for online fault reconstruction. Compared with traditional analytical-model-based thruster fault diagnosis methods, the proposed method can determine the fault cause to improve the submarine safety. The proposed method was validated based on the data of Jiaolong human occupied vehicle (HOV).	https://www.webofscience.com/wos/woscc/full-record/WOS:000551161000036

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
Інформатика				
1	Огляд підходів на основі глибокого навчання для автоматичного розпізнавання цілей гідролокатором	A Review on Deep Learning-Based Approaches for Automatic Sonar Target Recognition. Neupane, D.; Seok, J. ELECTRONICS. 2020. Volume 9. Issue 11, 1972.	Underwater acoustics has been implemented mostly in the field of sound navigation and ranging (SONAR) procedures for submarine communication, the examination of maritime assets and environment surveying, target and object recognition, and measurement and study of acoustic sources in the underwater atmosphere. With the rapid development in science and technology, the advancement in sonar systems has increased, resulting in a decrement in underwater casualties. The sonar signal processing and automatic target recognition using sonar signals or imagery is itself a challenging process. Meanwhile, highly advanced data-driven machine-learning and deep learning-based methods are being implemented for acquiring several types of information from underwater sound data. This paper reviews the recent sonar automatic target recognition, tracking, or detection works using deep learning algorithms. A thorough study of the available works is done, and the operating procedure, results, and other necessary details regarding the data acquisition process, the dataset used, and the information regarding hyper-parameters is presented in this article. This paper will be of great assistance for upcoming scholars to start their work on sonar automatic target recognition.	https://www.webofscience.com/wos/woscc/full-record/WOS:000593524800001
2	Характеристика сліду за гвинтом підводного човна за допомогою моделювання великих вихрів	Characterization of the wake of a submarine propeller via Large-Eddy simulation. Posa, A.; Broglia, R.; Felli, M.; Falchi, M.; Balaras, E. COMPUTERS & FLUIDS. 2019. Volume 184. Page 138-152.	Results of large-eddy simulations of a submarine propeller in open-water (isolated) configuration are presented for three load conditions. An immersed boundary approach is adopted to handle the rotating geometry of the propeller within a stationary cylindrical grid composed of about 840 million nodes. Direct comparisons with Particle Image Velocimetry experiments conducted in parallel demonstrate that the simulations reproduce the wake very accurately. In particular the wake dynamics are mainly dominated by tip and hub vortices. Strong structures are also shed in the near wake from the suction side of the propeller blades, correlating with local maxima of turbulent kinetic energy. However, they are not a long standing feature of the propeller wake. In contrast, helical structures originating form the root of the propeller blades are more persistent and their footprint is still visible few propeller diameters downstream. We verified that load conditions affect substantially both hub vortex and tip vortices. In a similar way, for increasing loads turbulent kinetic energy experiences a faster growth at the wake axis, populated by the hub vortex, compared to the outer radii, dominated by the tip vortices. Also, the evolution of turbulent kinetic energy at the outer edge of the wake is not monotonic, in contrast with that in the wake core, due to mutual interaction and	https://www.webofscience.com/wos/woscc/full-record/WOS:000467513200012

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			associated shear between tip vortices and the wake of the following blades.	
3	Автоматичне визначення типів цифрової модуляції з різними шумами за допомогою згорткової нейронної мережі на основі часово-частотної інформації	Automatic determination of digital modulation types with different noises using Convolutional Neural Network based on time-frequency information. Daldal, N.; Cömert, Z.; Polat, K. APPLIED SOFT COMPUTING. 2020. Volume 86, 105834.	In this study, a novel digital modulation classification model has been proposed for automatically recognizing six different modulation types including amplitude shift keying (ASK), frequency shift keying (FSK), phase-shift keying (PSK), quadrate amplitude shift keying (QASK), quadrate frequency shift keying (QFSK), and quadrate phase-shift keying (QPSK). The determination of modulation type is significant in military communication, satellite communication systems, and submarine communication. To classify the modulation types, we have proposed a two-stage hybrid method combining short-time Fourier transform (STFT) and convolutional neural network (CNN). In the first stage, as the data source, the time-frequency information from these modulation signals have been extracted with STFT. This information has been obtained as 2D images to feed the input of the CNN deep learning method. In the second stage, the obtained 2D time-frequency information has been given to the input of the CNN algorithm to classify the modulation types. In this work, noises at various SNR values from 0 dB to 25 dB were created and added to the modulated signals. Even in the presence of noise, the proposed hybrid deep learning model achieved excellent results in the noised-modulation signals. (C) 2019 Elsevier B.V. All rights reserved.	https://www.webofscience.com/wos/woscc/full-record/WOS:000503388200027
4	Моделювання великих вихрів: дослідження характеристик сліду гвинта за наявності керма напрямку вище за течією	LES study of the wake features of a propeller in presence of an upstream rudder. Posa, A.; Broglia, R.; Balaras, E. COMPUTERS & FLUIDS. 2019. Volume 192, 104247.	Large-Eddy Simulations were carried out on a notional submarine propeller in presence of a disturbance at the inflow, associated to the wake of an upstream hydrofoil, mimicking a rudder. Three orientations of the hydrofoil were simulated, equivalent to angles of incidence of alpha = 0 degrees, alpha = 10 degrees and alpha = 20 degrees, respectively. Results were also compared with the open-water configuration, featuring the same propeller in isolated conditions. Present computations demonstrate that the topology of the largest coherent structures, that are the tip vortices and the hub vortex, is practically unchanged across the three cases with different inflow perturbations. In the near wake, for alpha = 0 degrees and alpha = 10 degrees turbulent fluctuations within the propeller wake were increased only locally, at the azimuthal positions corresponding to the wake of the hydrofoil. In contrast, for alpha = 20 degrees. featuring separation over the suction side of the hydrofoil and thus a wider disturbance at the propeller inflow, turbulence within the core of the tip vortices was affected also at azimuthal positions away from the ingested perturbation. For the same condition also the wake axis demonstrated a stronger destabilization of the hub vortex, compared to the cases with	https://www.webofscience.com/wos/woscc/full-record/WOS:000503909700013

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			milder disturbances, with about a four fold increase of turbulent kinetic energy, relative to the open-water condition. Downstream of the destabilization of the wake system, increasing values of turbulent kinetic energy were associated to growing incidence angles of the upstream hydrofoil.	
5	Централізоване злиття даних на основі взаємодії кількох моделей та адаптивного фільтра Калмана для відстеження цілей у підводних акустичних сенсорних мережах	Centralized Fusion Based on Interacting Multiple Model and Adaptive Kalman Filter for Target Tracking in Underwater Acoustic Sensor Networks. Qiu, J.; Xing, ZR; Zhu, CS; Lu, KF; He, JL; Sun, YB; Yin, LH. IEEE ACCESS. 2019. Volume 7. Page 25948-25958.	Underwater acoustic sensor networks (UASNs) play an important role in the ocean's protection. They can realize real-time data collection, monitoring, exploration, and many other underwater applications by connecting and coordinating seafloor sensors and underwater vehicles. To achieve these application objectives, such as fishes tracking in biological monitoring field and submarines tracking in military field, target tracking is one of the key techniques. This paper presents a centralized fusion algorithm based on the interacting multiple models and the adaptive Kalman filter (IMMCFAKF) for target tracking in UASNs. Specifically, by introducing an adaptive forgetting factor into the optimal centralized fusion Kalman filter algorithm, the optimal centralized fusion adaptive Kalman filter (CFAKF) algorithm is obtained first. Then, combining the superiorities of both the optimal CFAKF algorithm and the conventional IMM algorithm, the optimal IMMCFAKF is achieved. The numerical simulations are provided to demonstrate the effectiveness of the proposed optimal IMMCFAKF algorithm.	https://www.webofscience.com/wos/woscc/full-record/WOS:000461253500001
Системи автоматизованого управління				
1	Усунення помутніння підводного зображення за допомогою глобальних колірних ознак	Underwater image dehazing using global color features. Alenezi, F.; Armghan, A.; Santosh, KC. ENGINEERING APPLICATIONS OF ARTIFICIAL INTELLIGENCE. 2022. Volume 116, 105489.	Accurate underwater imaging is a challenging task. Unlike regular photography, visibility underwater is drastically hazed by water molecules and suspended particles distorting light rays and causing differential absorption of different wavelengths of color. Existing research produces well-adjusted but not perfect results. In this work, we present a novel method that dehazed underwater images by estimating global background light based on the optimal eigenvalues of a matrix constructed from three components: (1) gradient of the pairwise wavelength of color channels (blue-red (br), blue-green (bg), and green-red (gr)) (2) gradient of the wavelength of color channels, and (3) the color channels themselves. We estimate transmission maps via scene depth by exploiting the difference in absorption of the different color channel wavelengths. The proposed technique is executed by augmenting UWCNN (Under-Water CNN) with graph-cut theory. The resultant dehazed images successfully show greatly improved color. The proposed results outperform the existing methods in terms of entropy, UIQMn,m, UICM, UISM, and UCIQE. These	https://www.webofscience.com/wos/woscc/full-record/WOS:000869747400001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			improvements will provide stronger imaging tools to domains like submarine search and rescue, navigation, oceanography, and mapping. There is room for future research because our process slightly darkens images which leads to marginally lower UIConM values. Future study can also further evaluate the effect of color channels while assuming pixels with the highest intensity are used as the global ambient light.	
2	Моделювання, імітація та керування маневруванням типового підводного човна	Modeling, simulation and maneuvering control of a generic submarine. MacLin, G.; Hammond, M.; Cichella, V.; Martin, JE. CONTROL ENGINEERING PRACTICE. 2024. Volume 144, 105792.	This work introduces two multi-level control strategies to address the problem of guidance and control of underwater vehicles. An outer-loop path-following algorithm and an outer-loop trajectory tracking algorithm are presented. Both outer-loop algorithms provide reference commands that enable the generic submarine to adhere to a three-dimensional path, and both use an inner-loop adaptive controller to determine the required actuation commands. Further, a reduced order model of a generic submarine is presented. Computational fluid dynamics (CFD) results are used to create and validate a model that includes depth dependence and the effect of waves on the craft. Results from the reduced order model for each control strategy are compared.	https://www.webofscience.com/wos/woscc/full-record/WOS:001145147300001
3	Виявлення кількох підводних човнів за допомогою мультистатичної гідролокаційної системи	Multi-Submarines Detection Using Multistatic Sonar System. Song, RP; Esmaiel, H.; Sun, HX; Qi, J.; Zhang, H.; Zhou, MZ. PROCEEDINGS OF 2020 IEEE 5TH INFORMATION TECHNOLOGY AND MECHATRONICS ENGINEERING CONFERENCE. 2020. Page 1671-1675.	Submarines and underwater automatic vehicles (UAV) are becoming better at concealing themselves by reducing noise. There is strong necessity to detect enemy submarines and UAVs timely in protecting the maritime border. Active sonar has been used to detect enemy submarines and UAV. There are two typical types of such active sonar based on the geometry locations of transmitter and receiver named monostatic sonar and bistatic sonar system. In the monostatic scenario the transmitter and receiver transducers are collocated while it is called bistatic sonar system in the case if they are separate. Both sonar systems can be used in underwater object detection. In this paper, a target strength model is proposed to estimate multi-object in the same time. A model of target strength in [10] is referred which is originally designed to calculate the scattering wave from a single submarine scanning from full-angle. The proposed scheme here is effective in detecting the number of enemy submarines and the moving direction of submarine queue. Monto Carlo simulation has been used to show the performance of the proposed model.	https://www.webofscience.com/wos/woscc/full-record/WOS:000617764100330
4	Перетворювач високої вхідної напруги з широким діапазоном вхідної напруги є критично необхідним у системі живлення підводних човнів на великих відстанях	A high input voltage converter with a wide input voltage range is crucially required in long-distance submarine power system.	A high input voltage converter with a wide input voltage range is crucially required in long-distance submarine power system. However, the concise implementation of high input voltage and wide input voltage ranges remains a challenge for existing converter. In this article, a serial hybrid-clamped three-level half-bridge LLC resonant converter is proposed. The proposed converter can withstand high	https://www.webofscience.com/wos/woscc/full-record/WOS:001177084200001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		Qin, JJ; He, ZX; Weng, ZJ; Guan, RF; Li, ZJ; Li, ZY; Zhang, ZY; Ding, SY; Xu, QM; Chen, YD. IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS. 2024. Volume 71. Issue 11. Page 13991-14001.	input voltage by connecting two hybrid-clamped three-level half-bridges in series. All the operating states of the converter are analyzed, five modulation modes are presented, four of which are controlled by pulse frequency modulation, and the other is controlled by changing the equivalent phase shift angle. The five modulation modes cover different voltage gain ranges, and can be combined to achieve wide input voltage regulation while maintaining soft switching of switching devices. The experimental prototype with 1 kW power level and 250 V-2 kV input voltage range is built to verify the wide voltage regulation rang soft-switching performance of the proposed converter.	
5	Роботизована спільна мережа для локалізації підводного човна, що зазнає лиха: результати REPMUS21	A Robotic Cooperative Network for Localising a Submarine in Distress: Results From REPMUS21. Ferri, G.; Faggiani, A.; Petroccia, R.; Stinco, P.; Tesei, A. IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION. 2023. Page 3088-3094.	Autonomy, cooperation and data fusion can increase the performance of robotic networks in many underwater applications. In this paper, we describe a novel occupancy grid (OG) based perception layer, and its use for controlling a network of autonomous underwater vehicles (AUVs), sensorised with passive sonars. Data fusion between the robots' bearing-only measurements (typical of passive sonars) enables the estimate of target position. The developed OG framework exploits networking and the spatial diversity provided by the multi-robot system. The perception layer was integrated in the intelligent Cooperative Autonomous Decision Making Engine (iCADME) control architecture and validated for the first time in the Robotics Experimentation and Prototyping MUS (REPMUS) Exercise, held in Portugal in September 2021. Our robotic network participated in a technical demonstration, whose main objective was to localise a bottomed submarine which emitted a periodic help request acoustically during a simulated distress situation. We report results which are one of the first examples to demonstrate how cooperative robotics, supported by data fusion, can be effective in a passive sonar scenario. They also confirm the viability of adopting such solutions in real-world applications, characterised by poor communications and challenging environments. What was achieved at REPMUS21 clearly demonstrates how a network of cooperative robots can improve search & rescue operations of a submarine.	https://www.webofscience.com/wos/woscc/full-record/WOS:001036713002068
Телекомунікації				
1	Квантовий розподіл ключів для захищених оптичних мереж: огляд	Quantum Key Distribution Secured Optical Networks: A Survey. Sharma, P.; Agrawal, A.; Bhatia, V.; Prakash, S.; Mishra, AK. IEEE OPEN JOURNAL OF	Increasing incidents of cyber attacks and evolution of quantum computing poses challenges to secure existing information and communication technologies infrastructure. In recent years, quantum key distribution (QKD) is being extensively researched, and is widely accepted as a promising technology to realize secure networks. Optical fiber networks carry a huge amount of information, and are widely	https://www.webofscience.com/wos/woscc/full-record/WOS:000694962900002

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		THE COMMUNICATIONS SOCIETY. 2021. Volume 2. Page 2049-2083.	deployed around the world in the backbone terrestrial, submarine, metro, and access networks. Thus, instead of using separate dark fibers for quantum communication, integration of QKD with the existing classical optical networks has been proposed as a cost-efficient solution, however, this integration introduces new research challenges. In this paper, we do a comprehensive survey of the state-of-the-art QKD secured optical networks, which is going to shape communication networks in the coming decades. We elucidate the methods and protocols used in QKD secured optical networks, and describe the process of key establishment. Various methods proposed in the literature to address the networking challenges in QKD secured optical networks, specifically, routing, wavelength and time-slot allocation (RWTA), resiliency, trusted repeater node (TRN) placement, QKD for multicast service, and quantum key recycling are described and compared in detail. This survey begins with the introduction to QKD and its advantages over conventional encryption methods. Thereafter, an overview of QKD is given including quantum bits, basic QKD system, QKD schemes and protocol families along with the detailed description of QKD process based on the Bennett and Brassard-84 (BB84) protocol as it is the most widely used QKD protocol in the literature. QKD system are also prone to some specific types of attacks, hence, we describe the types of quantum hacking attacks on the QKD system along with the methods used to prevent them. Subsequently, the process of point-to-point mechanism of QKD over an optical fiber link is described in detail using the BB84 protocol. Different architectures of QKD secured optical networks are described next. Finally, major findings from this comprehensive survey are summarized with highlighting open issues and challenges in QKD secured optical networks.	
2	Протокол передачі даних на основі стільникової кластеризації з урахуванням перешкод для підводних акустичних сенсорних мереж	Cellular Clustering-Based Interference-Aware Data Transmission Protocol for Underwater Acoustic Sensor Networks. Zhang, J.; Cai, MY; Han, GJ; Qian, YJ; Shu, L. IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY. 2020. Volume 69. Issue 3. Page 3217-3230.	Recently, the development of three-dimensional interference-aware data transmission methods has attracted the attention of scholars due to the increased interest in exploiting and studying the underwater acoustic sensor networks (UASNs). In this paper, an interference aware data transmission protocol based on cellular clustering architecture is proposed. The protocol involves two steps. The first one is an inter-cell time division multiple access (TDMA) scheduling, which reduces acoustic interference by restricting simultaneous data transmission via adjacent routing paths; and the second one is an intra-cell hierarchical routing, which targets efficient data collection in the submarine and reliable data transmission from the seabed to the surface. Moreover, a novel Ekman spiral-based low-cost location prediction method and a	https://www.webofscience.com/wos/woscc/full-record/WOS:000522456200069

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			void hole recovery scheme are adopted in each step to support the practicability of proposed protocol. Theoretical analysis and simulations indicate that the proposed protocol has advantages related to the quality of service (QoS) of UASNs because the signal interference is significantly mitigated.	
3	Аналіз продуктивності багатострибкових підводних бездротових оптичних систем зв'язку через експоненціально-узагальнені канали гамма-турбулентності	Performance Analysis of Multi-Hop Underwater Wireless Optical Communication Systems Over Exponential-Generalized Gamma Turbulence Channels. Le-Tran, M.; Kim, S. IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY. 2022. Volume 71. Issue 6. Page 6214-6227.	Underwater wireless optical communication (UWOC) has generated a much interest in the research community thanks to its wide range of applications, including submarine navigation, seafloor exploration, and military operation. Turbulence, scattering, and absorption phenomena generally can severely affect the performance of UWOC systems. The relaying methods have been shown as a promising technique to alleviate turbulence-induced and short-range fading. In this paper, under varying channel conditions, we present a unified framework to analyze the performance of multi-hop UWOC systems with both amplify-and-forward and decode-and-forward relaying techniques. In particular, for the end-to-end signal-to-noise ratio (SNR), we use the univariate and bivariate Fox-H functions to derive both the probability density function (PDF) and cumulative distribution function (CDF). Furthermore, for the performance of systems under both types of relaying techniques, we derive tight mathematical expressions for the outage probability and bit error probability. Besides, to highlight and provide some prominent engineering insights into the diversity order, an asymptotic analysis for the outage likelihood and average bit error rate (BER) is given. Consequently, results from Monte-Carlo simulations are used to verify the correctness of our derived mathematical expression.	https://www.webofscience.com/wos/woscc/full-record/WOS:000815676900046
4	Огляд електромагнітних, акустичних та нових технологій для зв'язку на підводних човнах	A Review on Electromagnetic, Acoustic, and New Emerging Technologies for Submarine Communication. Qu, ZH; Lai, MQ. IEEE ACCESS. 2024. Volume 12. Page 12110-12125.	The significance of the ocean in scientific research and military applications is growing, with submarines being pivotal for exploration and naval operations. However, the challenge of wireless communication with submerged submarines due to the strong absorption and scattering of electromagnetic waves in seawater limits their utility. This paper addresses the need for submarine communication methods characterized by speed, stability, cost-effectiveness, and long-range capabilities. It provides a comprehensive overview of current and potential future submarine communication techniques, including electromagnetic, acoustic, and optical methods, analyzing their performance in various channel complexities and discussing their advantages and drawbacks. Additionally, emerging technologies such as magnetic, translational acoustic-RF (TARF), photo/thermo-acoustic (PA/TA), neutrino, and quantum communication are explored, showing	https://www.webofscience.com/wos/woscc/full-record/WOS:001151647300001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			promise for the future of submarine communication systems. The upcoming generation of communication technology may establish a three-dimensional communication network connecting land-based stations, buoys, drones, satellites, and submarines to enhance the efficiency and reach of underwater communication.	
5	Інтелектуальна платформа конвергенції океану на основі Інтернету речей з підтримкою периферійних обчислень	Intelligent Ocean Convergence Platform Based on IoT Empowered with Edge Computing. Liang, MZ; Su, X.; Liu, XF; Zhang, XW. JOURNAL OF INTERNET TECHNOLOGY. 2020. Volume 21. Issue 1. Page 235-244.	The ocean is currently crowded with vessels, including but not limited to commercial ships and submarines used for military operations or scientific investigations. Each of these vessels and their on-board equipment produce a massive amount of data that need to be shared with potential destinations. The current popular Intelligent Ocean Convergence Platform is suggested to support oceanic services by taking advantage of the novel concepts of the Internet of Things and 5G communications. However, the processing activities are not always centrally performed within the cloud but are sometimes shifted to the edge of the network according to edge computing. In this paper, we propose a combination of software-defined networking and edge computing, where software technology is used to support interoperability of heterogeneous network technologies, as well as edge computing enables ultra-reliability, scalability, and low latency in ocean networks. This will meet the rapid growth of marine vessels' demand for rapid computing and communication capabilities. Through the simulation of the average end-to-end delay, the efficiency of the proposed architecture based edge computing is evaluated.	https://www.webofscience.com/wos/woscc/full-record/WOS:000513926800022
Інструменти				
1	Розробка та впровадження векторного гідрофона MEMS на основі зразка отоліта медузи для виявлення низькочастотних об'єктів	Design and implementation of a jellyfish otolith-inspired MEMS vector hydrophone for low-frequency detection. Wang, RX; Shen, W.; Zhang, WJ; Song, JL; Li, NS; Liu, MR; Zhang, GJ; Xue, CY; Zhang, WD. MICROSYSTEMS & NANOENGINEERING. 2021. Volume 7. Issue 1, 1.	Detecting low-frequency underwater acoustic signals can be a challenge for marine applications. Inspired by the notably strong response of the auditory organs of pectis jellyfish to ultralow frequencies, a kind of otolith-inspired vector hydrophone (OVH) is developed, enabled by hollow buoyant spheres atop cilia. Full parametric analysis is performed to optimize the cilium structure in order to balance the resonance frequency and sensitivity. After the structural parameters of the OVH are determined, the stress distributions of various vector hydrophones are simulated and analyzed. The shock resistance of the OVH is also investigated. Finally, the OVH is fabricated and calibrated. The receiving sensitivity of the OVH is measured to be as high as -202.1 dB@100 Hz (0 dB@1 V/mu Pa), and the average equivalent pressure sensitivity over the frequency range of interest of the OVH reaches -173.8 dB when the frequency ranges from 20 to 200 Hz. The 3 dB polar width of the directivity pattern for the OVH is measured as 87 degrees. Moreover, the OVH is demonstrated to operate under 10 MPa hydrostatic pressure. These	https://www.webofscience.com/wos/woscc/full-record/WOS:000604095500001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			results show that the OVH is promising in low-frequency underwater acoustic detection. Detecting submarines via biomimicry Jellyfish sensory organs offer the inspiration for a new sensor design that can sensitively detect low-frequency sounds underwater. These capabilities are particularly for the long-range detection of submarines, which produce faint sound signatures in the 5-200 Hertz range. Researchers have struggled to develop compact 'hydrophone' devices that can sensitively capture such frequencies underwater, but Wendong Zhang of the North University of China and colleagues have identified a promising solution. Modeled on the pectis jellyfish auditory organ, this system features an otolith-like structure mounted on a cross-beam that produces a piezoresisitive signal in response to vibrations. Based on this concept, the researchers fabricated a device that effectively detects very faint sounds in the 20-200 Hertz range at depths of at least 1000 meters, highlighting the potential of such 'otolith-inspired MEMS vector hydrophone' devices.	
2	Принцип та стан застосування повністю розподіленої технології виявлення вібрацій волоконно-оптичного сигналу на основі фоточутливої оптичної рефлектометрії в часовій області: огляд	Principle and Application State of Fully Distributed Fiber Optic Vibration Detection Technology Based on φ-OTDR: A Review. Marie, TFB; Bin, Y.; Han, DZ; An, BW. IEEE SENSORS JOURNAL. 2021. Volume 21. Issue 15. Page 16428-16442.	Phase-sensitive optical time-domain reflectometry Phi-OTDR) is a powerful sensing device that enables fully distributed optical fiber vibration detection with fast response and high sensitivity. Based on the introduction of its principles, Rayleigh backscatter, sensing mechanism, the characteristics of the Phi-OTDR system are analyzed in detail. Some gaps in the Phi-OTDR technology are outlined, and its development trends are highlighted. The application of its current technology is illustrated in different fields such as the perimeter security monitoring system, submarine cable surveillance, and so on. In the experiments analysis, it was pointed out that the device is very sensitive, which is subject to a high rate of false alarms; it also has unresolved types of disturbances. For these purposes, this paper first summarizes the development status of the Phi-OTDR-based fully distributed optical fiber sensing device. Then, it analyzes and proposes the use of a Printed Circuit Board (PCB) winding flyback converter with shielding, to solve the problem of sensitivity. The shielding method has been proven to significantly reduce high frequency noise up to 30 MHz. This will enable relevant industries and future researchers to know the current state of the Phi-OTDR device.	https://www.webofscience.com/wos/woscc/full-record/WOS:000679541000003
3	Інноваційні фотонні датчики для безпеки та захисту, частина II: застосування в аерокосмічній та підводній галузях	Innovative Photonic Sensors for Safety and Security, Part II: Aerospace and Submarine Applications. Cutolo, A.; Bernini, R.; Berruti, GM; Breglio, G.; Bruno, FA;	The employability of photonics technology in the modern era's highly demanding and sophisticated domain of aerospace and submarines has been an appealing challenge for the scientific communities. In this paper, we review our main results achieved so far on the use of optical fiber sensors for safety and security in innovative aerospace and submarine applications. In particular, recent results of in-field	https://www.webofscience.com/wos/woscc/full-record/WOS:000948237400001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		Buontempo, S.; Catalano, E.; Consales, M.; Coscetta, A.; Cusano, A.; Cutolo, MA; Di Palma, P.; Esposito, F.; Fienga, F.; Giordano, M.; Iele, A.; Iadicicco, A.; Irace, A.; Janneh, M.; Laudati, A.; Leone, M.; Maresca, L.; Marrazzo, VR; Minardo, A.; Pisco, M.; Quero, G.; Riccio, M.; Srivastava, A.; Vaiano, P.; Zeni, L.; Campopiano, S. SENSORS. 2023. Volume 23. Issue 5, 2417.	applications of optical fiber sensors in aircraft monitoring, from a weight and balance analysis to vehicle Structural Health Monitoring (SHM) and Landing Gear (LG) monitoring, are presented and discussed. Moreover, underwater fiber-optic hydrophones are presented from the design to marine application.	
4	Планування підводного шляху підводного човна на основі алгоритму колонії мурах зі штучним потенційним полем та методу швидкісних перешкод	Underwater Submarine Path Planning Based on Artificial Potential Field Ant Colony Algorithm and Velocity Obstacle Method. Fu, J.; Lv, T.; Li, B. SENSORS. 2022. Volume 22. Issue 10, 3652.	Navigating safely in complex marine environments is a challenge for submarines because proper path planning underwater is difficult. This paper decomposes the submarine path planning problem into global path planning and local dynamic obstacle avoidance. Firstly, an artificial potential field ant colony algorithm (APF-ACO) based on an improved artificial potential field algorithm and improved ant colony algorithm is proposed to solve the problem of submarine underwater global path planning. Compared with the Optimized ACO algorithm proposed based on a similar background, the APF-ACO algorithm has a faster convergence speed and better path planning results. Using an inflection point optimization algorithm greatly reduces the number and length of inflection points in the path. Using the Clothoid curve fitting algorithm to optimize the path results, a smoother and more stable path result is obtained. In addition, this paper uses a three-dimensional dynamic obstacle avoidance algorithm based on the velocity obstacle method. The experimental results show that the algorithm can help submarines to identify threatening dynamic obstacles and avoid collisions effectively. Finally, we experimented with the algorithm in the submarine underwater semi-physical simulation system, and the experimental results verified the effectiveness of the algorithm.	https://www.webofscience.com/wos/woscc/full-record/WOS:000803587500001
5	Розробка та реалізація гантелеподібного циліарного MEMS-векторного гідрофона	Design and realization of dumbbell-shaped ciliary MEMS vector hydrophone. Ji, SX; Zhang, LS; Zhang, WD; Zhang, GJ; Wang, RX; Song, JL; Zhang, XY; Lian, YQ; Shang, ZZ. SENSORS AND	An excellent hydrophone should have higher sensitivity in its working frequency-band to provide signal with better quality for direction of arrival (DOA). Aiming at the centralized distribution of radiation noise from ships generally below 1KHz, a Dumbbell-shaped ciliary MEMS vector hydrophone (DCVH) with better sensitivity below 1KHz is designed in this paper. When detecting the submarine sound signal, Dumbbell-shaped ciliary can obtain the area of receiving sound waves larger than common ciliary structure in the same mass, increase the	https://www.webofscience.com/wos/woscc/full-record/WOS:000564724600005

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		ACTUATORS A-PHYSICAL. 2020. Volume 311, 112019.	center of gravity position and increase the moment of force, so as to improve the high sensitivity of hydrophone under the premise of meeting the working frequency-band. In addition, the use of resin as the material for making cilia can bring better performance to hydrophone. Through theoretical analysis and simulation verification by COMSOL5.4, the design is feasible. Finally, DCVH is verified by hydrophone test calibration system, with the sensitivity of -186.1dB (1KHz, 0dB = 1V/mu Pa), 10.8dB higher than bionic ciliary MEMS vector hydrophone (CVH), the working frequency-band of 20Hz - 1KHz, the excellent "8" character directivity, and concave point depth exceeding 30dB, which is consistent with theory and simulation results and meets the design requirements.	
Матеріалознавство				
1	3D-друк волокноармованих пластикових композитів з використанням моделювання методом наплавлення: огляд стану	3D Printing of Fiber-Reinforced Plastic Composites Using Fused Deposition Modeling: A Status Review. Pervaiz, S.; Qureshi, TA; Kashwani, G.; Kannan, S. MATERIALS. 2021. Volume 14. Issue 16, 4520.	Composite materials are a combination of two or more types of materials used to enhance the mechanical and structural properties of engineering products. When fibers are mixed in the polymeric matrix, the composite material is known as fiber-reinforced polymer (FRP). FRP materials are widely used in structural applications related to defense, automotive, aerospace, and sports-based industries. These materials are used in producing lightweight components with high tensile strength and rigidity. The fiber component in fiber-reinforced polymers provides the desired strength-to-weight ratio; however, the polymer portion costs less, and the process of making the matrix is quite straightforward. There is a high demand in industrial sectors, such as defense and military, aerospace, automotive, biomedical and sports, to manufacture these fiber-reinforced polymers using 3D printing and additive manufacturing technologies. FRP composites are used in diversified applications such as military vehicles, shelters, war fighting safety equipment, fighter aircrafts, naval ships, and submarine structures. Techniques to fabricate composite materials, degrade the weight-to-strength ratio and the tensile strength of the components, and they can play a critical role towards the service life of the components. Fused deposition modeling (FDM) is a technique for 3D printing that allows layered fabrication of parts using thermoplastic composites. Complex shape and geometry with enhanced mechanical properties can be obtained using this technique. This paper highlights the limitations in the development of FRPs and challenges associated with their mechanical properties. The future prospects of carbon fiber (CF) and polymeric matrixes are also mentioned in this study. The study also highlights different areas	https://www.webofscience.com/wos/woscc/full-record/WOS:000689349500001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			requiring further investigation in FDM-assisted 3D printing. The available literature on FRP composites is focused only on describing the properties of the product and the potential applications for it. It has been observed that scientific knowledge has gaps when it comes to predicting the performance of FRP composite parts fabricated under 3D printing (FDM) techniques. The mechanical properties of 3D-printed FRPs were studied so that a correlation between the 3D printing method could be established. This review paper will be helpful for researchers, scientists, manufacturers, etc., working in the area of FDM-assisted 3D printing of FRPs.	
2	Технічний текстиль для військового застосування	Technical textiles for military applications. Revaiah, RG; Kotresh, TM; Kandasubramanian, B. JOURNAL OF THE TEXTILE INSTITUTE. 2020. Volume 111. Issue 2. Page 273-308.	Operation of Armed Forces personnel in harsh military terrains for extended tenure period necessitates protection from elements and battle hazards. Harsh military terrains exert profound effects on the physical and physiological performance of the soldiers and can impart serious health hazards on inadequately protected soldiers resulting in mission failure and avoidable loss of lives. Harsh military terrains can be Mountain environment characterized by treacherous terrains with extreme cold and hypoxia, Deserts characterized by extreme heat stress, Depths of underwater that can pose life threatening situation in case of a distressed submarine, Aviation hazards (such as deadly G-forces faced by fighter pilots during G-manoeuvres and fire hazards that may result from crash) etc. Clothing being the first layer of protection for the wearer, forms an important protective measure in military operation against combat and environmental hazards. A great deal of research is being carried out by military/defence research laboratories worldwide in collaboration with industries to develop technical textiles incorporating suitable smart material finishes for the alleviation of the dangers associated in the combat terrain. Extended Cold weather clothing ensemble, High Altitude Pulmonary Oedema chambers, Anti-G suits, Flame retardant overalls, Submarine Escape Sets, Chemical warfare protection ensemble, liquid cooled garment for protection against hyperthermia etc., are fabricated from variety of technical textiles having special material properties. Technical textiles are used worldwide to provide protection from the hazards of battlefield to the military and paramilitary forces, as 'man behind the machine' is the most important entity in a war theatre. This review focuses a collective account of harsh military environment faced by war fighters during War & Peacetime and material development to develop desired technical textiles to lower the attrition due to harsh environment and battle hazards.	https://www.webofscience.com/wos/woscc/full-record/WOS:000475067200001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
3	Від локальної структури до загальної продуктивності: огляд проектування акустичного покриття	From Local Structure to Overall Performance: An Overview on the Design of an Acoustic Coating. Bai, HB; Zhan, ZQ; Liu, JC; Ren, ZY. MATERIALS. 2019. Volume 12. Issue 16, 2509.	Based on the requirements of underwater acoustic stealth, the classification and research background of acoustic coatings are introduced herein. The research significance of acoustic coatings is expounded from the perspective of both the military and civilian use. A brief overview of the conventional design process of acoustic coatings is presented, which describes the substrates used in different countries. Aimed at the local design of acoustic coatings, research progress on passive and semi-active/active sound absorption structure is summarized. Focused on the passive acoustic coatings; acoustic cavity design and optimization, acoustic performance of acoustic coatings with rigid inclusions or scatterers, and acoustic coatings with a hybrid structure are discussed. Moreover, an overview of the overall design of acoustic coatings based on the sound field characteristics of the submarine is also presented. Finally, the shortcomings of the research are discussed, breakthroughs in acoustic coating design research are forecast, and the key technical issues to be solved are highlighted.	https://www.webofscience.com/wos/woscc/full-record/WOS:000484464800010
4	Вплив морської води на старіння полімерних композитів, армованих волокнами: механічні властивості, механізм старіння та прогнозування терміну служби	Seawater aging effect on fiber-reinforced polymer composites: Mechanical properties, aging mechanism, and life prediction. Nan, JJ; Zhi, C.; Meng, JG; Miao, MH; Yu, LJ. TEXTILE RESEARCH JOURNAL. 2023. Volume 93. Issue 13-14. Page 3393-3413.	Fiber-reinforced polymer (FRP) composites are widely used in marine engineering fields, such as coastal construction, offshore bridges, submarines, and warships, owing to their light weight, high strength, and corrosion resistance. However, owing to the harsh marine environment, FRP composites used in the ocean are inevitably affected by seawater aging. Therefore, it is necessary to investigate the seawater aging properties of FRP composites. In this study, the seawater aging mechanism of FRP composites is summarized, and the influence factors (matrix type, fiber type, immersion temperature, loading mode, and aging method) of seawater aging on the mechanical properties of FRP composites are further reviewed in detail. Based on this, the method for improving the seawater resistance of FRP composites is summarized. In addition, the research schemes of accelerated aging of FRP composites and commonly used life prediction models are summarized, and the methods and suggestions for improving the accuracy of life prediction are further discussed.	https://www.webofscience.com/wos/woscc/full-record/WOS:000922867900001
5	Огляд процесу плазмоелектро-літичного окислення, що застосовується до міді та латуні	A review on the plasma electrolytic oxidation (PEO) process applied to copper and brass. Fattah-alhosseini, A.; Molaei, M.; Kaseem, M. SURFACES AND INTERFACES. 2024. Volume 46, 104179.	Copper and its alloys, with their unique characteristics including a low coefficient of thermal expansion, a high melting point, superior thermal and electrical conductivities, outstanding ductility, and commendable resistance to corrosion, are considered highly suitable for applications in power generation, electrical sectors, military operations, and heat exchange pipelines in submarines. Despite its many advantages, the application of copper is somewhat restricted due to its low strength, hardness, and limited resistance to corrosion and wear. However, the	https://www.webofscience.com/wos/woscc/full-record/WOS:001208232800001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			plasma electrolytic oxidation (PEO) process, which can generate multifunctional oxides such as CuO, Cu2O, and ZnO, offers a promising method for improving the wear and corrosion characteristics of copper -based materials. This paper presents an overview of the latest advancements in the PEO treatment applied to copper and brass. This review offers a comprehensive understanding of the formation of PEO coatings on copper and brass substrates. It explores how the PEO process, its parameters like electrolyte composition, nanoparticle addition, and various post-PEO treatment methods can influence the coatings' morphology, composition, and resistance to corrosion and wear. This review serves as a valuable guide for future research in the field of PEO treatment for copper and its alloys.	
АВІАНОСЦІ				
Інженерія				
1	Пілотоване моделювання польоту гелікоптера для повернення на авіаносець класу «Королева Єлизавета»	Piloted Flight Simulation of Helicopter Recovery to the Queen Elizabeth Class Aircraft Carrier. Watson, NA; Owen, I. White, MD. JOURNAL OF AIRCRAFT. 2020. Volume 57. Issue 4. Page 742-760.	This Paper describes how flight simulation has been used to investigate helicopter recovery operations to the deck of HMS Queen Elizabeth, the United Kingdom's new aircraft carrier. A helicopter flight simulation environment has been developed in which the unsteady airflow over the ship has been created using full-scale computational fluid dynamics. A six-degree-of-freedom motion flight simulator has been used to conduct real-time piloted deck landings where a helicopter flight dynamics model representative of a Sikorsky SH-60B Seahawk helicopter was recovered to the designated rotorcraft landing spots toward the stern of the ship. A test pilot was instructed to land the helicopter and to give workload ratings for the difficulty of the task when flying in relative winds from Ahead, and 45 deg and 90 deg from starboard. The workload ratings, along with the corresponding pilot control activity and helicopter positional accuracy, are discussed in relation to the airflow to which the helicopter was subjected. The Paper demonstrates how flight simulation could be used to support flight trials and helicopter clearance activities but also notes that real-world trials data are needed to compare with the simulations before the techniques can be beneficially deployed.	https://www.webofscience.com/wos/woscc/full-record/WOS:000553129200015
2	Багатоцільова гіперевристична структура для комплексної оптимізації планування операцій на палубі палубних літаків та конфігурації ресурсів	A multi-objective hyper heuristic framework for integrated optimization of carrier-based aircraft flight deck operations scheduling and resource configuration. Cui, RW; Han, W.; Su, XC; Zhang, Y.; Guo, F. AEROSPACE	It is of great significance to produce an efficient flight deck operations scheduling plan for improving the carrier-based aircraft sortie rate and enhancing the combat capability of aircraft carrier formation. Flight deck operations scheduling plan is closely related to flight deck resource configuration. In this paper, in order to find a feasible method to produce an effective operations scheduling plan under different resource configurations, the flight deck operations scheduling problem and resource configuration optimization problem for the pre-flight	https://www.webofscience.com/wos/woscc/full-record/WOS:000596565600003

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		SCIENCE AND TECHNOLOGY, 2020. Volume 107, 106346.	preparation stage are studied simultaneously. The work is different from the existing literature in three aspects: (1) with considering the transfer time of resources and multiple operation execution modes and analyzing the precedence constraints and resource constraints for the flight deck operations, the integrated optimization model of operations scheduling and resource configuration is established and regarded as a multi-objective optimization model. (2) a novel choice function based multi-objective hyper heuristic is proposed for solving the model. The low level heuristics are three well-known multi-objective evolutionary algorithms, and the heuristic selection strategy is an online learning choice function. (3) in order to further improve the performance of proposed hyper heuristic, two modified hyper heuristics are introduced, one of which uses a simulated annealing-based non-deterministic move acceptance strategy and the other uses a modified initiation method, a simulated binary crossover operator, and a normal distribution sampling mutation operator. By conducting simulation experiments in the case study section, the correctness of the model and the superiority of the multi-objective hyper heuristic framework are verified.	
3	Дослідження методу планування місії для запуску групи палубних літаків	Exploring mission planning method for a team of carrier aircraft launching. Wu, Y.; Wang, YY; Qu, XJ; Sun, LG. CHINESE JOURNAL OF AERONAUTICS, 2019. Volume 32. Issue 5. Page 1256-1267.	High-level efficiency and safety are of great significance for improving the fighting capability of an aircraft carrier. One way to enhance efficiency and safety level is to organize the carrier aircraft into combat effectively. This paper studies the mission planning problem for a team of carrier aircraft launching, and a novel distributed mission planning architecture is proposed. The architecture is hierarchical and is comprised of four levels, namely, the input level, the coordination level, the path planning level and the execution level. Realistic constraints in each level of the distributed architecture, such as the vortex flow effect, the crowd effect and the motion of aircraft, are considered in the model. To solve this problem, a distributed path planning algorithm based on the asynchronous planning strategy is developed. The proposed Mission Planning Approach for Carrier Aircraft Launching (MPACAL) is validated using the setups of the Nimitz-class aircraft carrier. Compared to the isolated planning architecture and the centralized planning architecture, the proposed distributed planning architecture has advantages in coordinating the launch tasks not only belonging to the same catapult but also when all different catapults are considered. The proposed MPACAL provides a modeling method for the flight deck operation on aircraft carrier.	https://www.webofscience.com/wos/woscc/full-record/WOS:000468895800017
4	Метод кластеризації мурах на основі спільного використання придатності для мультимодальної	A fitness sharing based ant clustering method for multimodal optimization of the	With the flight envelope becoming larger and larger, the Automatic Carrier Landing System (ACLS) is becoming a complex large-scale system, and the corresponding control parameter design has been the	https://www.webofscience.com/wos/woscc/full-

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
	оптимізації системи поздовжньої автоматичної посадки авіаносця	aircraft longitudinal automatic carrier landing system. Bian, Q.; Nener, B.; Wang, JP.; Liu, XD; Ma, J. AEROSPACE SCIENCE AND TECHNOLOGY. 2022. Volume 122, 107392.	most important key link to ensure the safety and flight quality of aircraft carrier landing missions. In this paper, a Fitness Sharing based Ant Clustering (FSAC) method is presented for use in multimodal optimization of the longitudinal ACLS and to reveal the hidden properties of the solution space. In doing so, first, the lattice rule based space sampling strategy is used to create the individual ant sequences. Then a fading memory fitness sharing function is applied to modify the clustering strategy and regroup the ants for multimodal optimization of the search space. An adaptive learning strategy is developed to dynamically adjust the search scope of the ant colony. Moreover, an online health monitor is used to replace the weak ants with new ones in a timely manner in order to keep robustness of the FSAC. Finally, the multimodal feasible solutions which are good candidates for the ACLS design are presented and the characteristics of the solution space are also analyzed. The result shows that many large solution sets are located at the bottom of the solution space, whereas on the upper side of the solution space, the number of feasible solutions decreases sharply. An F/A-18 model is used as a test bed and the simulations are carried out in various wind conditions to demonstrate the effectiveness and feasibility of the proposed method.	record/WOS:000773811100007
5	Вплив аеродинамічного потоку на характеристики зльоту авіаносця	Aerodynamic Flow Effects on Aircraft Carrier Takeoff Performance. Bardera-Mora, R.; Garcia-Magariño, A.; Rodríguez-Sevillano, A.; Barcala-Montejano, MA. JOURNAL OF AIRCRAFT. 2019. Volume 56. Issue 3. Page 1005-1013.	The aircraft takeoff maneuver for onboard operations is the most critical aspect of maritime performance. In the last decades, several improvements have been made to reduce the number of accidents. One of them is the ski-jump ramp, a modern takeoff system that allows the maneuver to be performed more safely and using less runway distance. Thus, a new in-depth aerodynamic study of the ramp is required. A wind-tunnel test campaign was developed to study the disturbances caused by the ski-jump ramp over the flight deck and the influence on an aircraft carrier performance. Smoke visualizations over the ramp revealed a detached unsteady recirculation bubble at the ramp and a turbulent flow over the flight deck. Velocity measurements were carried out by means of particle image velocimetry. The influence of these disturbances was evaluated for the takeoff performance of the AV-8B Harrier II. The results proved the importance of taking into account these disturbance effects and provided a detailed characterization of the flow over the carrier deck, resulting in establishment of a useful background for future studies on aircraft-ship interference.	https://www.webofscience.com/wos/woscc/full-record/WOS:000472224100012
Океанографія				

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
1	Розрахунково-експериментальне моделювання нестаціонарного потоку повітря над авіаносцем HMS Queen Elizabeth	Computational and experimental modelling study of the unsteady airflow over the aircraft carrier HMS Queen Elizabeth. Watson, NA; Kelly, MF; Owen, I.; Hodge, SJ; White, MD. OCEAN ENGINEERING. 2019. Volume 172. Page 562-574.	This paper describes a comprehensive experimental and computational modelling study of the aerodynamic environment around the UK's new Queen Elizabeth Class (QEC) aircraft carriers. The study has been performed to support the integration of the F-35B Lightning II multi-role fighter with the UK Royal Navy's flagship, HMS Queen Elizabeth. Unsteady airwakes have been generated using Computational Fluid Dynamics (CFD) and have been incorporated into the F-35/QEC Integration Flight Simulator at BAE Systems Warton and into the HELI-FLIGHT-R research simulator at the University of Liverpool. A small-scale experiment has also been conducted in which a 1.4 m long (1:200) scale model of the QEC was submerged in a water channel and Acoustic Doppler Velocimetry was used to measure the unsteady flow around the ship. Delayed Detached Eddy Simulation CFD was used to model the flow in the water channel and the computed unsteady flow field has been compared with the experimental measurements. The results show generally excellent agreement between the model-scale experiment and CFD. Building on this, full-scale 30-s CFD airwakes have been generated for the nearfield area surrounding the QEC, and for about 400 m astern of the ship to capture the disturbed air flow along the fixed-wing approach glideslope.	https://www.webofscience.com/wos/woscc/full-record/WOS:000458591300046
2	Дослідження вітрових потоків над палубою авіаносця, проведене велосиметріяєю зображень частинок	Wind flow investigation over an aircraft carrier deck by PIV. Bardera, R.; Barcala-Montejano, MA; Rodríguez-Sevillano, AA; León-Calero, M. OCEAN ENGINEERING. 2019. Volume 178. Page 476-483.	An aircraft carrier is characterized by a superstructure where different systems are installed. This configuration is similar to a set of bluff bodies with sharp edges where massive flow separation appears in the wake. Depending on the wind-over deck (WOD) conditions, the flow field changes dramatically. Hence, aircraft performances are affected due to the adverse aerodynamic effects generated. Flight envelopes are needed to determine aircraft operating range. In situ measurements are costly and time-consuming. Numerical simulations are providing some solutions to this problem. However, they have to be validated by matching simulation results to those from experimental measurements. In the present paper, the study of the flow configuration at different wind angles has been conducted. Particle image velocimetry technique was used to obtain flow information due to the accurate results provided. Non-dimensional velocity and turbulence maps are presented in order to provide flow field characterization.	https://www.webofscience.com/wos/woscc/full-record/WOS:000464483700036
3	Експериментальне та обчислювальне дослідження аеродинаміки повітряного сліду типового авіаносця з трампліном	Experimental and computational investigation of airwake aerodynamics of the generic aircraft carrier with ski-jump.	A comprehensive experimental and computational investigation of flow past over a generic aircraft carrier with ski-jump is presented in this paper. The study has been performed to gain a deeper understanding of the airwake aerodynamics past such an aircraft carrier for different crosswind conditions. An experimental investigation is carried out in a wind tunnel on a prototype model of	https://www.webofscience.com/wos/woscc/full-record/WOS:000783632900005

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		Shukla, S.; Sinha, SS; Saroha, S.; Khan, HH; Singh, SN. OCEAN ENGINEERING. 2022. Volume 249, 110902.	having a length of 1.1 m (1:250 scale). The prototype model was conceived from the various aircraft carriers existing in the world. A five-hole cobra probe is used to measure all the three velocity components along the 3 degrees aircraft's landing slope for validation purposes. ReynoldsAveraged Navier-Stokes (RANS) based computational investigations are conducted to predict the overall airwake aerodynamics over the flight deck. Subsequently, a detailed parametric study has been conducted to examine the effect of relative wind conditions on the aircraft's landing slope. Detailed comparisons of velocity variations along the aircraft glide slope are discussed along with the experimental data. Results show that the top deck island structure and the oblique wind conditions are the two main contributors for adverse airwake aerodynamics over the flight deck.	
4	Чисельне моделювання нестаціонарного повітряного сліду авіаносця "Ляонін" на основі моделі відірваного вихру із затримкою, пов'язаної з перекриваючою мережею	Numerical Simulation of the Unsteady Airwake of the Liaoning Carrier Based on the DDES Model Coupled with Overset Grid. Yang, XX; Li, BK; Ren, ZB; Tian, FC. JOURNAL OF MARINE SCIENCE AND ENGINEERING. 2024. Volume 12. Issue 9, 1598.	The wake behind an aircraft carrier under heavy wind condition is a key concern in ship design. The Chinese Liaoning ship's upturned bow and the island on the deck could cause serious flow separation in the landing and take-off area. The flow separation induces strong velocity gradients and intense pulsations in the flow field. In addition, the sway of the aircraft carrier caused by waves could also intensify the flow separation. The complex flow field poses a significant risk to the shipboard aircraft take-off and landing operation. Therefore, accurately predicting the wake of an aircraft carrier during wave action motion is of great interest for design optimization and recovery aircraft control. In this research, the aerodynamic around an aircraft carrier (i.e., Liaoning) was analyzed using the computational fluid dynamics technique. The validity of two turbulence models was verified through comparison with the existing data from the literature. The upturned bow take-off deck and the right-hand island were the main areas where flow separation occurred. Delayed detached eddy simulation (DDES), which combines the advantages of LES and RANS, was adopted to capture the full-scale spatial and temporal flow information. The DDES was also coupled with the overset grid to calculate the flow field characteristics under the effect of hull sway. The downwash area at 15 degrees starboard wind became shorter when the hull was stationary, while the upwash area and turbulence intensity increased. The respective characteristics of the wake flow field in the stationary and swaying state of the ship were investigated, and the flow separation showed a clear periodic when the ship was swaying. Comprehensive analysis of the time-dependent flow characteristic of the approach line for fixed-wing naval aircraft is also presented.	https://www.webofscience.com/wos/woscc/full-record/WOS:001322953800001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
5	Оптимізація пасивного керування потоком над трампліном авіаносця за допомогою обчислювальної гідродинаміки та експериментальних досліджень	Optimization of passive flow control above the ski jump ramp of an aircraft carrier by CFD and experimental investigation. Bardera, R.; Matias-Garcia, JC. OCEAN ENGINEERING. 2022. Volume 263, 112419.	Aircraft carriers are a very useful operational tool for military operations. They are designed to provide service to aircraft at sea. For that reason studying the aerodynamic flow on their decks is essential. During take-off and landing maneuvers the aircraft can be affected by the turbulent flow generated by the non-aerodynamic surfaces that compose the geometry of the ship. Specifically, this study uses Computational Fluid Dynamics (CFD) applied to an aircraft carrier. The goal is to analyze and modify the flow detachment generated by the ski jump ramp on the flight deck that can affect the aircraft performances during take-off maneuvers. Passive flow control techniques such as holes in the ramp to allow airflow entering over the deck or aerodynamic devices added in the ramp corner have been tested. Different parameters of the devices have been studied and partial and even complete elimination of the flow detachment has been achieved. Finally, the numerical model has been compared with experimental wind-tunnel tests. They have demonstrated a full elimination of the flow detachment and up to 80% of turbulence intensity reduction above the ski jump ramp of the aircraft carrier.	https://www.webofscience.com/wos/woscc/full-record/WOS:000855218400002
Інформатика				
1	Інтеграційне проектування планування вильотів для палубних літаків на основі гібридної гнучкої логістичної схеми	Integration Design of Sortie Scheduling for Carrier Aircrafts Based on Hybrid Flexible Flowshop. Liu, J.; Han, W.; Li, J.; Zhang, Y.; Su, XC. IEEE SYSTEMS JOURNAL. 2020. Volume 14. Issue 1. Page 1503-1511.	Previous studies focused on deck-disposed and trajectory planning problem separately, and there was no systematic study from the whole process. This paper studied sortie scheduling for carrier aircrafts from the perspective of the whole scheduling and dispatch process. According to the process of sortie on flight deck, the sortie task was abstracted into six virtual stages, namely, deck-disposed, taxiing to preparing spot, taxiing from preparing spot to catapult, preparation on the catapult, takeoff, and cooling and recovery for the jet blast deflectors, and, the corresponding machines were also defined, respectively. The constraints were expressed, and the sortie scheduling model was build based on hybrid flexible flowshop scheduling. In addition, the one-sided symplectic pseudospectral method and the proposed collision avoidance strategy based on priority principle were combined to realize the collaborative trajectories planning of taxiing for multiple aircrafts. To obtain the optimal or near optimal solution, the double-layer genetic algorithm was proposed. Finally, the experiments were carried out based on the Nimitz-class aircraft carrier; the sortie task of 8 aircrafts under unknown conditions of deck-disposed and 13 aircrafts with fixed deck-disposed were studied, respectively. Experimental results show that the established model can well describe the sortie of aircraft, and it meets all constraints and	https://www.webofscience.com/wos/woscc/full-record/WOS:000526061100149

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			actual requirements, which shows that the proposed method and the model can be used for sortie task effectively.	
2	Агентно-орієнтований підхід до моделювання надійності та продуктивності для багатостанних складних людино-машинних систем з динамічною поведінкою	An Agent-Based Reliability and Performance Modeling Approach for Multistate Complex Human-Machine Systems With Dynamic Behavior. Feng, Q.; Hai, XS; Huang, BQ; Zuo, Z.; Ren, Y.; Sun, B.; Yang, DZ. IEEE ACCESS. 2019. Volume 7. Page 135300-135311.	A complex human-machine system (CHMS) consists of heterogeneous components with extensive human-machine interactions. CHMSs are typical multistate systems with the ability to adapt to disturbances such as machine failures. These characteristics must be considered comprehensively to accurately evaluate the reliability and performance of a CHMS. However, the existing literature scarcely considers both the reliability and performance simultaneously. In this paper, we propose an agent-based approach to model and evaluate a CHMS. First, a general agent-based modeling framework for a CHMS is generated by analyzing the structure and operations of a CHMS. Then, a dual-clock mechanism is introduced to describe the behaviors of the machine failures and human errors. Two environmental disturbance modeling methods are proposed based on the state transitions of the agent and random events. The methods to model the repair and reconfiguration behaviors are presented based on the contract network. A Monte Carlo-based method is developed to evaluate the reliability and performance of the CHMS simultaneously. Finally, a deck scheduling process for an aircraft carrier is used as a case study to verify the approach. The results show that the reliability and performance of a CHMS can be effectively evaluated.	https://www.webofscience.com/wos/woscc/full-record/WOS:000563954900097
3	Повністю нелінійний метод тривимірного динамічного аналізу фрикційного контакту за умов великої деформації з регуляризацією площі	A fully nonlinear three-dimensional dynamic frictional contact analysis method under large deformation with the area regularization. Kwon, SL; Kim, S.; Ha, D.; Yun, GJ. ENGINEERING WITH COMPUTERS. 2024. Volume 40. Issue 1. Page 399-421.	This paper presents the NTS-AR (node-to-segment with area regularization) method to analyze the three-dimensional dynamic frictional contact bodies under large deformation and plastic material behavior. The extended NTS-AR method considers the 3D geometric structure of the slave surface and frictional constraint in a convected coordinate system. Despite wide applications of the penalty-based node-to-segment (NTS) method, owing to its light computation cost, the penalty-based NTS algorithm still has limitations in convergence and accuracy. Unlike the original NTS method setting a constant penalty parameter, the NTS-AR method compensates the area so that a proper penalty parameter is applied for each slave node. To the best knowledge of authors, the NTS-AR method has been applied only to 2D frictionless contact problems, although the method maintains the advantages of the fast and straightforward algorithm of the original NTS method and shows an improved accuracy. Following validations with various three-dimensional numerical examples, the effects of friction on the tangential and normal forces and displacements under large deformation are investigated with the proposed method. In	https://www.webofscience.com/wos/woscc/full-record/WOS:000943521400001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			particular, a collision event of F-35B and aircraft carrier flight deck is simulated.	
4	Спільне планування маршруту кількох палубних літаків на основі багатоагентного навчання з підкріпленням	Collaborative Path Planning of Multiple Carrier-based Aircraft Based on Multi-agent Reinforcement Learning. Shang, ZH; Mao, ZQ; Zhang, HC; Xu, ML. 23RD IEEE INTERNATIONAL CONFERENCE ON MOBILE DATA MANAGEMENT. IEEE. 2022. Page 512-517.	Path planning of carrier-based aircraft is of great significance to improve the scheduling efficiency on the aircraft carrier deck. However, it is not easy to find the optimal paths for multiple carrier-based aircraft since the environment of carrier deck is highly dynamic and complex. To overcome this issue, we propose a collaborative path planning model based on multi-agent reinforcement learning. The collaborative path planning for multiple carrier-based aircraft is modeled as a multi-agent reinforcement learning problem, and we build a model based on the state and action space of the carrier-based aircraft. Then we train the model in the simulated gird environment of USS Ford. Finally, the performance of the proposed model is evaluated by experiments under three fixed scenarios and ten random scenarios, and results are shown in the form of simulation visualization. The experimental results show that compared with RRT-Star algorithm, PSO algorithm and deep reinforcement learning DQN model, the proposed model has lower response time, higher completion rate and shorter average path length.	https://www.webofscience.com/wos/woscc/full-record/WOS:000861618300088
5	Гібридна модель прогнозування «нейронна мережа зворотного поширення - генетичний алгоритм випадкового лісу - регресія опорних векторів» на основі розкладання узгодженості емпіричних мод для руху судна	A Hybrid BPNN-GARF-SVR Prediction Model Based on EEMD for Ship Motion. Han, H.; Wang, W. CMES-COMPUTER MODELING IN ENGINEERING & SCIENCES. 2022.	Accurate prediction of ship motion is very important for ensuring marine safety, weapon control, and aircraft carrier landing, etc. Ship motion is a complex time-varying nonlinear process which is affected by many factors. Time series analysis method and many machine learning methods such as neural networks, support vector machines regression (SVR) have been widely used in ship motion predictions. However, these single models have certain limitations, so this paper adopts a multi-model prediction method. First, ensemble empirical mode decomposition (EEMD) is used to remove noise in ship motion data. Then the random forest (RF) prediction model optimized by genetic algorithm (GA), back propagation neural network (BPNN) prediction model and SVR prediction model are respectively established, and the final prediction results are obtained by results of three models. And the weights coefficients are determined by the correlation coefficients, reducing the risk of prediction and improving the reliability. The experimental results show that the proposed combined model EEMD-GARF-BPNN-SVR is superior to the single predictive model and more reliable. The mean absolute percentage error (MAPE) of the proposed model is 0.84%, but the results of the single models are greater than 1%.	https://www.webofscience.com/wos/woscc/full-record/WOS:000812065500001
Системи автоматизованого управління				

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
1	Аналіз завдання посадки на авіаносець, пілотування плюс аугментація / автоматизація	Analysis of the Aircraft Carrier Landing Task, Pilot plus Augmentation/Automation. Hess, RA. 2nd International-Federation-of-Automatic-Control Conference on Cyber-Physical and Human-Systems. IFAC PAPERSONLINE. 2019. Volume 51. Issue 34. Page 359-365.	The piloted/automatic aircraft carrier landing task is analyzed. The design of a robust flight control system is utilized which forms the basis of either a control augmentation system or a completely automatic carrier landing system. A pursuit model of the human pilot is developed that includes the ability to generate landing approach time histories and handling qualities predictions. The aircraft carrier environment includes ship heave motion, atmospheric turbulence and ship airwake. The proposed methodology provides a framework for the analysis of human/machine integration in flight control.	https://www.webofscience.com/wos/woscc/full-record/WOS:000458143400059
2	Удосконалений метод керування посадкою безпілотного літального апарату на авіаносець на основі фільтрації частинок з урахуванням обмежень - нелінійної моделі прогнозного керування.	An Advanced Control Method for Aircraft Carrier Landing of UAV Based on CAPF-NMPC. Chen, DH; Xu, LF; Wang, CG. AEROSPACE. 2024. Volume 11. Issue 8, 656.	This paper investigates a carrier landing controller for unmanned aerial vehicles (UAVs), and a nonlinear model predictive control (NMPC) approach is proposed considering a precise motion control required under dynamic landing platform and environment disturbances. The NMPC controller adopts constraint aware particle filtering (CAPF) to predict deck positions for disturbance compensation and to solve the nonlinear optimization problem, based on a model establishment of carrier motion and wind field. CAPF leverages Monte Carlo sampling to optimally estimate control variables for improved optimization, while utilizing constraint barrier functions to keep particles within a feasible domain. The controller considers constraints such as fuel optimization, control saturation, and flight safety to achieve trajectory control. The advanced control method enhances the solution, estimating optimal control sequences of UAV and forecasting deck positions within a moving visual field, with effective trajectory tracing and higher control accuracy than traditional methods, while significantly reducing single-step computation time. The simulation is carried out using UAV "Silver Fox", considering several scenarios of different wind scales compared with traditional CAPF-NMPC and the nlmpc method. The results show that the proposed NMPC approach can effectively reduce control chattering, with a landing error in rough marine environments of around 0.08 m, and demonstrate improvements in trajectory tracking capability, constraint performance and computational efficiency.	https://www.webofscience.com/wos/woscc/full-record/WOS:001305153700001
3	Розробка еквідистантної шестикутної системи котушок для розмагнічування військово-морських транспортних засобів	Design of Equidistant Hexagonal Coil System for Demagnetization of Naval Vehicles. Singh, R.; Jain, S.;.Singh, V.; Kazi, F.; Singh, SN; Pandey, RK; Panigrahi, BK; Kothari, DP.	In various applications of defence and research such as demagnetization of naval vehicles and satellites, removal of residual magnetic field plays an essential role. For such use cases, conventional way of demagnetization is the use of Helmholtz coils and Merritt coils. These coil systems produce uniform magnetic field, but the volume of the uniform region is relatively smaller. Therefore, for the applications which require patch of uniform magnetic field for longer longitudinal	https://www.webofscience.com/wos/woscc/full-record/WOS:000613131000019

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		ADVANCES IN POWER AND CONTROL ENGINEERING, GUCON. 2020. Volume 609. Page 251-262.	length of the region such as deperming process of Submarine, Aircraft Carrier; these coil systems become infeasible to implement practically due to their enormous size. Another impediment in implementation of above-mentioned coil system is that when size of coil system becomes larger, the requirement current also increases for the same degree of results. This increasing amount of current poses issues of more complexities in electrical control circuits, heat dissipation and cost. Another disadvantage with such system is that a slight shift from the optimized position causes a larger change in uniformity, and thus, such systems are not robust with shift in location. This paper proposes a novel method for the design of a higher-order equidistant coil system which overcomes these flaws and presents a technique to compute the ampere-turns requirement of each coil for generation of higher-degree homogeneous magnetic field. The system so designed has more feasible design parameters as compared to the conventional systems for high uniformity applications. The proposed system is sturdier and fault tolerant against any deviation or error from the ideal design parameters. The theoretical results are matched against the finite element simulation software Opera which are in close agreement.	
4	Дослідження системи посадкових умов палубних літаків	Research on Landing Environment System of Carrier-Based Aircraft. Su, XD; Li, H.; Zhang, YR; Jiang, HT; Zhao, M. PROCEEDINGS OF THE 2019 31ST CHINESE CONTROL AND DECISION CONFERENCE. IEEE. 2019. Page 2747-2750.	To guarantee the safety of carrier-based aircraft, the landing environment system has been researched in this paper. After being familiar with deck landing geometry, we model the aircraft carrier motion, including deterministic model and random model. The transformation law of atmospheric disturbances has been analyzed. We design horizontal wake flow, lateral wake flow and vertical wake flow three components. Finally, the landing system of carrier-based aircraft is comprehensively integrated.	https://www.webofscience.com/wos/woscc/full-record/WOS:000555859002174
5	Проектування поздовжньої системи автоматичної посадки літаків на авіаносець на основі навчання з підкріпленням	Design of Longitudinal Automatic Carrier Landing System Based on Reinforcement Learning. Wang, JH; Tang, HN; Liu, HL; Wang, LX; Chen, DQ; Lu, YH. ADVANCES IN GUIDANCE, NAVIGATION AND CONTROL. 2023. Volume 845. Page 2964-2976.	This paper mainly aims at automatic carrier landing task under high sea conditions, and proposes a method for designing the landing guidance law based on reinforcement learning, and the effect of which is also tested and analyzed. This paper first established the longitudinal small perturbation equation, control law model, ship surface atmospheric environment model and aircraft carrier deck motion model of F-18 carrier-based aircraft as the guidance law training environment. For better docking engineering practice, the outer loop of the automatic carrier landing system (ACLS) designed in this paper adopts landing guidance law based on reinforcement learning, and the inner loop adopts traditional H(over dot) tracking control law. It is found that the landing accuracy of the guidance law-based on reinforcement learning	https://www.webofscience.com/wos/woscc/full-record/WOS:001463221800287

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			is significantly better than that based on the PID algorithm. When facing steady-state disturbance, it can anticipate disturbances and resist them to ensure the accuracy of the mean value of landing point. In the face of random disturbance, it can also generate more appropriate instructions and reduce the distribution range of landing points. In this paper, the Markov decision process modeling method of ship landing mission is also studied from the perspective of flight dynamic. The result shows that it is very important to select the appropriate state quantity as the input. And after adding random factors into the state transition function, the training effect of guidance law is significantly improved. The random environment should consider not only random distribution, but also amplitude. Adding random amplitude disturbance can significantly improve the training effect.	
Телекомунікації				
1	Відстеження еліптичного об'єкта з невідомими, але фіксованими довжинами осей	Tracking of Elliptical Object With Unknown but Fixed Lengths of Axes. Li, MK; Lan, J.; Li, XR. IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS, 2023. Volume 59. Issue 5. Page 6518-6533.	This article addresses the problem of tracking an elliptical object (e.g., a vehicle or aircraft carrier) with unknown but fixed lengths of axes. In practice, such axis lengths are usually time invariant, but the orientation and kinematics may be time varying. To model this extended object tracking (EOT) problem well, we represent the kinematics and orientation by a random vector, and represent the axis lengths by nonrandom unknown parameters. We investigate the expectation-maximization (EM) algorithm and propose an EM-based EOT approach, which utilizes the prior information about the invariant lengths and estimates the state and parameters in a unified framework. To reduce computation for real-time applications, we develop a recursive, easy to implement approach. Handy and efficient estimation of axis lengths is developed. Simulation and real-data results are presented to illustrate the effectiveness of our modeling and approach.	https://www.webofscience.com/wos/woscc/full-record/WOS:001101791300124
2	Метод розрахунку ймовірності безпечної посадки для корабельних літальних апаратів	Method of Calculating the Probability of a Safe Landing for Ship-Based Aircraft. Semakov, S.; Semakov, I. IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS. 2022. Volume 58. Issue 6. Page 5425-5442.	We propose the method for calculating the probability of a safe landing for ship-based aircraft. We define a safe landing as the event that the initial touch of the landing surface by an aircraft occurs on a given segment of the deck, and at the time of this contact, the phase coordinates of the aircraft (elevation angle, banking angle, vertical velocity, and so on) are within the specified limits. We propose a formula for estimating the desired probability and a formula for determining the maximum possible error Delta P of this estimate: If P is an unknown exact value of the desired probability and (P) over cap is an approximate calculated value. then vertical bar P - (P) over cap vertical bar <= Delta P. We implement the method on the example of the automatic landing of a MIG-29 K aircraft on the aircraft	https://www.webofscience.com/wos/woscc/full-record/WOS:000895081000041

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			carrier "Admiral Kuznetsov." Rand perturbations are caused by an atmospheric turbulence and ship's motions. We present and discuss the calculation remits. These results show that the error Delta P is negligible, so that the proposed formula for (P) over cap determines the desired probability P almost exactly.	
3	Новий орієнтир для класифікації зображень на рівні екземплярів	A New Benchmark for Instance-Level Image Classification. Kang, K; Pang, GM; Zhao, X; Wang, JB; Li, Y. IEEE ACCESS. 2020. Volume 8. Page 70306-70315.	Although fine-grained image classification is able to classify more fine-grained sub-categories compared to its coarse-grained counterpart, it often fails to identify individual instances. Therefore, we propose a new instance-level image classification task which further refines the granularity of fine-grained classification in order to identify unique instances rather than a sub-category containing multiple instances. In addition, we introduce an instance-level image classification dataset, AircraftCarrier, which contains 20 global aircraft carrier classes, as the first publically available dataset for instance-level image classification. The classification of instance-level aircraft carriers can prove to be a challenging task due to large intra-category differences as well as variations in the camera view, illumination, scale, and the presence of complex backgrounds. The AircraftCarrier dataset put forward here has the potential to improve the development of instance-level image classification. At the same time, we provide a Simple Classification Head (SCH) technique for the classification of aircraft carriers, with classical convolutional neural network models as the backbone network. The SCH has better performance than a direct classification head, and these results provide a benchmark performance result for researchers. Furthermore, we evaluate several fine-grained image classification methods and give their benchmark results. Finally, we present the challenges of instance-level classification and discuss further directions. This study provides the first publicly available instance-level image classification dataset and a performance benchmark for further research. The dataset and codes can be downloaded at https://github.com/tsingqsu/AircraftCarrier_Dataset.	https://www.webofscience.com/wos/woscc/full-record/WOS:000549829900018
4	Модель морського наведення та відстеження для оптичного зв'язку у вільному просторі для військових цілей	A Maritime Pointing and Tracking Model for Free Space Optical Communications in Military Use Cases. Eames, D.; Chen, C.; Videv, S.; McDonald, D.; Haas, H., Butler, IME. INTERNATIONAL CONFERENCE ON MILITARY COMMUNICATIONS AND	Due to increasing congestion found in the electromagnetic spectrum, alternatives must be explored for future communication capabilities. Free Space Optical Communications (FSOC) has the potential to achieve secure, reliable, pervasive, and high-performance wireless connectivity. In this paper, the advantages / disadvantages of the application of FSOC in military use cases will be discussed with a review of the related research. We will provide a case study on the simulation of a camera-based pointing and tracking system deployed on an above-water platforms (Queen Elizabeth Class aircraft carrier / Archer Class patrol vessel).	https://www.webofscience.com/wos/woscc/full-record/WOS:001071058500030

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		INFORMATION SYSTEMS, ICMCIS. IEEE. 2023.		
5	Чутливість до помилок навігації автономних систем посадки літаків на авіаносець у середовищах, де немає GPS	Navigation Error Sensitivity of Autonomous Carrier Landing Systems in GPS-denied Environments. Gerratt, T.; Strate, A.; Christensen, R. ION POSITION, LOCATION AND NAVIGATION SYMPOSIUM. IEEE. 2020. Page 81-90.	This paper presents a system-level analysis of the navigation errors in an autonomous UAV carrier-landing scenario with a focus on fixed-wing aircraft. The research identifies relationships between relative state estimation errors and navigation system parameters. The method for achieving this objective is to construct a Monte Carlo simulation of the UAV landing on the aircraft carrier. An indirect Extended Kalman Filter is used in the simulation to estimate the position, velocity, and attitude of both the UAV and aircraft carrier. Results of the simulation focus on the relative position, velocity and attitude covariances at three seconds prior to touch down. The sensitivity of these covariances to measurement availability and frequency is illustrated as a function of IMU grade and camera errors. The results identified in this research enables designers to select system components which minimize cost while maintaining mission-specific navigation error requirements.	https://www.webofscience.com/wos/woscc/full-record/WOS:000839298400011
Інструменти				
1	Прогнозне керування стохастичною моделлю зі зворотним зв'язком за виходом для відстеження глісади під час посадки авіаносця	Output-Feedback Stochastic Model Predictive Control for Glideslope Tracking During Aircraft Carrier Landing. Misra, G.; Bai, XL. JOURNAL OF GUIDANCE CONTROL AND DYNAMICS. 2019. Volume 42. Issue 9. Page 2098-2105.	AUTOMATED carrier landings, especially for unmanned aircraft, remain one of the most critical challenges in naval operations [1]. In addition to a smaller landing area as compared to a conventional airport, perturbations due to carrier airwakes, atmospheric turbulence, and carrier motion in the sea pose significant control difficulties. To maintain the predetermined airspeed, with reference glideslope tracking in the presence of external disturbances, a real-time robust optimal landing control methodology is desired. Research on carrier landing control is rich with some recent schemes, including proportional-derivative-integral (PID)-based designs [2], pseudo-sliding-mode control [3], l1 adaptive control [4], nominal model predictive control [5], adaptive disturbance rejection control [6], and optimal preview control [7]. An automated carrier landing system with noise rejection capability was proposed in Ref.[8] based on a tracking filter that was able to reduce the noise content of altitude and derivative estimates while maintaining the turbulence response to the original specifications. Although techniques such as PID control and nominal model predictive control (MPC) usually perform well. However, under inclement weather and sea-state perturbations, the controller performance will be severely degraded because these approaches are not robust to disturbances. Sliding-mode and adaptive control techniques are better suited to handle disturbances but lack optimality and constraint handling properties. During powered approach and landing, a large source of error is attributed to the turbulent air	https://www.webofscience.com/wos/woscc/full-record/WOS:000482388100016

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			environment in the approach path along with the carrier's own motion in the sea [9]. Sources of turbulence include discrete and continuous wind gusts, wind shear, and carrier ship airwakes [10]. An interesting feature of the wind disturbance models is that a portion of the wind can be modeled as filtered white noise [11]. Thus, the statistical properties of the underlying disturbance can be leveraged to develop an efficient robust optimal control scheme.	
2	Легке самоконтрольоване розпізнавання суден малих зразків з використанням мікродоплерівських сигнатур та надширокосмугового радара на базі безпілотного літального апарата	Lightweight Self-Supervised Recognition of Small-Sample Ships Using Micro-Doppler Signatures and UAV-Based UWB Radar. Zhu, LZ; Zhang, Q.; Chen, KY; Ma, Q.; Chen, S.; Zhang, SN; Yuan, Y. IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT. 2024. Volume 73, 8504210.	The continuous advancement of shipbuilding technology has enabled the further development of sea transport and naval vessels, which also poses significant challenges to navigation safety. Accurate recognition of different types of ships is crucial. In this study, three typical ships, namely a destroyer, cruise ship, and aircraft carrier, were taken as examples. The micro-Doppler effect of these ships was analyzed using a unmanned aerial vehicle (UAV)-based ultrawideband (UWB) radar. Echo signal models were established and compared with measured Doppler signals. Furthermore, a lightweight self-supervised learning network was proposed to achieve accurate recognition of small-sample labeled ship targets. The neural network architecture, including specific layers and parameters, was introduced. To enhance the micro-Doppler features, the 1-D signals were transformed into 2-D images, thereby converting the ship recognition problem into an image classification problem. The experimental results demonstrate that the proposed network achieves high recognition accuracy under different situations. When evaluated on measured data, the overall recognition rate reaches 97.50%. Moreover, even in challenging scenarios with a low signal-to-clutter ratio (SCR) of -10 dB, the overall recognition rate for simulated data still exceeds 90%, demonstrating the effectiveness and advantages of the proposed network.	https://www.webofscience.com/wos/woscc/full-record/WOS:001231633200002
3	Ієрархічне розпізнавання суден з багатьма мітками на зображеннях дистанційного зондування з використанням графів відношень міток	Hierarchical multi-label ship recognition in remote sensing images using label relation graphs. Chen, JZ; Qian, YT. IEEE INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM IGARSS. 2021. Page 4968-4971.	Hierarchical multi-label classification (HMC) aims to assign multiple labels to every instance with the labels organized under hierarchical relations. In the application of ship recognition in remote sensing images, a ship can own coarse-to-fine hierarchical labels, e.g., the military ship, aircraft carrier, and nimitz class aircraft carrier. In this paper, we propose to combine two forms of loss functions to solve the HMC problem based on the neural network. The first probabilistic classification loss is to encode the hierarchical knowledge by introducing hierarchy and exclusion (HEX) graphs to impose constraints on hierarchical labels. The second cross-entropy loss imposes the softmax normalization on leaf nodes in the hierarchy to discriminate fine-grained classes. We evaluate our method on the high resolution satellite image dataset for ship recognition (HRSC), in	https://www.webofscience.com/wos/woscc/full-record/WOS:001250139805036

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			which hierarchical labels are organized as the three-level tree. The proposed method shows comparative results compared to state-of-art HMC models.	
Матеріалознавство				
1	Метод природного натхнення для оптимізації параметрів зварювання A-GTAW для корабельної сталі	Natural inspiration technique for the parameter optimization of A-GTAW welding of naval steel. Sathish, T.; Kumar, SD; Muthukumar, K.; Karthick, S. International Conference on Recent Trends in Nanomaterials for Energy, Environmental and Engineering Applications. MATERIALS TODAY-PROCEEDINGS. 2020. Volume 21. Part 1. Page 843-846.	The DMR249A steel is uniquely developed by a high strength low alloy (HSLA) steel. In India, the steel is being used for the construction of Indian Aircraft Carrier and other shipyards. Develop the depth of penetration (DOP) and achieve in a single pass for gas tungsten arc welding (GTAW) process. The GTAW process is called activated flux gas tungsten arc welding (A-GTAW). Response surface methodology (RSM) and Taguchi technique are used for Design of experiments (DOE) approach. Depth of penetration in a single pass to optimize the welding parameters. The current, torch speed and arc gap are considered as an input variable. The DOP was considered as the response variable. To develop both optimization technique depends on the process parameters. To identified optimum process parameters were validated by bead on plate experiments. The RSM (D-optimal) and Taguchi optimization technique the DOP values are measured and predicted to the RMS error. Thus, RSM (D-optimal) was observed to predict optimized welding process parameters for achieving maximum DOP with better accuracy during A-GTAW process.	https://www.webofscience.com/wos/woscc/full-record/WOS:000512902400168
2	Чисельне дослідження теплопередачі та несучих характеристик гофрованої сендвіч-структури з металевою піною з відкритими порами	Numerical study of heat transfer and load-bearing performances of corrugated sandwich structure with open-cell metal foam. Xiao, T.; Lu, L.; Peng, WH; Yue, ZS; Yang, XH; Lu, TJ; Sunden, B. INTERNATIONAL JOURNAL OF HEAT AND MASS TRANSFER. 2023. Volume 215, 124517.	Critical engineering applications require lightweight components that can effectively dissipate heat and provide sufficient load-bearing capacity. Examples of such applications include the jet blast deflector (JBD) on an aircraft carrier and engine combustion chambers in supersonic vehicles. While lightweight corrugated sandwich structures (CSSs) exhibit excellent load-bearing capacity, their heat transfer capacity falls short. To overcome this limitation, a strategy of filling the CSS with an open-cell metal foam (MF) is proposed to create a sandwich structure with ultralight load bearing and heat transfer capabilities. Numerical simulations were conducted to study the heat transfer and load-bearing performance of this new structure. The findings indicate that the use of a MF significantly improves the heat transfer capabilities of the CSS. Compared to the CSS, the Nusselt number of MF and CSS-foam composite at a Reynolds number of 240 were enhanced by 51.3% and 102.3%, respectively. The overall thermal performance of CSS-foam composites was optimized under the same pumping power constraints. In turbulent conditions, the overall thermal performance of CSS-foam composites was 5.9% to 55.4% higher than that of CSS in turbulent conditions. Furthermore,	https://www.webofscience.com/wos/woscc/full-record/WOS:001048865400001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			the simulations showed that when the CSS was subjected to static and quasi-static compression, the maximum von Mises stress occurred at the connection between the panel and the web.	
3	Динамічна в'язкість руйнування та механізм пошкодження сталі 38CrMoAl під дією корозії в сольовому тумані	Dynamic fracture toughness and damage mechanism of 38CrMoAl steel under salt spray corrosion. Zhang, ZZ; Mao, HT; Chen, YL; Wu, XJ; Zhou, SL; Hu, WL. THEORETICAL AND APPLIED FRACTURE MECHANICS, 2022. Volume 119, 103382.	Under the environmental conditions of the aircraft carrier surface, the structure of the carrier aircraft has to withstand the interaction between the takeoff and landing impact load and the corrosion of the marine environment. 38CrMoAl steel is the main material of a carrier aircraft structure which is frequently subjected to impact load. In order to obtain its dynamic fracture toughness under corrosive conditions, it was tested by a experimental-numerical method. The dynamic constitutive model parameters of the corroded 38CrMoAl steel were obtained through dynamic mechanical tests, which were imported into the established finite element model to obtain the dynamic fracture factor time history curve of the material under corrosive conditions. Then, the dynamic crack initiation time of the corroded 38CrMoAl steel was obtained by the three-point bending dynamic fracture toughness test device. Combined with the dynamic fracture factor time history curve, the dynamic fracture toughness of the corroded 38CrMoAl steel was determined. Finally, the fracture mechanism of 38CrMoAl steel under the interaction between corrosion and high strain rate loading was analyzed according to the fracture morphology and EDS energy spectrum of specimens with different loading rates and corrosion cycles. This method provides a new idea for testing the dynamic fracture toughness of corroded materials.	https://www.webofscience.com/wos/woscc/full-record/WOS:000802185400001
4	Абляційні властивості композиту C/C-SiC у полі сліду палубних літаків	Ablative Properties of C/C-SiC Composite in the Wake Flow Field of Carrier-based Aircraft. Wang, DW; Li, C.; Meng, DR.; He, QF. RARE METAL MATERIALS AND ENGINEERING. 2019. Volume 48. Issue 7. Page 2317-2322.	In order to improve the working performance of the gas deflector of aircraft carrier, the ablation test intended for simulating the takeoff condition was conducted by placing the test specimens of C/C-SiC composite in the wake flow of carrier-based aircraft so as to measure the ablative rate of the specimens. The microstructure of the test specimens after ablation was analyzed by scanning electron microscope (SEM) and micro-CT, the components of combustion products were measured by energy dispersive spectrometry (EDS), and the ablation mechanism and thermal shock damage of the test specimens were analyzed. The results show that the linear ablative rate of the test specimen is about 0.0405 mm/s and the mass ablative rate is about 0.0349 g/s. The heat-affected zone experiences matrix cracking, and the oxidation reaction is not obvious. In the transition zone, the SiO2 produced by the reaction is precipitated around the carbon fibers and forms a sheathing structure, thus effectively retarding oxidation reaction from transferring inward and reducing the ablative rate of the test specimen. In the center of ablation, the retardation of SiC on	https://www.webofscience.com/wos/woscc/full-record/WOS:000480493400040

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			oxidation reaction is slight and the test specimen forms a concave pit, with carbon fibers being distributed in the shape of pointed bamboo shoots. On the whole, the material gives its outstanding anti-ablative performance.	
5	Удосконалений метод виявлення злітно-посадкової смуги авіаносця на основі усунення затуманювання зображення	An Enhanced Aircraft Carrier Runway Detection Method Based on Image Dehazing. Li, CL; Wang, YY; Zhao, Y.; Yuan, C.; Mao, RE; Lyu, P. APPLIED SCIENCES-BASEL. 2024. Volume 14. Issue 13, 5464.	Carrier-based Unmanned Aerial Vehicle (CUAV) landing is an extremely critical link in the overall chain of CUAV operations on ships. Vision-based landing location methods have advantages such as low cost and high accuracy. However, when an aircraft carrier is at sea, it may encounter complex weather conditions such as haze, which could lead to vision-based landing failures. This paper proposes a runway line recognition and localization method based on haze removal enhancement to solve this problem. Firstly, a haze removal algorithm using a multi-mechanism, multi-architecture network model is introduced. Compared with traditional algorithms, the proposed model not only consumes less GPU memory but also achieves superior image restoration results. Based on this, We employed the random sample consensus method to reduce the error in runway line localization. Additionally, extensive experiments conducted in the Airsim simulation environment have shown that our pipeline effectively addresses the issue of decreased detection accuracy of runway line detection algorithms in haze maritime conditions, improving the runway line localization accuracy by approximately 85%.	https://www.webofscience.com/wos/woscc/full-record/WOS:001270002000001
МІННО-ТРАЛЬНІ КОРАБЛІ				
Інженерія				
1	Нечітка ідентифікація стану надійності продуктивної системи мінного виявлення корабля	Fuzzy identification of the reliability state of the mine detecting ship propulsion system. Pajak, M.; Muslewski, L.; Landowski, B.; Grzadziela, A. POLISH MARITIME RESEARCH. 2019. Volume 26. Issue 1. Page 55-64.	The study presents the evaluation and comparative analysis of engine shaft line performance in maritime transport ships of the same type. During its operation, a technical system performs functions for which it was designed. It goes through different states. Dynamic state changes of a rotational system can be identified by means of its vibration measurement. For this purpose, a research was carried out which involved recording vibrations of the analysed rotational systems. The recordings were used for calculating selected characteristics in the time-domain, where one of the most unique is the value of the normalized mutual correlation function. On the basis of the concentration values, the characteristics which unambiguously determine the ability state were selected for further studies. Then an identification method for rotational system non-coaxiality was proposed. The method involves using fuzzy clustering. According to this method the values of input signal characteristics were used to formulate fuzzy clusters of system ability and inability states. The	https://www.webofscience.com/wos/woscc/full-record/WOS:000463944900007

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			method can be used for identifying the current state of the system. The study presents the results of the application of this method in engine turbine shaft lines of minesweepers, with the rotational system selected as an example. It needs to be noted that the efficiency of identifying the operating state of the system with this method is higher than with other methods described in the literature by authors who deal with this issue. The research results have a significant impact on the evaluation of mechanical properties of the studied objects and directly affect operational states of mechanical systems, including those installed in minesweepers, thus determining their reliability.	
2	Вимоги до точності руху для операцій гелікоптера-судна в морських авіасимуляторах гвинтокрилів	Motion Fidelity Requirements for Helicopter-Ship Operations in Maritime Rotorcraft Flight Simulators. Memon, WA; Owen, I.; White, MD. JOURNAL OF AIRCRAFT. 2019. Volume 56. Issue 6. Page 2189-2209.	The research presented in this paper is part of a longer-term project to develop overall fidelity requirements for simulated helicopter shipboard operations to inform and support first-of-class flight trials. The paper reports the results of motion cueing assessment and optimization research, conducted in a six-degree-of-freedom motion flight simulator, to develop simulator motion drive laws capable of providing high-fidelity motion cueing for simulated shipboard operations. To do this, a novel objective technique, vestibular motion perception error (VMPE), has been developed. The technique was used to optimize the motion cues for simulated helicopter landings on a naval single-spot destroyer at different wind and sea-state conditions. New simulator motion tuning sets were derived offline and then tested experimentally to compare the objective VMPE predictions with subjective assessments from a test pilot. Results show the influence of different motion cues, airwake conditions, and ship motion states on the pilot's overall perception of self-motion, control strategy, task performance, and workload. It was found that high-fidelity motion cueing becomes more desirable for the pilot at higher wind conditions and sea states, for which an "Optimized" motion setting was obtained using the new technique. Moreover, the use of an "Optimized" motion setting generated by the VMPE methodology resulted in reduced pilot workload, leading to improved simulated maritime helicopter operational capability. The technique provides a rational methodology for motion tuning, which could be applied in training and engineering simulators.	https://www.webofscience.com/wos/woscc/full-record/WOS:000506382300008
3	Моделювання статичної та повітряної слідової хвилі есмінця НАТО середньої точності з використанням методу Решітки-Больцмана у порівнянні з експериментальними даними	Mid-fidelity NATO generic destroyer static and moving-ship airwake simulations using the Lattice-Boltzmann method compared with experimental data.	During rotorcraft ship -deck landing operations, complex interactional aerodynamic phenomena occur between the rotor and ship airwakes which are not fully understood. To aid in ship-rotorcraft interactional investigations, efficient mid -fidelity ship airwake solutions are needed. Additionally, the effects of ship motion have not been explored much. In this study, the NATO Generic Destroyer, a shared,	https://www.webofscience.com/wos/woscc/full-record/WOS:001195430600001

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		Ashok, SG; Rauleder, J. OCEAN ENGINEERING. 2024. Volume 298, 117264.	representative ship geometry created for collaborative studies, was investigated numerically using a GPU-accelerated Lattice -Boltzmann Method solver, and the ship airwake results compared with wind tunnel measurements using discrete velocity probes on the landing deck. The ship surface was modeled using a robust Grad immersed boundary approach, and ship motion was thereby included in the simulations. Ship airwake results showed good agreement with the experiment and excellent computational performance. Simulations took under four hours to run on a single GPU node. This is several orders of magnitude improvement over traditional Delayed Detached -Eddy Simulations typically used to solve this problem, which may take days or weeks on CPU -based HPC clusters.	
4	Сонар бокового огляду: доповнення зразків зображень підводних цілей на основі взаємозв'язку міждоменного відображення зображень одного й того ж фізичного об'єкта	SSS Underwater Target Image Samples Augmentation Based on the Cross-Domain Mapping Relationship of Images of the Same Physical Object. Tang, YL; Wang, LM; Bian, SF; Jin, SH; Dong, YT; Li, HP; Ji, B. IEEE JOURNAL OF SELECTED TOPICS IN APPLIED EARTH OBSERVATIONS AND REMOTE SENSING. 2023. Volume 16. Page 6393-6410.	Side-scan sonar (SSS) image sample augmentation plays an important role in improving the effect of deep-learning-based underwater target detection. However, the existing sample augmentation methods for cross-domain conversion always result in weak representativeness of the augmented samples since the targets in the nondomain images are similar but not exactly the same as the actual underwater target to be detected. In this article, an augmentation method for SSS image samples of underwater targets based on the cross-domain mapping relationship of images of the same object is proposed. A physical model of the actual underwater target was first constructed using three-dimensional printing. A series of optical images and SSS images of underwater targets can be obtained by using the actual measurement of underwater targets under different conditions. To achieve the augmentation of SSS target samples, a single-cycle-consistency network structure with a channel and spatial attention and generative adversarial networks with least squares loss was designed for efficient and robust conversion of information between optical and SSS acoustic samples. To verify the effectiveness of the proposed method in generating high-quality samples, underwater targets were detected using the detection model trained by the generated samples. The experimental results revealed that the proposed method achieved impressive performance with a more than 5.8% improvement in average precision value for zero-sample underwater mine target detection and 4.3% for few-sample shipwreck target detection, compared with using only real SSS data.	https://www.webofscience.com/wos/woscc/full-record/WOS:001036111000010
5	Підхід до проектування для оцінки впливу безконтактних підводних вибухів на композитні кораблі ВМФ.	A Design Approach to Assess Effects of Non-Contact Underwater Explosions on Naval Composite Vessels.	Despite the non-contact underwater explosion phenomena (UNDEX) have been studied for decades and several numerical methods have been proposed in literature, its effects on military structures, especially composite ones, are even nowadays matter of research. In early design	https://www.webofscience.com/wos/woscc/full-

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		Mannacio, F., Gaiotti, M.; Rizzo, CM; Rizzo, C.; Venturini, M. JOURNAL OF MARINE SCIENCE AND APPLICATION. 2024. Volume 23. Issue 2. Page 316-326.	phases, it is not always possible to verify the shock resistance of hull structures modelling the whole phenomenon, in which fluid, gas and solid properties must be properly set in a fully coupled fluid-structure interaction (FSI) numerical model. These ones are extremely complex to set, computationally demanding and certainly not suitable for everyday design practice. In this paper, a simplified finite element (FE) model, easy to use in an early design phase, is proposed. Both, the structure and the fluid are simulated. In this approximation, the fluid behaviour is simplified, using special finite elements, available in a commercial software environment. This choice reduces the computational time and numerical efforts avoiding the problem of combining computational fluid dynamics (CFD) and FE domains and equations in a fully coupled fluid-structure interaction model. A typical parallel body block of a minesweeper is modelled, using two-dimensional multi-layered shell elements to properly account for the composite materials behaviour. For the fluid instead, three dimensional volumetric elements, directly coupled to the structural elements, are placed. In addition, the same calculation is performed, modelling separately fluid in the CFD environment and structures in the finite element one. Thus, realizing a fully coupled fluid-structure interaction model. The results obtained by applying both numerical models are compared with the structural response measured on board of a composite ship during a full-scale shock test. The simplified proposed procedure provides results in satisfactory agreement with experiments, allowing the validation of the model. Approximations are discussed and differences with the real phenomenon and fully coupled CFD+FE method are shown, providing a better understanding of the phenomena. Eventually, the modelling strategy has been considered a valuable and cost-effective tool for the concept and preliminary design of composite structures subject to underwater explosions.	record/WOS:001230327200006
Океанографія				
1	Система ідентифікації руху судна з 6 ступенями свободи у хвилях на основі даних за допомогою нейронних мереж	Data-Driven system identification of 6-DoF ship motion in waves with neural networks. Silva, KM; Maki, KJ. APPLIED OCEAN RESEARCH. 2022. Volume 125, 103322.	Critical evaluation of ship responses in the ocean is important for not only the design and engineering of future platforms but also the operation and safety of those that are currently deployed. Short-term temporal predictions of ship responses given the current wave environment and ship state would enable enhanced decision-making onboard and reduce the overall risk for both manned and unmanned vessels, especially as the marine industry trends towards more autonomy. However, state-of-the-art numerical hydrodynamic simulation tools are too computationally expensive to be employed for real-time ship motion forecasting. Thus, a methodology is needed to	https://www.webofscience.com/wos/woscc/full-record/WOS:000811961000005

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			provide fast predictions with levels of accuracy closer to the higher-fidelity tools. A methodology is developed with long short-term memory (LSTM) neural networks to represent the motions of a free running David Taylor Model Basin (DTMB) 5415 destroyer operating at 20 knots in Sea State 7 stern-quartering long-crested irregular seas. Case studies are performed for both course-keeping and turning circle scenarios. An estimate of the vessel's encounter frame is made with the trajectories observed in the training dataset. Wave elevation time histories are given by artificial wave probes that travel with the estimated encounter frame and serve as input into the neural network, while the output is the 6-DOF temporal ship motion response. Overall, the neural network is able to predict the temporal response of the ship due to unseen wave sequences accurately. The methodology, the dependence of model accuracy on wave probe and training data quantity and the estimated encounter frame are all detailed.	
2	Есмінець НАТО загального призначення – спільна геометрія для спільних досліджень моделювання та симуляції запуску та повернення гелікоптерів з борту корабля	The NATO generic destroyer - a shared geometry for collaborative research into modelling and simulation of shipboard helicopter launch and recovery. Owen, I.; Lee, R.; Wall, A.; Fernandez, N. OCEAN ENGINEERING. 2021. Volume 228, 108428.	The helicopter-ship dynamic interface is the environment above the landing deck of a ship where a helicopter pilot has to control the aircraft while contending with a moving deck and an unsteady airflow known as the ship airwake. Research into understanding this environment has included modelling the airwake using wind tunnel studies and Computational Fluid Dynamics, and has often used the Simple Frigate Shape (SFS), a generic ship geometry representative of a naval frigate. This paper reviews the contribution that the SFS has made to research into the helicopter-ship dynamic interface, and introduces a new ship geometry for future research. The new ship, developed within a NATO Research Task Group, is the NATO Generic Destroyer (NATO-GD), a concept ship with a simplified geometry that is more representative of a modern helicopter-enabled combat ship with a stealthy superstructure. As well as introducing the NATO-GD as a common platform for research, the paper also introduces a number of ship motion profiles to encourage new research that will include the effect of ship motion on the airwake. It is anticipated that future research on a common ship, with prescribed motion and adopting a common helicopter will lead to improved or new modelling methodologies.	https://www.webofscience.com/wos/woscc/full-record/WOS:000643687000001
3	Нестаціонарне усереднене за Рейнольдсом рівняння Нав'є-Стокса: аналіз есмінця, що вільно ходить, на нерегулярних хвилях кормового квартерування за стану моря 7	URANS analysis of a free-running destroyer sailing in irregular stern-quartering waves at sea state 7. Serani, A.; Diez, M.; van Walree, F.; Stern, F. OCEAN	Computational fluid dynamics (CFD) simulations and stochastic validation of free-running 5415M in irregular stern-quartering sea state 7 and Froude number 0.33 are presented. Unsteady Reynolds-averaged Navier-Stokes (URANS) computations are validated against experimental fluid dynamics (EFD) tests. EFD static stability, forward speed, wave direction and spectrum were set such that roll-motion resonance were induced, causing large roll angles, significant deck-	https://www.webofscience.com/wos/woscc/full-record/WOS:000696790000005

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		ENGINEERING. 2021. Volume 237, 109600.	edge immersion, and static instability. Prerequisite calm-water validation covers roll decay at zero speed and self-propulsion studies for propeller RPM. Subsequent CFD stochastic validation is achieved by statistical assessment of EFD data and CFD results (expected value, standard deviation, and probability distribution) for input waves and ship response: time series are assessed by their wave energy-spectra, autocovariance (waves only), and block-bootstrap analysis (waves and motions); mean-crossing amplitudes are studied by bootstrap method. Dynamic mode decomposition is used with EFD and CFD time histories to unveil the underlying ship dynamics and the motion correlation. Overall, CFD results are in agreement with EFD. Finally, a clustering approach is used to identify wave sequences causing large roll angles. As proof of concept, the characteristics of these sequences are used for the deterministic reconstruction of severe (large roll) and rare (capsize) events via regular wave computations.	
4	Турбулентні характеристики повітряного сліду від судна з двома різними розташуваннями верхньої палуби та умовами припливу	Turbulence characteristics of the ship air-wake with two different topside arrangements and inflow conditions. Setiawan, H.; Kevin; Philip, J.; Monty, JP. OCEAN ENGINEERING. 2022. Volume 260, 111931.	We investigate the effect of the Atmospheric Boundary Layer (ABL) and vessel topside arrangement on ship air-wake flow. The investigation is performed by comparing experimental results with two inflow conditions: a simulated ABL and a smooth-wall flat-plate turbulent boundary layer; and two simplified ship models: Simplified Frigate Ship model 2 (SFS2) and NATO-Generic Destroyer (NATO-GD). Particle Image Velocimetry (PIV) and point measurements over the landing deck center-line show that the ABL inflow increases the flow fluctuations but reduces the length of the wake. Furthermore, we observed an enhancement of turbulence energy on the ship landing deck when the ABL is simulated. The data also show that the topside arrangement, especially at the hangar elevation upstream of the landing deck, plays an essential role in the air-wake over the ship center line. There are significant differences in the flow re-circulation regions, turbulence structure and energy content. Based on a turbulence structure and energy spectrum analysis, we highlight regions with a possible increased safety risk for both models. Over the SFS2 center line, regions with an increased safety risk are located directly above the landing deck. Meanwhile, on the NATO-GD center line, these regions are located above the hangar elevation.	https://www.webofscience.com/wos/woscc/full-record/WOS:000864735800001
5	Прогнозування руху судна в реальному часі на основі покращеного емпіричного складу мод та динамічної залишкової нейронної мережі	Real-time prediction of ship motion based on improved empirical mode composition and dynamic residual neural network.	Ship motion attitude data have strong random and non-stationary characteristics under severe sea states. Real-time and accurate prediction of the ship's motion attitude can significantly improve the safety of navigation. Therefore, this article proposes a prediction model based on the improved empirical mode decomposition (IEMD) and the dynamic residual recurrent neural network with bidirectional structure	https://www.webofscience.com/wos/woscc/full-record/WOS:001138610300001

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		Gao, N.; Chuang, ZJ; Hu, AK. OCEAN ENGINEERING. 2024. Volume 292, 116528.	and time pattern attention mechanism (TPA-Bi-DRRNN), and proposes a new algorithm: dynamic adaptive beetle swarm antennae search (DABSAS) algorithm to optimise the initial weight and threshold of the prediction model. The input data are adaptively composed into multiple intrinsic mode functions (IMFs) containing their frequency characteristics using IEMD, and a prediction is made for each IMF using TPA-Bi-DRRNN. The model structure can be regulated in real time according to the sliding window. The destroyer DTMB5415 is used as an example to conduct a performance test of the hybrid prediction model and DABSAS. The results show that no mode mixing occurred in the IMFs, the noise in each IMF was significantly reduced, thus dramatically reducing the difficulty of using the input data for prediction; and the optimization performance of DABSAS in applying the TPA-Bi-DRRNN is much better than that of the traditional algorithms. Compared with other models, the difference in the predictive accuracy of TPA-Bi-DRRNN under each condition is the smallest, suggestings that it has extremely high robustness and will always be able to maintain much higher accuracy than other models over a long period, thus meeting the needs for real-time accurate prediction of ship motion attitude.	
Інформатика				
1	Прогнозування руху суден у хвилях на основі даних з використанням машинного навчання та динамічної декомпозиції режимів	Data-driven forecasting of ship motions in waves using machine learning and dynamic mode decomposition. Diez, M.; Gaggero, M.; Serani, A. INTERNATIONAL JOURNAL OF ADAPTIVE CONTROL AND SIGNAL PROCESSING, 2024.	Data-driven forecasting of ship motions in waves is investigated through feedforward and recurrent neural networks as well as dynamic mode decomposition. The goal is to predict future ship motion variables based on past data collected on the field, using equation-free approaches. Numerical results in two case studies involving the course-keeping of a naval destroyer in a high sea state using simulation data at model scale are presented. The proposed methods reveal successful in predicting ship motions both in short-term and medium-term perspectives with accuracy and reduced computational effort, thus enabling further advances in the identification, control, and optimization of ships operating in waves.	https://www.webofscience.com/wos/woscc/full-record/WOS:001223291700001
2	Оптимізація робочого навантаження оператора дронів у термінальній зоні для операцій на борту судна	Optimizing Drone Operator Workload in the Terminal Area for Shipboard Operations. Bostock, N.; Richez, A.; Wickramasuriya, M.; Webster-Giddings, A.; Costello, D. INTERNATIONAL CONFERENCE ON UNMANNED AIRCRAFT	The United States Navy (USN) is heavily reliant on its ability to operate aircraft in the maritime environment. Done successfully, shipboard flight operations allow air-capable ships to act as mobile airfields, ensuring the USN's ability to maintain freedom of the seas. Typically rotary-wing aircraft land at the stern of USN surface vessels (i.e., a guided missile destroyer (DDG)). Ship movement creates turbulence induced by its superstructure, which may produce unfavorable conditions for rotary-wing aircraft just after takeoff and just before recovery. This ship-aircraft interplay is termed dynamic	https://www.webofscience.com/wos/woscc/full-record/WOS:001259354800079

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		SYSTEMS, ICUAS. 2024. Page 887-892.	interface (DI). With the growing prominence of uncrewed aerial systems, the USN deems characterizing the DI a crucial step towards employing these systems from air-capable ships. The United States Naval Academy operates a fleet of 108 ft Yard Patrol Craft tasked with training future naval officers. One of these ships has been modified such that the air wake models a DDG to the 1/4 scale. This research documents the DI tests conducted with a remote-piloted drone through mission representative recoveries to the modified Yard Patrol Craft. While operating in the terminal area, the pilot assessed their workload via a modified Cooper Harper scale.	
3	Оптимізація робочого навантаження оператора дронів у термінальній зоні для операцій на борту судна	Optimizing Drone Operator Workload in the Terminal Area for Shipboard Operations. Bostock, N.; Richez, A.; Wickramasuriya, M.; Webster-Giddings, A.; Costello, D. INTERNATIONAL CONFERENCE ON UNMANNED AIRCRAFT SYSTEMS, ICUAS. 2024. Page 887-892.	The United States Navy (USN) is heavily reliant on its ability to operate aircraft in the maritime environment. Done successfully, shipboard flight operations allow air-capable ships to act as mobile airfields, ensuring the USN's ability to maintain freedom of the seas. Typically rotary-wing aircraft land at the stern of USN surface vessels (i.e., a guided missile destroyer (DDG)). Ship movement creates turbulence induced by its superstructure, which may produce unfavorable conditions for rotary-wing aircraft just after takeoff and just before recovery. This ship-aircraft interplay is termed dynamic interface (DI). With the growing prominence of uncrewed aerial systems, the USN deems characterizing the DI a crucial step towards employing these systems from air-capable ships. The United States Naval Academy operates a fleet of 108 ft Yard Patrol Craft tasked with training future naval officers. One of these ships has been modified such that the air wake models a DDG to the 1/4 scale. This research documents the DI tests conducted with a remote-piloted drone through mission representative recoveries to the modified Yard Patrol Craft. While operating in the terminal area, the pilot assessed their workload via a modified Cooper Harper scale.	https://www.webofscience.com/wos/woscc/full-record/WOS:001259354800079
4	Виявлення морських мін за допомогою глибокого навчання	Marine Mine Detection Using Deep Learning. Diana, M.; Munteanu, D.; Cristea, DS; Munteanu, N. 26TH INTERNATIONAL CONFERENCE ON SYSTEM THEORY, CONTROL AND COMPUTING. 2022. Page 237-243.	The paper addresses the detection of floating and underwater marine mines from images recorded from cameras (taken from drones, submarines, ships, boats). Due to the lack of image datasets, images were taken from the Internet and by using the technique of augmentation and synthetic image generation (by overlapping images with different types of mines over water backgrounds) 2 data sets were built (one for floating mines and one for underwater mines). The networks were trained and compared using 3 types of Deep Learning models Yolov5, SSD and EfficientDet (Yolov5, SSD for floating mines and Yolov5 and EfficientDet for underwater mines). The networks were also tested in the context of an IoT device (RaspberryPi 4, RPi camera).	https://www.webofscience.com/wos/woscc/full-record/WOS:000889980600041

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
5	Прогнозування часових рядів маневрування суден у хвилях за допомогою динамічної модальної декомпозиції	Time-series forecasting of ships maneuvering in waves via dynamic mode decomposition. Diez, M.; Serani, A.; Campana, EF; Stern, F. JOURNAL OF OCEAN ENGINEERING AND MARINE ENERGY. 2022. Volume 8. Issue 4. Page 471-478.	A data-driven and equation-free approach is proposed and discussed to forecast responses of ships maneuvering in waves, based on the dynamic mode decomposition (DMD). DMD is a dimensionality-reduction/reduced-order modeling method, which provides a linear finite-dimensional representation of a possibly nonlinear system dynamics by means of a set of modes with associated oscillation frequencies and decay/growth rates. This linear representation is entirely derived from available data and does not require the knowledge of the underlying system equations, which are and remain unknown. Based on the linear representation, DMD allows for short-term future estimates of the system state, which can be used for real-time prediction and control. Here, the objective of the DMD is the analysis and forecast of the trajectories/motions/forces of ships operating in waves, offering a complementary efficient method to equation-based system identification approaches. Results are presented for the course keeping of a free-running naval destroyer (5415M) in irregular stern-quartering waves and for the free-running KRISO Container Ship performing a turning circle in regular waves. Results are overall promising and show how DMD is able to identify the most important modes and forecast the system state with reasonable accuracy upto two wave encounter periods.	https://www.webofscience.com/wos/woscc/full-record/WOS:000830272500001
Системи автоматизованого управління				
1	Прогнозування руху суден у хвилях на основі даних з використанням машинного навчання та динамічної декомпозиції режимів	Data-driven forecasting of ship motions in waves using machine learning and dynamic mode decomposition. Diez, M.; Gaggero, M.; Serani, A. INTERNATIONAL JOURNAL OF ADAPTIVE CONTROL AND SIGNAL PROCESSING, 2024.	Data-driven forecasting of ship motions in waves is investigated through feedforward and recurrent neural networks as well as dynamic mode decomposition. The goal is to predict future ship motion variables based on past data collected on the field, using equation-free approaches. Numerical results in two case studies involving the course-keeping of a naval destroyer in a high sea state using simulation data at model scale are presented. The proposed methods reveal successful in predicting ship motions both in short-term and medium-term perspectives with accuracy and reduced computational effort, thus enabling further advances in the identification, control, and optimization of ships operating in waves.	https://www.webofscience.com/wos/woscc/full-record/WOS:001223291700001
2	Оптимізація робочого навантаження оператора дронів у термінальній зоні для операцій на борту судна	Optimizing Drone Operator Workload in the Terminal Area for Shipboard Operations. Bostock, N.; Richez, A.; Wickramasuriya, M.; Webster-Giddings, A.; Costello, D. INTERNATIONAL	The United States Navy (USN) is heavily reliant on its ability to operate aircraft in the maritime environment. Done successfully, shipboard flight operations allow air-capable ships to act as mobile airfields, ensuring the USN's ability to maintain freedom of the seas. Typically rotary-wing aircraft land at the stern of USN surface vessels (i.e., a guided missile destroyer (DDG)). Ship movement creates turbulence induced by its superstructure, which may produce	https://www.webofscience.com/wos/woscc/full-record/WOS:001259354800079

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		CONFERENCE ON UNMANNED AIRCRAFT SYSTEMS, ICUAS. 2024. Page 887-892.	unfavorable conditions for rotary-wing aircraft just after takeoff and just before recovery. This ship-aircraft interplay is termed dynamic interface (DI). With the growing prominence of uncrewed aerial systems, the USN deems characterizing the DI a crucial step towards employing these systems from air-capable ships. The United States Naval Academy operates a fleet of 108 ft Yard Patrol Craft tasked with training future naval officers. One of these ships has been modified such that the air wake models a DDG to the 1/4 scale. This research documents the DI tests conducted with a remote-piloted drone through mission representative recoveries to the modified Yard Patrol Craft. While operating in the terminal area, the pilot assessed their workload via a modified Cooper Harper scale.	
3	Оптимізація робочого навантаження оператора дронів у термінальній зоні для операцій на борту судна	Optimizing Drone Operator Workload in the Terminal Area for Shipboard Operations. Bostock, N.; Richez, A.; Wickramasuriya, M.; Webster-Giddings, A.; Costello, D. INTERNATIONAL CONFERENCE ON UNMANNED AIRCRAFT SYSTEMS, ICUAS. 2024. Page 887-892.	The United States Navy (USN) is heavily reliant on its ability to operate aircraft in the maritime environment. Done successfully, shipboard flight operations allow air-capable ships to act as mobile airfields, ensuring the USN's ability to maintain freedom of the seas. Typically rotary-wing aircraft land at the stern of USN surface vessels (i.e., a guided missile destroyer (DDG)). Ship movement creates turbulence induced by its superstructure, which may produce unfavorable conditions for rotary-wing aircraft just after takeoff and just before recovery. This ship-aircraft interplay is termed dynamic interface (DI). With the growing prominence of uncrewed aerial systems, the USN deems characterizing the DI a crucial step towards employing these systems from air-capable ships. The United States Naval Academy operates a fleet of 108 ft Yard Patrol Craft tasked with training future naval officers. One of these ships has been modified such that the air wake models a DDG to the 1/4 scale. This research documents the DI tests conducted with a remote-piloted drone through mission representative recoveries to the modified Yard Patrol Craft. While operating in the terminal area, the pilot assessed their workload via a modified Cooper Harper scale.	https://www.webofscience.com/wos/woscc/full-record/WOS:001259354800079
4	Виявлення морських мін за допомогою глибокого навчання	Marine Mine Detection Using Deep Learning. Diana, M.; Munteanu, D.; Cristea, DS; Munteanu, N.. 26TH INTERNATIONAL CONFERENCE ON SYSTEM THEORY, CONTROL AND COMPUTING. 2022. Page 237-243.	The paper addresses the detection of floating and underwater marine mines from images recorded from cameras (taken from drones, submarines, ships, boats). Due to the lack of image datasets, images were taken from the Internet and by using the technique of augmentation and synthetic image generation (by overlapping images with different types of mines over water backgrounds) 2 data sets were built (one for floating mines and one for underwater mines). The networks were trained and compared using 3 types of Deep Learning models Yolov5, SSD and EfficientDet (Yolov5, SSD for floating mines and Yolov5 and EfficientDet for underwater mines). The networks	https://www.webofscience.com/wos/woscc/full-record/WOS:000889980600041

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			were also tested in the context of an IoT device (RaspberryPi 4, RPi camera).	
5	Прогнозування часових рядів маневрування суден у хвилях за допомогою динамічної модальної декомпозиції	Time-series forecasting of ships maneuvering in waves via dynamic mode decomposition. Diez, M.; Serani, A.; Campana, EF; Stern, F. JOURNAL OF OCEAN ENGINEERING AND MARINE ENERGY. 2022. Volume 8. Issue 4. Page 471-478.	A data-driven and equation-free approach is proposed and discussed to forecast responses of ships maneuvering in waves, based on the dynamic mode decomposition (DMD). DMD is a dimensionality-reduction/reduced-order modeling method, which provides a linear finite-dimensional representation of a possibly nonlinear system dynamics by means of a set of modes with associated oscillation frequencies and decay/growth rates. This linear representation is entirely derived from available data and does not require the knowledge of the underlying system equations, which are and remain unknown. Based on the linear representation, DMD allows for short-term future estimates of the system state, which can be used for real-time prediction and control. Here, the objective of the DMD is the analysis and forecast of the trajectories/motions/forces of ships operating in waves, offering a complementary efficient method to equation-based system identification approaches. Results are presented for the course keeping of a free-running naval destroyer (5415M) in irregular stern-quartering waves and for the free-running KRISO Container Ship performing a turning circle in regular waves. Results are overall promising and show how DMD is able to identify the most important modes and forecast the system state with reasonable accuracy upto two wave encounter periods.	https://www.webofscience.com/wos/woscc/full-record/WOS:000830272500001
Телекомунікації				
1	Моделювання та керування роботом-розвідником підводних мін UX-1	Modeling and Control of Underwater Mine Explorer Robot UX-1. Fernandez, RAS; Grande, D.; Martins, A.; Bascetta, L.; Dominguez, S.; Rossi, C. IEEE ACCESS. 2019. Volume 7. Page 39432-39447.	This paper presents the design and experimental assessment of the control system for the UX-1 robot, a novel spherical underwater vehicle for flooded mine tunnel exploration. Propulsion and maneuvering are based on an innovative manifold system. First, the overall design concepts of the robot are presented. Then, a theoretical six degree-of-freedom (DOF) dynamic model of the system is derived. Based on the dynamic model, two control systems have been developed and tested, one based on the principle of nonlinear state feedback linearization and another based on a finite horizon linear quadratic regulator (LQR). A series of experimental tests have been carried out in a controlled environment to experimentally identify the complex parameters of the dynamic model. Furthermore, the two proposed controllers have been tested in underwater path tracking experiments designed to simulate navigation in mine tunnel environments. The experimental results demonstrated the effectiveness of both the proposed controllers and showed that the state feedback linearization	https://www.webofscience.com/wos/woscc/full-record/WOS:000464253100002

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			controller outperforms the finite horizon LQR controller in terms of robustness and response time, while the LQR appears to be superior in terms of fall time.	
2	Дані зображення бокового огляду підводних апаратів для виявлення мін	Side-scan sonar imaging data of underwater vehicles for mine detection. Santos, NP; Moura, R.; Torgal, GS; Lobo, V.; Neto, MD. DATA IN BRIEF. 2024. Volume 53, 110132.	Unmanned vehicles have become increasingly popular in the underwater domain in the last decade, as they provide better operation reliability by minimizing human involvement in most tasks. Perception of the environment is crucial for safety and other tasks, such as guidance and trajectory control, mainly when operating underwater. Mine detection is one of the riskiest operations since it involves systems that can easily damage vehicles and endanger human lives if manned. Automating mine detection from side-scan sonar images enhances safety while reducing false negatives. The collected dataset contains 1170 real sonar images taken between 2010 and 2021 using a Teledyne Marine Gavia Autonomous Underwater Vehicle (AUV), which includes enough information to classify its content objects as NOn-Mine-like BOttom Objects (NOMBO) and MIne-Like COntacts (MILCO). The dataset is annotated and can be quickly deployed for object detection, classification, or image segmentation tasks. Collecting a dataset of this type requires a significant amount of time and cost, which increases its rarity and relevance to research and industrial development.	https://www.webofscience.com/wos/woscc/full-record/WOS:000118685300 0001
3	Адаптивні підводні мережі: зв'язок між автономією та комунікаціями	Adaptable Underwater Networks: The Relation between Autonomy and Communications. Hamilton, A.; Holdcroft, S.; Fenucci, D.; Mitchell, P.; Morozs, N.; Munafò, A.; Sitbon, J. REMOTE SENSING. 2020. Volume 12. Issue 20, 3290.	This paper discusses requirements for autonomy and communications in maritime environments through two use cases which are sourced from military scenarios: Mine Counter Measures (MCM) and Anti-Submarine Warfare (ASW). To address these requirements, this work proposes a service-oriented architecture that breaks the typical boundaries between the autonomy and the communications stacks. An initial version of the architecture has been implemented and its deployment during a field trial done in January 2019 is reported. The paper discusses the achieved results in terms of system flexibility and ability to address the MCM and ASW requirements.	https://www.webofscience.com/wos/woscc/full-record/WOS:0005857213 00001
4	Метод навчання з перенесенням знань для розпізнавання цілей кораблів на зображенні дистанційного зондування	A Transfer Learning Method for Ship Target Recognition in Remote Sensing Image. Li, HB; Guo, B.; Chen, H.; Han, S. COMMUNICATIONS, SIGNAL PROCESSING, AND SYSTEMS. VOL II: SIGNAL PROCESSING. 2020. Volume 516. Page 738-745.	In this paper, an effective approach of ship target recognition is proposed. This method based on the theory of transfer learning aims at using labeled ships with different imaging angles and different resolutions to help identifying unlabeled ships in a fixed angle. Since training ship samples and test ship samples are imaging in different angles, they obey different distributions. However, in traditional machine learning method, training data and test data obey the same distribution. In order to solve this problem, we proposed a method called mapped subspace alignment (MSA) which is different from other domain adaptation methods. While maximizing the difference	https://www.webofscience.com/wos/woscc/full-record/WOS:0006130037 00089

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			between different categories, it first uses Isometric Feature Mapping (Isomap) to generate subspace and uses objective functions to spatial alignment and probabilistic adaptation. This paper focuses on the identification of three types of ships which are destroyers, cruisers, and aircraft carriers basing on MSA. The experimental results show that this method is better than several state-of-the-art methods.	
Інструменти				
1	Система виявлення морських мін з використанням моделей глибокого навчання YOLO, SSD та EfficientDet	Sea Mine Detection Framework Using YOLO, SSD and EfficientDet Deep Learning Models. Munteanu, D.; Moina, D.; Zamfir, CG; Petrea, SM; Cristea, DS; Munteanu, N. SENSORS, 2022. Volume 22. Issue 23, 9536.	In the context of new geopolitical tensions due to the current armed conflicts, safety in terms of navigation has been threatened due to the large number of sea mines placed, in particular, within the sea conflict areas. Additionally, since a large number of mines have recently been reported to have drifted into the territories of the Black Sea countries such as Romania, Bulgaria Georgia and Turkey, which have intense commercial and tourism activities in their coastal areas, the safety of those economic activities is threatened by possible accidents that may occur due to the above-mentioned situation. The use of deep learning in a military operation is widespread, especially for combating drones and other killer robots. Therefore, the present research addresses the detection of floating and underwater sea mines using images recorded from cameras (taken from drones, submarines, ships and boats). Due to the low number of sea mine images, the current research used both an augmentation technique and synthetic image generation (by overlapping images with different types of mines over water backgrounds), and two datasets were built (for floating mines and for underwater mines). Three deep learning models, respectively, YOLOv5, SSD and EfficientDet (YOLOv5 and SSD for floating mines and YOLOv5 and EfficientDet for underwater mines), were trained and compared. In the context of using three algorithm models, YOLO, SSD and EfficientDet, the new generated system revealed high accuracy in object recognition, namely the detection of floating and anchored mines. Moreover, tests carried out on portable computing equipment, such as Raspberry Pi, illustrated the possibility of including such an application for real-time scenarios, with the time of 2 s per frame being improved if devices use high-performance cameras.	https://www.webofscience.com/wos/woscc/full-record/WOS:000897299400001
2	Легке самоконтрольоване розпізнавання суден малих зразків з використанням мікродоплерівських сигнатур та надширокосмугового радара на базі безпілотного літального апарату	Lightweight Self-Supervised Recognition of Small-Sample Ships Using Micro-Doppler Signatures and UAV-Based UWB Radar. Zhu, LZ; Zhang, Q.; Chen, KY; Ma, Q.; Chen, S.; Zhang, SN;	The continuous advancement of shipbuilding technology has enabled the further development of sea transport and naval vessels, which also poses significant challenges to navigation safety. Accurate recognition of different types of ships is crucial. In this study, three typical ships, namely a destroyer, cruise ship, and aircraft carrier, were taken as examples. The micro-Doppler effect of these ships was analyzed using a unmanned aerial vehicle (UAV)-based ultrawideband (UWB) radar.	https://www.webofscience.com/wos/woscc/full-record/WOS:001231633200002

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		Yuan, Y. IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT. 2024. Volume 73, 8504210.	Echo signal models were established and compared with measured Doppler signals. Furthermore, a lightweight self-supervised learning network was proposed to achieve accurate recognition of small-sample labeled ship targets. The neural network architecture, including specific layers and parameters, was introduced. To enhance the micro-Doppler features, the 1-D signals were transformed into 2-D images, thereby converting the ship recognition problem into an image classification problem. The experimental results demonstrate that the proposed network achieves high recognition accuracy under different situations. When evaluated on measured data, the overall recognition rate reaches 97.50%. Moreover, even in challenging scenarios with a low signal-to-clutter ratio (SCR) of -10 dB, the overall recognition rate for simulated data still exceeds 90%, demonstrating the effectiveness and advantages of the proposed network.	
3	Метод реконструкції електричного сигналу тральщика, що імітує ціль, на основі невеликої безпілотної платформи для човнів	Electrical signal reconstruction method of target-simulated minesweeper based on small unmanned boat platform. Liu, Q.; Sun, ZL; Jiang, RX; Li, GD. MEASUREMENT. 2023. Volume 214, 112825.	In recent years, with the continuous development of military unmanned boat technology, there has been a significant increase in interest in small unmanned boat-based minesweeper hunting technology. In this paper, an electrical signal reconstruction method based on time-frequency characteristics and used for small mine-sweeping gear is proposed. Compared with the existing methods, the method does not require measurement to obtain the complete electrical signal of the distribution and is applicable to both surface ships and submarines for signal reconstruction, which can complete the reconstruction of the original signal with high accuracy in the case of incomplete signal acquisition and can be applied to the signal reconstruction under the harsh marine acquisition environment or strong electromagnetic interference. In this paper, the mathematical model between the maximum sampling interval and the captain is established by extracting the time-frequency features of large ships, and the optimal size of the minesweeper and the optimal parameters of the point charge model are ob-tained based on the point charge model, and the performance of the method under low signal-to-noise ratio conditions is evaluated by depth permutation. Under the challenging signal-to-noise ratio conditions, the pro-posed method can accomplish the high-precision reconstruction of the electrical signal distribution of a large ship with the passage data collected by only one measurement node. From the results of simulation and ship model experiments, it can be seen that the electric signal can be simulated with a series unmanned boat array of one-tenth the size of a large ship, and the amplitude error of the reconstructed signal is less than 0.2 mV, the inversion error of	https://www.webofscience.com/wos/woscc/full-record/WOS:000976913200001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			EF(Electrostatic Field) is less than 10%, and the inversion error of SEF(shaft-frequency electric field) is less than 12%.	
4	Новий універсальний підхід до проектування підводних конформних об'ємних решіток	A Novel Versatile Approach for Underwater Conformal Volumetric Array Design. Yusuf, TA; Pyo, S.; Roh, Y. SENSORS. 2021. Volume 21. Issue 11, 3591.	In this study, we present a novel approach to the design of a conformal volumetric array composed of M x N convex subarrays in two orthogonal curvilinear directions for underwater acoustic imaging for mine detection. Our design targets require that the proposed array transducer has three-dimensional half-power beamwidths of 85 degrees and 25 degrees in either of its convex subarray parts, while also reaching a peak transmitting voltage response above 147 dB. The radiated sound pressure of the subarrays was independently derived as a function of their geometrical parameters. The resulting directional factors were then combined to analyze the beam profile of the entire array. The design was finally optimized to minimize the ripple level. To validate this theoretical design, the structure was modeled and analyzed using the finite element method. The comparison between the resulting beam pattern from the finite element analysis and the analytical computation showed an excellent compliance. The method advanced is a simple and systematic analytical model to facilitate the development of new conformal volumetric arrays for underwater mine detection.	https://www.webofscience.com/wos/woscc/full-record/WOS:000660651300001
5	Оптимізація з використанням сонара в інженерних додатках	Sonar inspired optimization (SIO) in engineering applications. Tzanetos, A.; Dounias, G. EVOLVING SYSTEMS. 2020. Volume 11. Issue 3. Page 531-539.	Recently, a new Nature Inspired Intelligent scheme has been proposed and presented, named Sonar Inspired Optimization (SIO). This algorithm is inspired by the SONAR mechanism, which is used by Warships to detect targets and avoid mines. In this paper, improvements have been done to the SIO approach in an attempt to increase the performance of the algorithm. Also, results from experiments in known constrained Engineering applications are presented and discussed. SIO tackles with these problems, managing to overcome the performance of other Nature Inspired metaheuristics, heuristics and mathematical approaches in most of the cases.	https://www.webofscience.com/wos/woscc/full-record/WOS:000563132800014
Матеріалознавство				
1	Підводна зварна броня з алюмінієвих сплавів марки AA5083 методом тертя та перемішування: експериментальні балістичні характеристики та дослідження корозії	Underwater Friction Stir Welded Armour Grade AA5083 Aluminum Alloys: Experimental Ballistic Performance and Corrosion Investigation. Saravanakumar, R.; Rajasekaran, T.; Pandey, C. JOURNAL OF MATERIALS ENGINEERING AND	Lightweight combat units, assault warplanes, and destroyers are being developed to increase agility and resource efficiency. This is realized using lightweight frames composed of aluminum and magnesium alloys, which decrease weight, enhance cargo-carrying capacity, and improve vehicular efficiency. This research used 18.5 mm Armour Piercing Projectiles at a target velocity of 200 m/sec to test the ballistic performance of AA5083 Base Metal and underwater friction-stir welded (UWFSW) target welded plates. The Al's joints were fabricated utilizing the UWFSW process at tool rotational speed (TRS), tool	https://www.webofscience.com/wos/woscc/full-record/WOS:000916623500001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		PERFORMANCE. 2023. Volume 32. Issue 22. Page 10175-10190.	welding speed (TWS), and tool tilt angle (TTA), as well as variable tool pin shapes, cylindrical threaded, straight hexagonal, and straight cylindrical. With a TRS of 1200 rpm, TWS of 40 mm/min, TTA of 1 degrees, and straight hexagonal tool pin shape, defect-free welds with improved tensile and impact qualities were attained. The macro hardness and microstructure of the UWFSW joints were examined. The fine grain structure has the highest hardness (135 HV). Adiabatic Shear Bands (ASBs) were confirmed by scanning electron microscopy of a projectile-pierced channel. Because of the increased amount of ASB lines on the ballistic hit UWFSW surface, there were more macro cracks. There was no fragmentation loss, reduced fissures, and lesser ASB lines in the hexagonal pin joints, all of which increased ballistic performance. In order to protect against the corrosion of UWFSWed 5083 Al alloy in seawater, electrochemical tests and nitric acid mass loss tests were conducted.	
2	Генерація водню шляхом гідролізу композиту MgH2-LiH	Hydrogen Generation by Hydrolysis of MgH_2-LiH Composite. Wu, XJ; Xue, HQ; Peng, Y.; Deng, JF; Xie, ZW; Zheng, J.; Li, XG; Li, S. MATERIALS. 2022. Volume 15. Issue 4, 1593.	As a most promising material for hydrogen generation by hydrolysis, magnesium hydride (MgH2) is also trapped by its yielded byproduct Mg(OH)(2) whose dense passivated layers prevent the further contact of intimal MgH2 with water. In this work, LiH, as a destroyer, has been added to promote the hydrogen properties of MgH2. The results demonstrate that even 3 wt % LiH was added into MgH2-G, the hydrogen generation yield can increase about 72% compared to the hydrogen generation yield of MgH2-G. The possible mechanism is that Mg2+ from the hydrolysis of MgH2 preferentially bound with OH- ions from the hydrolysis of LiH to form Mg(OH)(2) precipitation, which is dispersed in water rather than coated on the surface of MgH2. Moreover, adding MgCl2 into hydrolysis solution, using ball milling technology, and increasing the hydrolysis temperature can make the hydrolysis rate higher and reaction process more complete. It is noted that a too high weight ratio of LiH with too high of a hydrolysis temperature will make the reaction too violent to be safe in the experiment. We determinate the best experimental condition is that the LiH ratio added into MgH2 is 3 wt %, the hydrolysis temperature is 60 degrees C, and the concentration of MgCl2 hydrating solution is 1 M. MgH2-LiH composite hydrogen generation technology can meet the needs of various types of hydrogen supply and has broad application prospects.	https://www.webofscience.com/wos/woscc/full-record/WOS:000763079500001
3	Комунікаційно-сталий пористий вуглець, легований азотом, отриманий з морських зірок, для	Communication-Sustainable Starfish-Derived N-Doped Porous Carbon for High-	Electric double layer capacitors can be used in broad applications, including portable electronics, high power tools, and transportation. However, such systems require more sustainable materials and a boosting of their electrochemical performance. In this study, starfish,	https://www.webofscience.com/wos/woscc/full-

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
	високопродуктивних двошарових електричних конденсаторів	Performance Electric Double Layer Capacitors. Hong, TH; Lee, YH; Jang, H.; Lee, JT. JOURNAL OF THE ELECTROCHEMICAL SOCIETY. 2022. Volume 169. Issue 8, 080517.	as an unusable destroyer of marine ecosystems, are transformed into functional nitrogen-doped carbon materials with high porosity toward high-performance EDLC electrodes. The synthesized starfish-derived carbon exhibits a surface area of up to 3122 m(2) g(-1), a specific capacitance of up to 295.7 F g(-1) at a current density of 0.5 A g(-1), and capacitance retention of 81.5% upon an increase in current density from 0.5 to 10 A g(-1).	record/WOS:000841983900001
4	Уніфікована система покращення мовлення на основі нейронного формування променя з параболічним відбивачем	A Unified Speech Enhancement System Based on Neural Beamforming With Parabolic Reflector. Zhang, T.; Geng, YZ; Sun, JH; Jiao, C.; Ding, BY. APPLIED SCIENCES-BASEL. 2020. Volume 10. Issue 7, 2218.	This paper presents a unified speech enhancement system to remove both background noise and interfering speech in serious noise environments by jointly utilizing the parabolic reflector model and neural beamformer. First, the amplification property of paraboloid is discussed, which significantly improves the Signal-to-Noise Ratio (SNR) of a desired signal. Therefore, an appropriate paraboloid channel is analyzed and designed through the boundary element method. On the other hand, a time-frequency masking approach and a mask-based beamforming approach are discussed and incorporated in an enhancement system. It is worth noticing that signals provided by the paraboloid and the beamformer are exactly complementary. Finally, these signals are employed in a learning-based fusion framework to further improve the system performance in low SNR environments. Experiments demonstrate that our system is effective and robust in five different noisy conditions (speech interfered with factory, pink, destroyer engine, volvo, and babble noise), as well as in different noise levels. Compared with the original noisy speech, significant average objective metrics improvements are about Delta STOI= 0.28, Delta PESQ= 1.31, Delta fwSegSNR= 11.9.	https://www.webofscience.com/wos/woscc/full-record/WOS:000533356200017
БЕЗПІЛОТНІ МОРСЬКІ СИСТЕМИ				
Інженерія				
1	Досягнення в галузі автономних підводних апаратів	Advancements in the field of autonomous underwater vehicle. Sahoo, A.; Dwivedy, SK; Robi, PS. OCEAN ENGINEERING. 2019. Volume 181. Page 145-160.	Autonomous Underwater Vehicles (AUVs) are robotic devices with a propulsion system for navigation and an onboard computer for decision making. AUV research is gaining popularity because of its extensive applications in fields from military to science. Robotic systems are need of the hour for exploration and environmental safety of the vast and deep oceans and water bodies. This paper presents current research trends in the field of AUVs and highlights future research directions. Here localization and navigation techniques such as inertial navigation to simultaneous localization and mapping being used in current AUVs are discussed in detail. Different optimal path planning and control methods are highlighted. Use of different sensor technology like sonar, laser, acoustic modems and stereo vision systems for localization,	https://www.webofscience.com/wos/woscc/full-record/WOS:000470043800012

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			navigation and mapping is presented. Recent developments in underwater wireless communication along with the commercially available devices are discussed.	
2	Гібридний алгоритм планування шляху на основі покращеного поля A* та штучного потенційного поля для безпілотних надводних апаратів	The hybrid path planning algorithm based on improved A* and artificial potential field for unmanned surface vehicle formations. Sang, HQ; You, YS; Sun, XJ; Zhou, Y.; Liu, F. OCEAN ENGINEERING. 2021. Volume 223, 108709.	To effectively improve system autonomy, increase fault-tolerant resilience, solve low payload capacity and short endurance time of unmanned surface vehicles (USVs), there's a trend to deploy multiple USVs as a formation fleet. The formation path planning algorithms are essential to generate optimal trajectories and provide practical collision avoidance maneuvers to efficiently navigate the USV fleet. To ensure the optimality, rationality and path continuity of the formation trajectories, this paper presents a novel deterministic algorithm named multiple sub-target artificial potential field (MTAPF) based on an improved APF. The MTAPF belongs to the local path planning algorithm, which refers to the global optimal path generated by an improved heuristic A* algorithm. and the optimal path is divided by this algorithm into multiple sub-target points to form sub-target point sequence. The MTAPF can greatly reduce the probability that USVs will fall into the local minimum and help USVs to get out of the local minimum by switching target points. As an underactuated system, the USV is restricted by various motion constraints, and the MTAPF is presented to make the generated path compliant with USV' s dynamics and orientation restrictions. The proposed algorithm is validated on simulations and proven to work effectively in different environments.	https://www.webofscience.com/wos/woscc/full-record/WOS:000625304400048
3	Двоконтурне інтегральне термінальне ковзне відстеження для безпілотних підводних апаратів з адаптивною динамічною компенсацією невизначеностей та збурень	Double-Loop Integral Terminal Sliding Mode Tracking Control for UUVs With Adaptive Dynamic Compensation of Uncertainties and Disturbances. Qiao, L.; Zhang, WD. IEEE JOURNAL OF OCEANIC ENGINEERING. 2019. Volume 44. Issue 1. Page 29-53.	This paper focuses on the trajectory tracking control of unmanned underwater vehicles (UUVs) in the presence of dynamic uncertainties and time-varying external disturbances. Two adaptive integral terminal sliding mode control schemes, namely, adaptive integral terminal slidingmode control (AITSMC) scheme and adaptive fast integral terminal sliding mode control (AFITSMC) scheme are proposed for UUVs based on integral terminal sliding mode (ITSM) and fast ITSM (FITSM), respectively. Each control scheme is double-looped: composed of a kinematic controller and a dynamic controller. First, a kinematic controller is designed for each of the two control schemes. The two kinematic controllers are based on ITSM and FITSM, respectively. These kinematic controllers yield local finite-time convergence of the position tracking errors to zero meanwhile avoid the singularity problem in the conventional terminal sliding mode control (TSMC). Then, using the output of the kinematic controller as a reference velocity command, a dynamic controller is developed for each of the two control schemes. The two dynamic controllers are also based on ITSM and FITSM, respectively. An adaptive mechanism is	https://www.webofscience.com/wos/woscc/full-record/WOS:000456175300003

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			introduced to estimate the unknown parameters of the upper bound of the lumped system uncertainty which consists of dynamic uncertainties and time-varying external disturbances so that the prior knowledge of the upper bound of the lumped system uncertainty is not required. The estimated parameters are then used as controller parameters to eliminate the effects of the lumped system uncertainty. The convergence rate of the integral terminal sliding variable vector is investigated and the local finitetime convergence of the velocity tracking errors to zero in the ITSM or FITSM is obtained. Finally, based on the designed kinematic and dynamic controllers, the finite-time stability of the full closed-loop cascaded system is shown. The two proposed control schemes improve the tracking accuracy over the existing globally finite-time stable tracking control (GFTSTC) and adaptive nonsingular TSMC schemes, and enhance the robustness against parameter uncertainties and external disturbances over the GFTSTC scheme. Compared with the conventional adaptive integral sliding mode control (AISMC) scheme, the two proposed control schemes offer faster convergence rate and stronger robustness against dynamic uncertainties and time-varying external disturbances for the trajectory tracking control of UUVs due to involving the fractional integrator. Comparative numerical simulations are performed on the dynamic model of the Omni Directional Intelligent Navigator UUV for two trajectory tracking cases. The convergence rate and robustness to uncertainties and disturbances are quantified as the convergent time and bounds of the steady-state position and velocity tracking errors, respectively. The results show that the two proposed control schemes improve at least 20s in convergence rate and enhance about 2% robustness in position tracking and 20% robustness in velocity tracking over the AISMC scheme.	
4	Планування шляху та уникнення перешкод для автономного підводного апарату: огляд	Path planning and obstacle avoidance for AUV: A review. Cheng, CX; Sha, QX; He, B.; Li, GL. OCEAN ENGINEERING. 2021. Volume 235, 109355.	Autonomous underwater vehicle plays a more and more important role in the exploration of marine resources. Path planning and obstacle avoidance is the core technology to realize the autonomy of AUV, which will determine the application prospect of AUV. This paper mainly describes the state-of-the-art methods of path planning and obstacle avoidance for AUV and aims to become a starting point for researchers who are initiating their endeavors in this field. Moreover, the objective of this paper is to give a comprehensive overview of work on recent advances and new breakthroughs, also to discuss some future directions worthy to research in this area. The focus of this article is put on these path planning algorithms that deal with constraints and characteristics of AUV and the influence of marine environments.	https://www.webofscience.com/wos/woscc/full-record/WOS:000685456200002

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			Since most of the time AUV will operate in the environments full of obstacles, we divide path planning methods of AUV into two categories: global path planning with known static obstacles, and local path planning with unknown and dynamic obstacles. We describe the basic principles of each method and survey most related work to them. An in-depth discussion and comparisons between different path planning algorithms are also provided. Lastly, we propose some potential future research directions that are worthy to investigate in this field.	
5	Згладжений алгоритм A* для практичного планування шляху безпілотних надводних апаратів	Smoothed A* algorithm for practical unmanned surface vehicle path planning. Song, R.; Liu, YC.; Bucknall, R. APPLIED OCEAN RESEARCH. 2019. Volume 83. Page 9-20.	An effective path planning or route planning algorithm is essential for guiding unmanned surface vehicles (USVs) between way points or along a trajectory. The A* algorithm is one of the most efficient algorithms for calculating a safe route with the shortest distance cost. However, the route generated by the conventional A* algorithm is constrained by the resolution of the map and it may not be compatible with the non-holonomic constraint of the USV. In this paper an improved A* algorithm has been proposed and applied to the Springer USV. A new path smoothing process with three path smoothers has been developed to improve the performance of the generated route, reducing unnecessary 'jags', having no redundant waypoints and offering a more continuous route. Both simulation and experimental results show that the smoothed A* algorithm outperforms the conventional algorithm in both sparse and cluttered environments that have been uniformly rasterised. It has been demonstrated that the proposed improved A* route planning algorithm can be applied to the Springer USV providing promising results when tracking trajectories.	https://www.webofscience.com/wos/woscc/full-record/WOS:000457657700002
Океанографія				
1	Уникнення зіткнень для безпілотного надводного апарату з використанням глибокого навчання з підкріпленням	Collision avoidance for an unmanned surface vehicle using deep reinforcement learning. Woo, J.; Kim, N. OCEAN ENGINEERING. 2020. Volume 199, 107001.	In this paper, a deep reinforcement learning (DRL)-based collision avoidance method is proposed for an unmanned surface vehicle (USV). This approach is applicable to the decision-making stage of collision avoidance, which determines whether the avoidance is necessary, and if so, determines the direction of the avoidance maneuver. To utilize the visual recognition capability of deep neural networks as a tool for analyzing the complex and ambiguous situations that are typically encountered, a grid map representation of the ship encounter situation was suggested. For the composition of the DRL network, we proposed a neural network architecture and semi-Markov decision process model that was specially designed for the USV collision avoidance problem. The proposed DRL network was trained through repeated simulations of collision avoidance. After the training process, the DRL network was implemented in collision avoidance	https://www.webofscience.com/wos/woscc/full-record/WOS:000518873800022

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			experiments and simulations to evaluate its situation recognition and collision avoidance capability.	
2	Автономна навігація підводного апарату: огляд	Autonomous Underwater Vehicle navigation: A review. Zhang, BB; Ji, DX; Liu, S.; Zhu, XK; Xu, W. OCEAN ENGINEERING. 2023. Volume 273, 113861.	Autonomous Underwater Vehicles (AUVs) have been focused on by research efforts because of their extensive applications in scientific, commercial as well as military fields. However, due to the complexity of underwater environments, AUV navigation remains a challenging problem. This review first presents a comprehensive description of the three classical techniques of AUV navigation, i.e., Dead Reckoning, Signal-Based Navigation, and Map-Matching Navigation. In what follows, an in-depth survey of Integrated Navigation is given. Furthermore, a thorough discussion on Cooperative Navigation is also detailed along with an analysis of its capabilities and limitations. Finally, recent significant challenges of AUV navigation and further research directions are summarized.	https://www.webofscience.com/wos/woscc/full-record/WOS:000996418700001
3	Контролер на основі глибокого навчання з підкріпленням для стеження за траєкторією безпілотного надводного апарату	Deep reinforcement learning-based controller for path following of an unmanned surface vehicle. Woo, J.; Yu, C.; Kim, N. OCEAN ENGINEERING. 2019. Volume 183. Page 155-166.	In this paper, a deep reinforcement learning (DRL)-based controller for path following of an unmanned surface vehicle (USV) is proposed. The proposed controller can self-develop a vehicle's path following capability by interacting with the nearby environment. A deep deterministic policy gradient (DDPG) algorithm, which is an actor-critic-based reinforcement learning algorithm, was adapted to capture the USV's experience during the path-following trials. A Markov decision process model, which includes the state, action, and reward formulation, specially designed for the USV path-following problem is suggested. The control policy was trained with repeated trials of path-following simulation. The proposed method's path-following and self-learning capabilities were validated through USV simulation and a free-running test of the full-scale USV.	https://www.webofscience.com/wos/woscc/full-record/WOS:000479025700011
4	Надійне адаптивне керування ковзним режимом для недостатньо керованих автономних підводних апаратів з невизначеною динамікою	Robust adaptive sliding mode control of underactuated autonomous underwater vehicles with uncertain dynamics. Yan, ZP; Wang, M.; Xu, J. OCEAN ENGINEERING. 2019. Volume 173. Page 802-809.	This paper focuses on adaptive integral sliding mode control for a class of underactuated autonomous underwater vehicles (AUVs) with uncertain dynamics, where the vehicles moving in three-dimensional (3-D) space have only three available control inputs provided by the stem propellers, steering and diving rudders but five degrees of freedom to be controlled. Different from the traditional sliding mode control, the proposed dual closed-loop integral sliding mode control design can be described as comprising two distinct phases: 1) in outer-loop, the virtual velocity commands are determined for the following work; 2) in inner-loop, the actual control inputs are designed to achieve the trajectory tracking. Moreover, the practical situations that there exist systematic parametric uncertainties and external disturbances are also considered, and a novel direct adaptive neural network controller combined with a conditional integrator is presented, which provides	https://www.webofscience.com/wos/woscc/full-record/WOS:000460709700061

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			the robustness and adaptation for the vehicle. In addition, the rigorous stability analysis based Lyapunov's method demonstrates the uniform ultimate boundedness of all the tracking errors in the closed-loop system. Finally, simulation results are shown the effectiveness of the proposed controllers.	
5	Глобальне планування траєкторії та багатоцільове керування траєкторією для безпілотного надводного апарату на основі модифікованого алгоритму оптимізації рою частинок	Global path planning and multi-objective path control for unmanned surface vehicle based on modified particle swarm optimization (PSO) algorithm. Guo, XH; Ji, MJ; Zhao, ZW; Wen, DS; Zhang, WD. OCEAN ENGINEERING. 2020. Volume 216, 107693.	This paper investigates the novel path navigation method for an unmanned surface vehicle (USV), which is divided into two-stage: global path planning and path control. In the first stage, combined with the travelling salesman problem (TSP), a global path is obtained by maximizing the profit per unit time in multiple task locations. In the second stage, a nonlinear multi-objective optimization model is formulated for the path control between two task locations. In addition, fixed and time-varying currents are also considered for USV motion, which aims to avoid collision and take full advantage of the direction of currents. To solve the problem quickly and accurately, a chaotic and sharing-learning particle swarm optimization (CSPSO) algorithm is developed to solve the extended TSP and the nonlinear multi-objective model. Simulation experiments validate that the proposed hierarchical navigation method, CSPSO algorithm, and collision avoidance rules are effective and justifiable.	https://www.webofscience.com/wos/woscc/full-record/WOS:000596863000016
Інформатика				
1	Огляд формування автономних підводних апаратів: продуктивність, контроль формування та можливості зв'язку	A Survey of Autonomous Underwater Vehicle Formation: Performance, Formation Control, and Communication Capability. Yang, Y.; Xiao, Y.; Li, TS. IEEE COMMUNICATIONS SURVEYS AND TUTORIALS. 2021. Volume 23. Issue 2. Page 815-841.	Autonomous underwater vehicles (AUVs) are submersible underwater vehicles controlled by onboard computers. AUV formation is a cooperative control which focuses on controlling multiple AUVs to move in a group while executing tasks. In contrast to a single AUV, multi-AUV formation represents higher efficiency and better stability for many applications, such as oil and gas industries, hydrographic surveys, and military missions, etc. To achieve better formation, there are several key factors, including AUV performance, formation control, and communication capability. However, most studies in the field of AUV formation mainly focus on formation control methods. We observe that the research of communication capability and AUV performance of multiple AUV formation is still in an early stage. It is beneficial to researchers to present a comprehensive survey of the state of the art of AUV formation research and development. In this paper, we study AUV, formation control, and underwater acoustic communication capability in detail. We propose a classification framework with three dimensions, including AUV performance, formation control, and communication capability. This framework provides a comprehensive classification method for future AUV	https://www.webofscience.com/wos/woscc/full-record/WOS:000654905700006

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			formation research. It also can be used to compare different methods and help engineers choose suitable formation methods for various applications. Moreover, our survey discusses formation architecture with communication constraints and we identify some common misconceptions and questionable research for formation control related to communication.	
2	Оптимальне керування стеженням невідомого безпілотного надводного апарату на основі навчання з підкріпленням	Reinforcement Learning-Based Optimal Tracking Control of an Unknown Unmanned Surface Vehicle. Wang, N.; Gao, Y.; Zhao, H.; Ahn, CK. IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS. 2021. Volume 32. Issue 7. Page 3034-3045.	In this article, a novel reinforcement learning-based optimal tracking control (RLOTC) scheme is established for an unmanned surface vehicle (USV) in the presence of complex unknowns, including dead-zone input nonlinearities, system dynamics, and disturbances. To be specific, dead-zone nonlinearities are decoupled to be input-dependent sloped controls and unknown biases that are encapsulated into lumped unknowns within tracking error dynamics. Neural network (NN) approximators are further deployed to adaptively identify complex unknowns and facilitate a Hamilton-Jacobi-Bellman (HJB) equation that formulates optimal tracking. In order to derive a practically optimal solution, an actor-critic reinforcement learning framework is built by employing adaptive NN identifiers to recursively approximate the total optimal policy and cost function. Eventually, theoretical analysis shows that the entire RLOTC scheme can render tracking errors that converge to an arbitrarily small neighborhood of the origin, subject to optimal cost. Simulation results and comprehensive comparisons on a prototype USV demonstrate remarkable effectiveness and superiority.	https://www.webofscience.com/wos/woscc/full-record/WOS:000670541500019
3	Керування безпілотним наземним надводним апаратом на основі навчання з підкріпленням, що базується на даних та сприяє продуктивності	Data-Driven Performance-Prescribed Reinforcement Learning Control of an Unmanned Surface Vehicle. Wang, N.; Gao, Y.; Zhang, XF. IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS. 2021. Volume 32. Issue 12. Page 5456-5467.	An unmanned surface vehicle (USV) under complicated marine environments can hardly be modeled well such that model-based optimal control approaches become infeasible. In this article, a self-learning-based model-free solution only using input-output signals of the USV is innovatively provided. To this end, a data-driven performance-prescribed reinforcement learning control (DPRLC) scheme is created to pursue control optimality and prescribed tracking accuracy simultaneously. By devising state transformation with prescribed performance, constrained tracking errors are substantially converted into constraint-free stabilization of tracking errors with unknown dynamics. Reinforcement learning paradigm using neural network-based actor-critic learning framework is further deployed to directly optimize controller synthesis deduced from the Bellman error formulation such that transformed tracking errors evolve a data-driven optimal controller. Theoretical analysis eventually ensures that the entire DPRLC scheme can guarantee prescribed tracking accuracy, subject to optimal cost. Both simulations and virtual-reality	https://www.webofscience.com/wos/woscc/full-record/WOS:000724480600024

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			experiments demonstrate the remarkable effectiveness and superiority of the proposed DPRLC scheme.	
4	Орієнтоване наближене оптимальне керування траєкторією руху безпілотних надводних апаратів з обмеженнями стану, що спрацьовує за подіями	Event-Triggered Approximate Optimal Path-Following Control for Unmanned Surface Vehicles With State Constraints. Zhou, WX; Fu, J.; Yan, HC; Du, X.; Wang, YY; Zhou, H. IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS. 2023. Volume 34. Issue 1. Page 104-118.	This article investigates the problem of path following for the underactuated unmanned surface vehicles (USVs) subject to state constraints. A useful control algorithm is proposed by combining the backstepping technique, adaptive dynamic programming (ADP), and the event-triggered mechanism. The presented approach consists of three modules: guidance law, dynamic controller, and event triggering. First, to deal with the ``singularity'' problem, the guidance-based path-following (GBPF) principle is introduced in the guidance law loop. In contrast to the traditional barrier Lyapunov function (BLF) method, this article converts the USV's constraint model to a class of nonlinear systems without state constraints by introducing a nonlinear mapping. The control signal generated by the dynamic controller module consists of a backstepping-based feedforward control signal and an ADP-based approximate optimal feedback control signal. Therefore, the presented scheme can guarantee the approximate optimal performance. To approximate the cost function and its partial derivative, a critic neural network (NN) is constructed. By considering the event-triggered condition, the dynamic controller is further improved. Compared with traditional time-triggered control methods, the proposed approach can greatly reduce communication and computational burdens. This article proves that the closed-loop system is stable, and the simulation results and experimental validation are given to illustrate the effectiveness of the proposed approach.	https://www.webofscience.com/wos/woscc/full-record/WOS:000732191000001
5	Планування шляху на основі глибокого навчання з підкріпленням для автономних підводних апаратів в умовах збурень океанських течій	Path Planning Based on Deep Reinforcement Learning for Autonomous Underwater Vehicles Under Ocean Current Disturbance. Chu, ZZ; Wang, FL; Lei, TJ; Luo, CM. IEEE TRANSACTIONS ON INTELLIGENT VEHICLES. 2023. Volume 8. Issue 1. Page 108-120.	The path planning issue of the underactuated autonomous underwater vehicle (AUV) under ocean current disturbance is studied in this paper. In order to improve the AUV's path planning capability in the unknown environments, a deep reinforcement learning (DRL) path planning method based on double deep Q Network (DDQN) is proposed. It is created from an improved convolutional neural network, which has two input layers to adapt to the processing of high-dimensional environments. Considering the maneuverability of underactuated AUV under current disturbance, especially, the issue of ocean current disturbance under unknown environments, a dynamic and composite reward function is developed to enable the AUV to reach the destination with obstacle avoidance. Finally, the path planning ability of the proposed method in the unknown environments is validated by simulation analysis and comparison studies.	https://www.webofscience.com/wos/woscc/full-record/WOS:000967371800001
Системи автоматизованого управління				

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
1	Огляд методів керування на основі ковзного режиму для застосувань у системах керування	Review of sliding mode based control techniques for control system applications. Gambhire, SJ; Kishore, DR; Londhe, PS; Pawar, SN. INTERNATIONAL JOURNAL OF DYNAMICS AND CONTROL. 2021. Volume 9. Issue 1. Page 363-378.	In recent development in the control area, advanced control schemes are well established for the systems under the influence of parametric uncertainties due to modelling error, nonlinearities, and the external disturbances. Among the different robust control schemes sliding mode control (SMC) has made attention for the control engineer due to its merits. SMC has grown rapidly as a control in comparison with other robust control strategies due to its distinguish features like insensitive to matched uncertainties, reduced order sliding mode equations, zero error convergence of closed loop system and it offers a nonlinear control. The objective of this paper is to present the literature review of SMC development in an era of control technology. The development of SMC based technique with integration of intelligent control in the field of control engineering has been surveyed by considering numerous applications.	https://www.webofscience.com/wos/woscc/full-record/WOS:001054388500030
2	Керування кількома системами автономних підводних апаратів без обмежень швидкості та зближення у скінченному часі з періодичним зв'язком	Finite-Time Velocity-Free Rendezvous Control of Multiple AUV Systems With Intermittent Communication. Chen, B.; Hu, JP; Zhao, YY; Ghosh, BK; Chen, B.; Hu, JP; Zhao, YY; Ghosh, BK. 2022. Volume 52. Issue 10. Page 6618-6629.	In this study, a finite-time velocity-free rendezvous control method is considered for multiple autonomous underwater vehicle (AUV) systems with intermittent undirected communication. First, we develop a distributed finite-time observer for each AUV to estimate its own state information. Second, we design a rendezvous control algorithm that utilizes the estimated state information intermittently through a communication network in the absence of velocity measurement. A homogeneous method is used to prove that all AUVs in the group can achieve rendezvous in finite time for a network with intermittent communication, even without velocity measurements. The proposed method is shown to reduce the communication load of the system. More importantly, the control algorithm achieves the control goal of the system and is proven to be viable for many practical applications of multiple AUV systems from both economic and security perspectives. Finally, the effectiveness of the proposed control protocol is demonstrated via numerical simulations.	https://www.webofscience.com/wos/woscc/full-record/WOS:000754270200001
3	Робустне нечітке адаптивне керування на основі помилок наведення для відстеження дна автономного підводного апарата з динамікою насиченого приводу	Guidance-Error-Based Robust Fuzzy Adaptive Control for Bottom Following of a Flight-Style AUV With Saturated Actuator Dynamics. Yu, CY; Xiang, XB; Wilson, PA; Zhang, Q. IEEE TRANSACTIONS ON CYBERNETICS. 2020. Volume 50. Issue 5. Page 1887-1899.	This paper addresses the problem of robust bottom following control for a flight-style autonomous underwater vehicle (AUV) subject to system uncertainties, actuator dynamics, and input saturation. First, the actuator dynamics that is approximated by a first-order differential equation is inserted into the AUV dynamics model, which renders a high-order nonlinear dynamics analysis and design in the model-based backstepping controller by utilizing guidance errors. Second, to overcome the shaking control behavior resulted by the model-based high-order derivative calculation, a fuzzy approximator-based model-free controller is proposed, in order to online approximate the unknown part of the ideal backstepping architecture. In addition, the adaptive	https://www.webofscience.com/wos/woscc/full-record/WOS:000528622000010

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			error estimation technology is resorted to compensate the system approximation error, ensuring that all the position and orientation errors of robust bottom following control tend to zero. Third, to further tackle the potential unstable control behavior from inherent saturation of control surfaces driven by rudders, an additional adaptive fuzzy compensator is introduced, in order to compensate control truncation between the unsaturated and saturation inputs. Subsequently, Lyapunov theory and Barbalat lemma are adopted to synthesize asymptotic stability of the entire bottom following control system. Finally, comparative numerical simulations with different controllers, environmental disturbances and initial states are provided to illustrate adaptability and robustness of the proposed bottom following controller for a flight-style AUV with saturated actuator dynamics.	
4	Надійне керування траєкторією руху для недостатньо керованих автономних підводних апаратів у невизначених умовах	Robust Trajectory Tracking Control for Underactuated Autonomous Underwater Vehicles in Uncertain Environments. Heshmati-Alamdari, S.; Nikou, A.; Dimarogonas, DV. IEEE TRANSACTIONS ON AUTOMATION SCIENCE AND ENGINEERING. 2021. Volume 18. Issue 3. Page 1288-1301.	This article addresses the tracking control problem of 3-D trajectories for underactuated underwater robotic vehicles operating in a constrained workspace including obstacles. More specifically, a robust nonlinear model predictive control (NMPC) scheme is presented for the case of underactuated autonomous underwater vehicles (AUVs) (i.e., unicycle-like vehicles actuated only in the surge, heave, and yaw). The purpose of the controller is to steer the unicycle-like AUV to the desired trajectory with guaranteed input and state constraints (e.g., obstacles, predefined vehicle velocity bounds, and thruster saturations) inside a partially known and dynamic environment where the knowledge of the operating workspace is constantly updated via the vehicle's onboard sensors. In particular, considering the sensing range of the vehicle, obstacle avoidance with any of the detected obstacles is guaranteed by the online generation of a collision-free trajectory tracking path, despite the model dynamic uncertainties and the presence of external disturbances representing ocean currents and waves. Finally, realistic simulation studies verify the performance and efficiency of the proposed framework. Note to Practitioners-This article was motivated by the problem of robust trajectory tracking for an autonomous underwater vehicle (AUV) operating in an uncertain environment where the knowledge of the operating workspace (e.g., obstacle positions) is constantly updated online via the vehicle's onboard sensors (e.g., multibeam imaging sonars and laser-based vision systems). In addition, there may be other system limitations (e.g., thruster saturation limits) and other operational constraints, induced by the need of various common underwater tasks (e.g., a predefined vehicle speed limit for inspecting the seabed, and mosaicking), where it should also be considered into the control	https://www.webofscience.com/wos/woscc/full-record/WOS:000670593000033

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			strategy. However, based on the existing trajectory tracking control approaches for underwater robotics, there is a lack of an autonomous control scheme that provides a complete and credible control strategy that takes the aforementioned issues into consideration. Based on this, we present a reliable control strategy that takes into account the aforementioned issues, along with dynamic uncertainties of the model and the presence of ocean currents. In future research, we will extend the proposed methodology for multiple AUV performing collaborative inspection tasks in an uncertain environment.	
5	Розподілена реалізація нелінійної моделі прогнозного керування для відстеження траєкторії автономного підводного апарата	Distributed implementation of nonlinear model predictive control for AUV trajectory tracking. Shen, C.; Shi, Y. AUTOMATICA. 2020. Volume 115, 108863.	This paper studies the trajectory tracking control of an autonomous underwater vehicle (AUV). We investigate the nonlinear model predictive control (NMPC) method looking for possible approaches to alleviate the heavy computational burden. Novel distributed NMPC algorithms are developed exploiting the dynamic properties of the AUV motion. By appropriately decomposing the original optimization problems into smaller size subproblems and then solving them in a distributed manner, the expected floating point operations (flops) can be reduced dramatically. We show that the convergence of the AUV trajectory can be guaranteed by the proposed contraction constraints in the decomposed subproblems. Recursive feasibility and closed-loop stability are proved. Taking advantage of the guaranteed stability, a real-time distributed implementation algorithm is further developed to automatically trade off between control performance and computational complexity. Extensive simulation studies on the Falcon AUV model demonstrate the effectiveness and robustness of the proposed approach. (C) 2020 Elsevier Ltd. All rights reserved.	https://www.webofscience.com/wos/woscc/full-record/WOS:000525865500034
Телекомунікації				
1	Адаптивне нечітке керування формуванням безпілотних надводних апаратів на основі зворотного кроку з невідомою нелінійністю моделі та насиченістю виконавчих механізмів	Adaptive Fuzzy Backstepping-Based Formation Control of Unmanned Surface Vehicles With Unknown Model Nonlinearity and Actuator Saturation. Zhou, WX; Wang, YY; Ahn, CK; Cheng, J.; Chen, CY. IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY. 2020. Volume 69. Issue 12. Page 14749-14764.	In this article, the formation control of unmanned surface vehicles (USVs) is addressed considering actuator saturation and unknown nonlinear items. The algorithm can be divided into two parts, steering the leader USV to trace along the desired path and steering the follower USV to follow the leader in the desired formation. In the proposed formation control framework, a virtual USV is first constructed so that the leader USV can be guided to the desired path. To solve the input constraint problem, an auxiliary is introduced, and the adaptive fuzzy method is used to estimate unknown nonlinear items in the USV. To maintain the desired formation, the desired velocities of follower USVs are deduced using geometry and Lyapunov stability theories; the stability of the closed-loop system is also proved. Finally, the	https://www.webofscience.com/wos/woscc/full-record/WOS:000612152100025

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			effectiveness of the proposed approach is demonstrated by the simulation and experimental results.	
2	Спільне планування шляху для гетерогенних безпілотних апаратів у місії пошуку та відстеження підводної цілі	Cooperative Path Planning for Heterogeneous Unmanned Vehicles in a Search-and-Track Mission Aiming at an Underwater Target. Wu, Y.; Low, KH; Lv, C. IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY. 2020. Volume 69. Issue 6. Page 6782-6787.	It is an effective way to execute a complicated mission by cooperating unmanned vehicles. This paper focuses on a search- and-track (SAT) mission for an underwater target, and the mission is implemented by combining an unmanned aerial vehicle (UAV), an unmanned surface vehicle (USV) and an autonomous underwater vehicle (AUV). In the cooperative path planning model, the mission is divided into the search phase and the track phase, and the goals of the two phases are to maximize the search space and minimize the terminal error respectively. The constraints contain the maneuverability of vehicles and communication ranges between vehicles. Strategies based on random simulation experiments and asynchronous planning are developed to design the cooperative path planning algorithm in the two phases, and the paths are generated by an improved particle swarm optimization (IPSO) algorithm in a centralized or a distributed mode. Simulation results demonstrate that the proposed method can deal with different situations. The UAV & USV & AUV system is superior to the USV & AUV system in the SAT mission.	https://www.webofscience.com/wos/woscc/full-record/WOS:000558744200088
3	Енергоефективний збір даних за допомогою автономних підводних апаратів у підводних акустичних сенсорних мережах	AUV-Aided Energy-Efficient Data Collection in Underwater Acoustic Sensor Networks. Zhuo, XX; Liu, MY; Wei, Y; Yu, GD; Qu, FZ; Sun, R. IEEE INTERNET OF THINGS JOURNAL. 2020. Volume 7. Issue 10. Page 10010-10022.	With the development of the Internet of Underwater Things (IoUT), two critical problems have been prominent, i.e., the energy constraint of underwater devices and large demand for data collection. In this article, we introduce an autonomous underwater vehicle (AUV)-aided underwater acoustic sensor networks (UWSNs) to solve these problems. To improve the performance of UWSNs, we formulate an optimization problem to maximize the energy consumption utility, which is defined to balance the energy consumption and network throughput. To solve this optimization problem, we decompose it into four parts. First, due to the constraint of communication distance, we construct a cluster-based network and formulate the selection of cluster heads as a maximal clique problem (MCP). Second, the clustering algorithm is proposed. Third, we design a novel media access control (MAC) protocol to coordinate data transmission between AUV and cluster heads, among intracluster nodes, as well as among intercluster nodes. Finally, path planning of AUV is formulated as a traveling salesman problem to minimize AUV travel time. Based on the above analysis, two algorithms, namely, AUV-aided energy-efficient data collection (AEEDCO) and approximate AUV-aided energy-efficient data collection (AEEDCO-A), are developed accordingly. The simulation results show that the proposed algorithms perform well and are very promising in UWSNs with demand for large-scale	https://www.webofscience.com/wos/woscc/full-record/WOS:000577624800064

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			communication, large system capacity, long-term monitoring, and high data traffic load.	
4	Автономний пілот безпілотних надводних апаратів: планування та відстеження траєкторії	Autonomous Pilot of Unmanned Surface Vehicles: Bridging Path Planning and Tracking. Wang, N.; Zhang, YH; Ahn, CK; Xu, QY. IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY. 2022. Volume 71. Issue 3. Page 2358-2374.	Autonomous pilot is crucial in integrally promoting the autonomy of an unmanned surface vehicle (USV). However, the integration mechanism of decision and control is still unclear within the entire autonomy. In this paper, by organically bridging path planning and tracking, an autonomous pilot framework with waypoints generation, path smoothing and policy guidance of a USV in congested waters is established, for the first time. Incorporating elite and diversity operations into the genetic algorithm (GA), an elite-duplication GA (EGA) strategy is devised to optimally generate sparse waypoints in a constrained space. The B-spline technique is further deployed to make flexibly smooth interpolation facilitating path smoothing supported by optimal sparse-waypoints. Seamlessly bridged by the parametric smooth path, deep reinforcement learning (DRL) technique is resorted to continuously extract in-depth pilotage policies, i.e., mappings from path tracking errors, collision risks and control constraints to continuous control forces/torques. Eventually, the entire spline-bridged EGA-DRL (SED) framework merits autonomous global-pilotage and local-reaction in an organically modular manner. Comprehensive validations and comparisons in various real-world geographies demonstrate the effectiveness and superiority of the proposed SED autonomous pilot framework.	https://www.webofscience.com/wos/woscc/full-record/WOS:000769985100015
5	Схема збору даних за допомогою автономних підводних апаратів на основі кластеризації та матричного доповнення для Smart Ocean	An AUV-Assisted Data Gathering Scheme Based on Clustering and Matrix Completion for Smart Ocean. Huang, MF; Zhang, K.; Zeng, ZW; Wang, T.; Liu, YX. IEEE INTERNET OF THINGS JOURNAL. 2020. Volume 7. Issue 10. Page 9904-9918.	The oceans cover more than 71% of the Earth's surface and have a surging amount of data. It is of great significance to seek energy-effective and ultrareliable communication and transmission mechanism for effectively gathering abundant maritime data. In this article, we propose an autonomous underwater vehicle (AUV)-assisted data gathering scheme based on clustering and matrix completion (ACMC) to improve the data gathering efficiency in the underwater wireless sensor network (UWSN). Specifically, we first improve the K-means algorithm by adopting the Elbow method to determine the optimal K and setting a distance threshold to select the separate initial cluster centers. Then, we introduce a two-phase AUV trajectory optimization mechanism to effectively reduce the trajectory length of the AUV. In the first phase, the optimized trajectory of the AUV is planned by adopting the greedy algorithm. In the second phase, the ordinary nodes close to the AUV trajectory are selected as secondary cluster heads to share the workload of cluster heads. Finally, we present an in-cluster data collection mechanism based on matrix	https://www.webofscience.com/wos/woscc/full-record/WOS:000577624800056

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			completion. An extensive experiment validates the effectiveness of our proposed scheme in terms of energy and data collection delay.	
Інструменти				
1	Нова безплатформна інерціальна навігаційна система / доплерівський лаг швидкості: тісно інтегрований метод навігації для складного середовища.	A Novel SINS/DVL Tightly Integrated Navigation Method for Complex Environment. Wang, D.; Xu, XS; Yao, YQ; Zhang, T; Zhu, YY. IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT. 2020. Volume 69. Issue 7. Page 5183-5196.	In general, the strap-down inertial navigation system (SINS)/Doppler velocity log (DVL)-integrated navigation method can provide continuous and accurate navigation information for autonomous underwater vehicles (AUV). This SINS/DVL fusion is the loosely integrated method, in which DVL may contain large error or does not work when some beam measurements are inaccurate or outages for complex underwater environment. To solve these problems, in this article, a novel tightly integrated navigation method composed of an SINS, a DVL, and a pressure sensor (PS) is proposed, in which beam measurements are used without transforming them to 3-D velocity. The simulation and vehicle test show that the proposed method can significantly outperform the traditional loosely integrated method in providing estimation continuously with higher accuracy when DVL data are inaccurate or unavailable for a complex environment. Compared with loosely integrated method, the position accuracy of the proposed method has improved by 32.5%y.	https://www.webofscience.com/wos/woscc/full-record/WOS:000542954500056
2	Глобальне керування траєкторією відстеження недоактивованого безпілотного надводного апарату з фіксованим часом на основі розширеного спостерігача стану фіксованого часу	Global fixed-time trajectory tracking control of underactuated USV based on fixed-time extended state observer. Fan, YS; Qiu, BB; Liu, L.; Yang, Y. ISA TRANSACTIONS. 2023. Volume 132. Page 267-277.	This paper studies the trajectory tracking problem of unmanned surface vehicle subject to unmeasurable velocities and unknown disturbances. By combining a fixed-time extended state observer (FESO) and a fixed-time differentiator, a fixed-time sliding mode control (FTSMC) law is proposed, in which a saturation function is adopted to make the terminal sliding mode surface leave the singularity area. The value of this paper can be described: first, this paper designs a novel guidance law that can converge in a fixed time to reduce the convergence time of the error. Then, unmeasurable velocities and lumped disturbances are estimated by applying a FESO. Meanwhile, a fixed-time differentiator is used to obtain real-time differential signals, thus reducing the difficulty of controller design. Subsequently, a novel auxiliary dynamic system is designed to address actuator saturation. According to Lyapunov's theory, the entire closed-loop control system has uniformly global fixed-time stability (UGFTS). The superiority of the designed controller is demonstrated through numerical simulations.	https://www.webofscience.com/wos/woscc/full-record/WOS:000964386800001
3	Удосконалений генетичний алгоритм для планування шляху безпілотного надводного апарату	An Improved Genetic Algorithm for Path-Planning of Unmanned Surface Vehicle. Xin, JF; Zhong, JB; Yang, FR; Cui, Y.; Sheng, JL. SENSORS. 2019. Volume 19. Issue 11, 2640.	The genetic algorithm (GA) is an effective method to solve the path-planning problem and help realize the autonomous navigation for and control of unmanned surface vehicles. In order to overcome the inherent shortcomings of conventional GA such as population premature and slow convergence speed, this paper proposes the strategy of increasing the number of offsprings by using the multi-	https://www.webofscience.com/wos/woscc/full-record/WOS:000472133300218

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			domain inversion. Meanwhile, a second fitness evaluation was conducted to eliminate undesirable offsprings and reserve the most advantageous individuals. The improvement could help enhance the capability of local search effectively and increase the probability of generating excellent individuals. Monte-Carlo simulations for five examples from the library for the travelling salesman problem were first conducted to assess the effectiveness of algorithms. Furthermore, the improved algorithms were applied to the navigation, guidance, and control system of an unmanned surface vehicle in a real maritime environment. Comparative study reveals that the algorithm with multi-domain inversion is superior with a desirable balance between the path length and time-cost, and has a shorter optimal path, a faster convergence speed, and better robustness than the others.	
4	Адаптивне безпараметричне керування траєкторією руху для автономних підводних апаратів	Adaptive model-parameter-free fault-tolerant trajectory tracking control for autonomous underwater vehicles. Zhu, C.; Huang, B.; Zhou, B.; Su, YM; Zhang, EH. ISA TRANSACTIONS. 2021. Volume 114. Page 57-71.	This paper provides a model-parameter-free control strategy for the trajectory tracking problem of the autonomous underwater vehicle exposed to external disturbances and actuator failures. Two control architectures have been constructed such that the system states could be forced to the desired trajectories with acceptable performance. By combining sliding mode control (SMC) technology and adaptive algorithm, the first control architecture is developed for tracking missions under healthy actuators. Taking actuator failures scenario into account, system reliability is improved considerably by the utilization of a passive fault-tolerant technology in the second controller. Benefitting from properties of Euler-Lagrange systems, the nonlinear dynamics of the underwater vehicles could be handled properly such that the proposed controllers could be developed without model parameters. Finally, the validity of the proposed controllers is demonstrated by theoretical analysis and numerical simulations.	https://www.webofscience.com/wos/woscc/full-record/WOS:000663789200005
5	Автономні підводні апарати: прилади та вимірювання	Autonomous underwater vehicles: Instrumentation and measurements. Sánchez, PJB; Papaelias, M.; Márquez, FPG. IEEE INSTRUMENTATION & MEASUREMENT MAGAZINE. 2020. Volume 23. Issue 2. Page 105-114.	Oceans exploration and inspection are a great challenge for the industry nowadays. The underwater instrumentation and measurements are improving due to the current technologies, or by development of new ones, to cover the demand of the new industry offshore. The Autonomous Underwater Vehicle (AUV), a subcategory of submarine, is used to perform subaquatic tasks. This vehicle provides advantages for underwater works, e.g., safety and reliability inspections, but it also offers limitations for sensors systems, monitoring and communications systems, autonomous operational endurances, propulsion systems or mapping designs, etc. The main scientific contributions of this paper are: a review of the state of art in novel and main instrumentation and measurement systems embedded in AUVs; an illustration of their future uses and development; and a	https://www.webofscience.com/wos/woscc/full-record/WOS:000528671300015

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			synthesis of the main and current navigation, mapping and sampling technologies, together with different applications.	
Матеріалознавство				
1	Автономні підводні апарати: локалізація, навігація та зв'язок для спільних місій	Autonomous Underwater Vehicles: Localization, Navigation, and Communication for Collaborative Missions. González-García, J.; Gómez-Espinosa, A.; Cuan-Urquizo, E.; García-Valdovinos, LG; Salgado-Jiménez, T.; Cabello, JAE. APPLIED SCIENCES-BASEL. 2020. Volume 10. Issue 4, 1256.	Development of Autonomous Underwater Vehicles (AUVs) has permitted the automatization of many tasks originally achieved with manned vehicles in underwater environments. Teams of AUVs designed to work within a common mission are opening the possibilities for new and more complex applications. In underwater environments, communication, localization, and navigation of AUVs are considered challenges due to the impossibility of relying on radio communications and global positioning systems. For a long time, acoustic systems have been the main approach for solving these challenges. However, they present their own shortcomings, which are more relevant for AUV teams. As a result, researchers have explored different alternatives. To summarize and analyze these alternatives, a review of the literature is presented in this paper. Finally, a summary of collaborative AUV teams and missions is also included, with the aim of analyzing their applicability, advantages, and limitations.	Автономні підводні апарати: локалізація, навігація та зв'язок для спільних місій
2	Адаптивне керування відслідковуванням траєкторії в ковзному режимі для безпілотного надводного апарату з врахуванням невизначеностей моделювання та насичення вхідних даних	Adaptive Sliding Mode Trajectory Tracking Control for Unmanned Surface Vehicle with Modeling Uncertainties and Input Saturation. Qiu, BB; Wang, GF; Fan, YS; Mu, DD; Sun, XJ. APPLIED SCIENCES-BASEL. 2019. Volume 9. Issue 6, 1240.	In the presence of modeling uncertainties and input saturation, this paper proposes a practical adaptive sliding mode control scheme for an underactuated unmanned surface vehicle (USV) using neural network, auxiliary dynamic system, sliding mode control and backstepping technique. First, the radial basis function neural network with minimum learning parameter method (MLP) is constructed to online approximate the uncertain system dynamics, which uses single parameter instead of all weights online learning, leading to a reduction in the computational burdens. Then a hyperbolic tangent function is adopted to reduce the chattering phenomenon due to the sliding mode surface. Meanwhile, the auxiliary dynamic system and the adaptive technology are employed to handle input saturation and unknown disturbances, respectively. In addition, a neural shunting model is introduced to eliminate the "explosion of complexity" problem caused by the backstepping method for virtual control derivation. The stability of the closed-loop system is guaranteed by the Lyapunov stability theory. Finally, simulations are provided to validate the effectiveness of the proposed control scheme.	Адаптивне керування відслідковуванням траєкторії в ковзному режимі для безпілотного надводного апарату з врахуванням невизначеностей моделювання та насичення вхідних даних
3	Керування стикуванням автономного підводного апарату з використанням навчання з підкріпленням	Docking Control of an Autonomous Underwater Vehicle Using Reinforcement Learning.	To achieve persistent systems in the future, autonomous underwater vehicles (AUVs) will need to autonomously dock onto a charging station. Here, reinforcement learning strategies were applied for the first time to control the docking of an AUV onto a fixed platform in a simulation environment. Two reinforcement learning schemes were	Керування стикуванням автономного підводного апарату з використанням

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		Anderlini, E.; Parker, GG; Thomas, G. APPLIED SCIENCES-BASEL. 2019. Volume 9. Issue 17, 3456.	investigated: one with continuous state and action spaces, deep deterministic policy gradient (DDPG), and one with continuous state but discrete action spaces, deep Q network (DQN). For DQN, the discrete actions were selected as step changes in the control input signals. The performance of the reinforcement learning strategies was compared with classical and optimal control techniques. The control actions selected by DDPG suffer from chattering effects due to a hyperbolic tangent layer in the actor. Conversely, DQN presents the best compromise between short docking time and low control effort, whilst meeting the docking requirements. Whereas the reinforcement learning algorithms present a very high computational cost at training time, they are five orders of magnitude faster than optimal control at deployment time, thus enabling an on-line implementation. Therefore, reinforcement learning achieves a performance similar to optimal control at a much lower computational cost at deployment, whilst also presenting a more general framework.	навчання з підкріпленням
4	Планування шляху та запобігання зіткненням у невідомих умовах для безпілотних надводних апаратів на основі вдосконаленого алгоритму D* Lite	Path Planning and Collision Avoidance in Unknown Environments for USVs Based on an Improved D* Lite. Zhu, XH; Yan, B.; Yue, Y. APPLIED SCIENCES-BASEL. 2021. Volume 11. Issue 17, 7863.	Path planning and collision avoidance during autonomous navigation in unknown environments is a crucial issue for unmanned surface vehicles (USVs). This paper improves the traditional D* Lite algorithm and achieves multi-goal path planning and collision avoidance for USVs in unknown and complex environments. By expanding the adjacent search range and setting a safe distance for USVs, we solve the issue of limited steering maneuverability in USVs with fewer DOF during autonomous navigation. We propose an approach to optimize the planned path during navigation by comparing the estimated distance with the actual distance between the current waypoint and the goal waypoint. A minimum binary heap is used to optimize the priority queue of the D* Lite and significantly reduce the path search time. Simulation results show that the improved D * Lite can significantly reduce the path planning time, optimize the planned path and solve the issue of limited steering maneuverability in USVs. We apply the algorithm to a real USV for further tests. Experimental results show that the USV can plan an optimized path while avoiding both static and dynamic obstacles in complex environments with a safe distance during autonomous navigation.	Планування шляху та запобігання зіткненням у невідомих умовах для безпілотних надводних апаратів на основі вдосконаленого алгоритму D* Lite
5	Дослідження механічних та водовідштовхувальних властивостей біонічних вуглецево-армованих пластикових композитів на основі луски латимерії та листків лотоса	Research on the mechanical and water-repellent properties of bionic carbon fiber reinforced plastic composites inspired by coelacanth scale and lotus leaf. Shi, MD; Han, ZW; Han, QG; Li,	Carbon fiber reinforced plastic (CFRP) laminates are widely used in vessel side plate, underwater propeller, and submarine oil pipeline because they possess superior specific strength and hydrophobicity compared with metal materials. However, conventional CFRP laminates are limited by insufficient mechanical properties and incompetent water-repellent performance. Herein, a biomimetic	Дослідження механічних та водовідштовхувальних властивостей біонічних вуглецево-армованих пластикових композитів

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		B.; Ren, LQ. COMPOSITES SCIENCE AND TECHNOLOGY. 2022. Volume 226, 109542.	double-helicoidal superhydrophobic laminate (BDHSL) was designed and manufactured through a method combining hot press forming and two-step spraying. The BDHSL was composed of double-helicoidal (inspired by coelacanth scale) carbon fiber prepreg and SiO2-based coating with multiscale hierarchical structures (inspired by lotus leaf), which displayed excellent mechanical properties and water-repellency. Besides, mechanical tests were carried out systematically. Remarkably, the peak impact force of the BDHSL at the impact energy of 20 J was 2865.25 N, which increased by 136.88% compared with traditional unidirectional laminate (UL 1209.56 N). Meanwhile, the finite element simulation was conducted using 3D Hashin's failure criteria. The simulation results showed that the predicted stress deflection curve for four types of laminates correlated well with experimental results. Moreover, the water contact angle of BDHSL reached approximately 156.5 degrees, which indicated its superhydrophobicity. What is more, the durability and water-repellency of the SiO2-based coatings were investigated, which further confirmed its potential underwater applicability. The investigations in this work offer a promising way to effectively design and fabricate exquisitely structured CFRP laminates with hierarchically textured coatings that are more suitable for various marine applications under practical conditions, such as offshore oil drilling platform, autonomous underwater vehicle, high-speed ship, and so forth.	на основі луски латимерії та листків лотоса
БЕРЕГОВА АРТИЛЕРІЯ				
Інженерія				
1	Оцінка потужності боєголовки на основі теорії нечітких лінгвістичних термінів з подвійною ієрархією та методу оцінки набутого та втраченого домінування	Warhead power assessment based on double hierarchy hesitant fuzzy linguistic term sets theory and gained and lost dominance score method. Yao, TL; Wang, WL; Miao, R.; Hu, QW; Dong, J.; Yan, XF. CHINESE JOURNAL OF AERONAUTICS. 2022. Volume 35. Issue 4. Page 362-375.	Warhead power assessment of the anti-ship missile plays a vital role in determining the optimal design of missile, thus having important strategic research significance. However, in the assessment process, expert's judgement will directly affect the assessment accuracy. In addition, there are many criteria involved in the missile design alternatives. Some criteria with poor performance may be compensated by other criteria with excellent performance, and then it is impossible to find the truly optimal alternative. Aimed at solving these problems, this paper proposes a synthetical assessment process based on fuzzy hesitant linguistic term set and the Gained and Lost Dominance Score (GLDS) method. In order to improve the assessment accuracy of experts and solve the problem that experts generate different opinions, combined with the advantages of fuzzy hesitant sets and linguistic term sets, the double hierarchy hesitant fuzzy linguistic term sets are used in this paper to improve the accuracy of expert's judgement. In order to	https://www.webofscience.com/wos/woscc/full-record/WOS:000788224800002

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			effectively combine expert's experience with the data of criteria, the evidence theory and entropy weight method are used to transfer the expert's judgement to the weight. In order to avoid selecting defective alternative of missile design, the GLDS is used to fuse expert information and criteria information. Sensitivity analysis shows that the assessment process has sensitivity to some extent. However, when the fluctuation of expert's assessment makes the fluctuation of h in the range of-5% to 5%, the impact on the results is not quite conspicuous. The analysis of calculation result and comparative analysis show that the assessment process proposed in this paper is accurate enough, has great advantage in selecting the current and potential optimal alternative of missile design, and avoids the alternatives with low criteria performance that cannot be compensated by other criteria being selected.	
2	Тривимірний розподілений закон спільного наведення з обмеженнями кута удару для протикорабельних ракет	Three-dimensional impact angle constrained distributed cooperative guidance law for anti-ship missiles. Li, W.; Wen, QQ; He, L.; Xia, QL. JOURNAL OF SYSTEMS ENGINEERING AND ELECTRONICS. 2021. Volume 32. Issue 2. Page 447-459.	This paper investigates the problem of distributed cooperative guidance law design for multiple anti-ship missiles in the three-dimensional (3-D) space hitting simultaneously the same target with considering the desired terminal impact angle constraint. To address this issue, the problem formulation including 3-D nonlinear mathematical model description, and communication topology are built firstly. Then the consensus variable is constructed using the available information and can reach consensus under the proposed acceleration command along the line-of-sight (LOS) which satisfies the impact time constraint. However, the normal accelerations are designed to guarantee the convergence of the LOS angular rate. Furthermore, consider the terminal impact angle constraints, a nonsingular terminal sliding mode (NTSM) control is introduced, and a finite time convergent control law of normal acceleration is proposed. The convergence of the proposed guidance law is proved by using the second Lyapunov stability method, and numerical simulations are also conducted to verify its effectiveness. The results indicate that the proposed cooperative guidance law can regulate the impact time error and impact angle error in finite time if the connecting time of the communication topology is longer than the required convergent time.	https://www.webofscience.com/wos/woscc/full-record/WOS:000646042500016
3	Оптимізація конфігурації корпусу протикорабельної ракети з використанням сурогатних методів та урахуванням високошвидкісного контакту з водою	Surrogate-assisted optimization for anti-ship missile body configuration considering high-velocity water touching. Ye, NH.; Long, T.; Meng, JH., Shi, RH; Zhang, BS. CHINESE JOURNAL OF	As a crucial weapon in the sea battle, anti-ship missiles generally employ a sea-skimming penetration strategy to reduce the probability of being detected by the target radar, which greatly increases the risk of touching water caused by sensor errors or random sea conditions. To alleviate the large impact load by high-velocity water touching, a novel anti-ship missile body configuration is proposed in this paper, which is inspired by the idea of hydroplaning. A parametric geometry	https://www.webofscience.com/wos/woscc/full-record/WOS:001135866700001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		AERONAUTICS. 2023. Volume 36. Issue 12. Page 268-281.	model is first developed to modify the configuration of the anti-ship missile body. Subsequently, a structured arbitrary Lagrange-Eulerian based Fluid-Structure Interaction (FSI) model is established to analyze the kinematics parameters of the missile body during the hydroplaning process. A missile body configuration optimization problem is then formulated to minimize the impact load considering several constraints, e.g., horizontal velocity loss, pitch angle after touching water, and inside capacity for payload. Due to the time-consuming FSI simulation, a Kriging-assisted constrained differential evolution method is utilized to optimize the missile body configuration for reducing the impact load. During the optimization process, radial basis function and Kriging are combined with evolutionary operators to lead the search to the vicinity of the optimum rapidly. The result shows that the proposed missile body configuration can reduce the impact load by 18.8% compared with the ordinary configuration. Additionally, the optimized configuration can further yield a 17.4% impact load decrease subject to all the constraints and avoid structural damage by the high-velocity water touching, which demonstrates the effectiveness and practicability of the proposed anti-ship missile body configuration and corresponding optimization framework for reducing the impact load.	
4	Маневрування та супровід цілей за допомогою багатомодельного моделювання на основі адаптивної структури	Maneuvering Target Tracking with Multi-Model Based on the Adaptive Structure. Guo, Q.; Teng, L. IEEJ TRANSACTIONS ON ELECTRICAL AND ELECTRONIC ENGINEERING. 2022. Volume 17. Issue 6. Page 865-871.	In the "snake" maneuver tracking of anti-ship missiles, the traditional interactive multi-model algorithm has poor tracking accuracy and the computational complexity of the improved algorithm is large. An adaptive structure multi-model (ASMM) algorithm is proposed to solve this problem. The multi-model tracking algorithm is improved from two aspects: tracking accuracy and computational complexity. First, the fuzzy control idea is introduced to speed up the update of the model probability, which improves the convergence speed and tracking accuracy of the interacting multiple model (IMM) algorithm. Next, a tracking model with an adaptive structure is proposed, which can adjust the tracking model adaptively according to the motion form of the target, thereby reducing the calculation redundancy. The simulation experiment shows that the proposed algorithm has better tracking accuracy than the traditional multi-model algorithm while maintaining the approximate computational complexity, and has smaller computational complexity than the traditional improved algorithm while maintaining the approximate tracking accuracy.	https://www.webofscience.com/wos/woscc/full-record/WOS:000758370900001
5	Перепланування двоцільових ракет для військово-морської тактичної групи з динамічними перебоями	Bi-objective missile rescheduling for a naval task group with dynamic disruptions.	This paper considers the rescheduling of surface-to-air missiles (SAMs) for a naval task group (TG), where a set of SAMs have already been scheduled to intercept a set of anti-ship missiles (ASMs). In	https://www.webofscience.com/wos/woscc/full-

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		Silav, A.; Karasakal, O.; Karasakal, E. NAVAL RESEARCH LOGISTICS. 2019. Volume 66. Issue. 7. Page 596-615.	missile defense, the initial engagement schedule is developed according to the initial state of the defensive and attacking units. However, unforeseen events may arise during the engagement, creating a dynamic environment to be handled, and making the initial schedule infeasible or inefficient. In this study, the initial engagement schedule of a TG is assumed to be disrupted by the occurrence of a destroyed ASM, the breakdown of a SAM system, or an incoming new target ASM. To produce an updated schedule, a new biobjective mathematical model is formulated that maximizes the no-leaker probability value for the TG and minimizes the total deviation from the initial schedule. With the problem shown to be NP-hard, some special cases are presented that can be solved in polynomial time. We solve small size problems by the augmented epsilon-constraint method and propose heuristic procedures to generate a set of nondominated solutions for larger problems. The results are presented for different size problems and the total effectiveness of the model is evaluated.	record/WOS:000487782300005
Інформатика				
1	Багатоцільовий підхід до динамічного розподілу ракет з використанням штучних нейронних мереж для прийняття рішень, залежних від часу	A multi-objective approach for dynamic missile allocation using artificial neural networks for time sensitive decisions. Karasakal, O.; Karasakal, E.; Silav, A. SOFT COMPUTING. 2021. Volume 25. Issue 15. Page 10153-10166.	In this study, we develop a new solution approach for the dynamic missile allocation problem of a naval task group (TG). The approach considers the rescheduling of the surface-to-air missiles (SAMs), where a set of them have already been scheduled to a set of attacking anti-ship missiles (ASMs). The initial schedule is mostly inexecutable due to disruptions such as neutralization of a target ASM, detecting a new ASM, and breakdown of a SAM system. To handle the dynamic disruptions while keeping efficiency high, we use a bi-objective model that considers the efficiency of SAM systems and the stability of the schedule simultaneously. The rescheduling decision is time-sensitive, and the amount of information to be processed is enormous. Thus, we propose a novel approach that supplements the decision-maker (DM) in choosing a Pareto optimal solution considering two conflicting objectives. The proposed approach uses an artificial neural network (ANN) that includes an adaptive learning algorithm to structure the DM's prior articulated preferences. ANN acts like a DM during the engagement process and chooses one of the non-dominated solutions in each rescheduling time point. We assume that the DM's utility function is consistent with a non-decreasing quasi-concave function, and the cone domination principle is incorporated into the solution procedure. An extensive computational study is provided to present the effectiveness of the proposed approach.	https://www.webofscience.com/wos/woscc/full-record/WOS:000659438600002

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
2	Глибоке навчання для автоматичного розпізнавання цілей за допомогою реальних та синтетичних інфрачервоних морських зображень	Deep Learning for Automatic Target Recognition with Real and Synthetic Infrared Maritime Imagery. Westlake, ST; Volonakis, TN; Jackman, J.; James, DB; Sherriff, A. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN DEFENSE APPLICATIONS II. 2020. Volume 11543, 1154309.	Supervised deep learning algorithms are re-defining the state-of-the-art for object detection and classification. However, training these algorithms requires extensive datasets that are typically expensive and time-consuming to collect. In the field of defence and security, this can become impractical when data is of a sensitive nature, such as infrared imagery of military vessels. Consequently, algorithm development and training are often conducted in synthetic environments, but this brings into question the generalisability of the solution to real world data. In this paper we investigate training deep learning algorithms for infrared automatic target recognition without using real-world infrared data. A large synthetic dataset of infrared images of maritime vessels in the long wave infrared waveband was generated using target-missile engagement simulation software and ten high-fidelity computer-aided design models. Multiple approaches to training a YOLOv3 architecture were explored and subsequently evaluated using a video sequence of real-world infrared data. Experiments demonstrated that supplementing the training data with a small sample of semi-labelled pseudo-IR imagery caused a marked improvement in performance. Despite the absence of real infrared training data, high average precision and recall scores of 99% and 93% respectively were achieved on our real-world test data. To further the development and benchmarking of automatic target recognition algorithms this paper also contributes our dataset of photo-realistic synthetic infrared images.	https://www.webofscience.com/wos/woscc/full-record/WOS:000632473200007
3	Підхід до перевибору цілі для протикорабельної ракети проти центроїдних перешкод з використанням точної інформації про відстеження	An Approach to Target Reselection for Anti-Ship Missile Against Centroid Jamming with Accurate Tracking Information. Zhang, JQ; Li, K.; Li, Y.; Li, JL. INTERNATIONAL JOURNAL OF PATTERN RECOGNITION AND ARTIFICIAL INTELLIGENCE. 2021. Volume 35. Issue 11, 2150032.	By equaling the detection of centroid jamming to the "outlier" detection in the process of tracking with Kalman filter, an approach to target reselection for anti-ship missile against centroid jamming with accurate tracking information is proposed in this paper considering the mutation of the law of motion at the tracking point under centroid jamming. For this approach, an accurate target tracking model is built on the basis of extended Kalman filter (EKF). Using the information collected by radar seeker including distance, velocity and angle, it could achieve the accurate tracking of the target and determine the motion state of the target accurately. On this basis, the orthogonality of innovation in the process of Kalman filtering is utilized to detect any mutation of the motion state of the target, so that the existence of centroid jamming is detected when there is any mutation of the law of motion at the tracking point in the process of chaff centroid jamming. This offers a new solution for remote beyond-visual-range (BVR) anti-ship missile against centroid jamming.	https://www.webofscience.com/wos/woscc/full-record/WOS:000697185300013

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
4	Закон кінцевого наведення малогабаритної протикорабельної ракети на базі глибокий детермінованої градієнтної політики	Terminal guidance law of small anti-ship missile based on DDPG. Li, CX; Deng, BY; Zhang, TQ. INTERNATIONAL CONFERENCE ON IMAGE, VIDEO PROCESSING AND ARTIFICIAL INTELLIGENCE. 2020. Volume 11584, 115841W.	Intelligence of weapon system, precision of striking weapon and diversification of combat formulation are important developing trends in future combat operations. A terminal guidance law based on reinforcement learning (RL) and deep deterministic Policy Gradient (DDPG) is proposed to solve the problems in missile guidance system, such as heavy dependence on simulated environment training, poor interception effected by condition constraints, and insufficient guidance accuracy caused by the difference between simulated environment and the real environment. Taking advantage of the maneuverability of the small anti-ship missile relative to the ship, according to the game theory in reinforcement learning combined with the deep neural network, the optimizing trajectory is updated by analyzing the projectile motion and line of sight angle. Reward was set reasonably in line with the spatial position and the strategy gradient was optimized by using the deep neural network. Simulating experiments show that after iterative training, the DDPG guidance model for small anti-ship missiles can optimize the ballistic curve, and the miss distance can meet the requirements. Compared with traditional guidance laws, this model has better autonomous decision-making ability and strike capability.	https://www.webofscience.com/wos/woscc/full-record/WOS:000656898000063
5	Інтеграція технології аналізу великих даних для покращення здатності інформаційних систем приймати рішення	Integrating Big Data Mining Technology to Improve Information System Decision-making Ability. Chen, YG; Zhang, G; Xiong, ZX. 10TH INTERNATIONAL CONFERENCE ON BIG DATA AND INFORMATION ANALYTICS. IEEE. 2024. Page 364-367.	For the currently used joint command information system severely restricted the improvement of assistant decision-making and intelligent command capability, which the data requirement analysis is insufficient. Starting from the anti-ship mission of surface ships, this paper uses large-scale data mining and analysis technology to excavate the data characteristics of preparation, command and execution, evaluation and analysis, and to compile the specific data requirements. The analysis conclusion could theoretically provide the key direction and theoretical support for the date collection of the combat system, which has great significance to perfect system performance and assistant decision-making..	https://www.webofscience.com/wos/woscc/full-record/WOS:001414176500054
Системи автоматизованого управління				
1	Метод оцінки ефективності пошкоджень протикорабельних ракет на основі лінгвістичних термінів подвійної ієрархії та теорії доказів	Damage effectiveness assessment method for anti-ship missiles based on double hierarchy linguistic term sets and evidence theory. Yao, TL; Wang, WL; Miao, R.; Dong, J.; Yan, XF. JOURNAL OF SYSTEMS ENGINEERING AND ELECTRONICS. 2022.	The research on the damage effectiveness assessment of anti-ship missiles involves system science and weapon science, and has essential strategic research significance. With comprehensive analysis of the specific process of the damage assessment process of anti-missile against ships, a synthetic damage effectiveness assessment process is proposed based on the double hierarchy linguistic term set and the evidence theory. In order to improve the accuracy of the expert's assessment information, double hierarchy linguistic terms are used to describe the assessment opinions of experts. In order to avoid	https://www.webofscience.com/wos/woscc/full-record/WOS:000795583000019

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		Volume 33. Issue 2. Page 393-405.	the loss of experts' original information caused by information fusion rules, the evidence theory is used to fuse the assessment information of various experts on each case. Good stability of the assessment process can be reflected through sensitivity analysis, and the fluctuation of a certain parameter does not have an excessive influence on the assessment results. The assessment process is accurate enough to be reflected through comparative analysis and it has a good advantage in damage effectiveness assessment.	
2	Метод розподілу вогневої потужності протикорабельної ракети на основі планування пов'язаної траєкторії	Firepower distribution method of anti-ship missile based on coupled path planning. Gang, L.; Zhibiao, A.; Songyang, L.; Wu, L. JOURNAL OF SYSTEMS ENGINEERING AND ELECTRONICS. 2022. Volume 33. Issue 4. Page 1010-1024.	Anti-ship missile coordinated attack mission planning is a complex multi-objective optimization problem with multiple combinations of platforms, strong decision-making constraints, and tightly coupled links. To avoid the coupling disorder between path planning and firepower distribution and improve the efficiency of coordinated attack mission planning, a fire-power distribution model under the conditions of path planning is established from the perspective of decoupling optimization and the algorithm is implemented. First, we establish reference coordinate system of firepower distribution to clarify the refer-ence direction of firepower distribution and divide the area of firepower distribution; then, we construct an index table of mem-bership of firepower distribution to obtain alternative firepower distribution plans; finally, the fitness function of firepower distri-bution is established based on damage income, missile loss, ratio of efficiency and cost of firepower distribution, and the mean square deviation of the number of missiles used, and the alternatives are sorted to obtain the optimal firepower distribu-tion plan. According to two simulation experiments, the method in this paper can effectively solve the many-to-many firepower distribution problem of coupled path planning. Under the premise of ensuring that no path crossing occurs, the optimal global solution can be obtained, and the operability and timeli-ness are good.	https://www.webofscience.com/wos/woscc/full-record/WOS:000862815400023
3	Планування траєкторії протикорабельної ракети з використанням дотичної до траєкторії Дубінса	Path Planning for Anti-Ship Missile Using Tangent Based Dubins Path. Cheng, L.; Lu, H.; Lei, T.; Chen, J. 2ND INTERNATIONAL CONFERENCE ON INTELLIGENT AUTONOMOUS SYSTEMS. 2019. Page 175-180.	Path planning is a significant component to achieve successful operation of anti-ship missile in dynamic battlefield environment. A threat-free path planning algorithm based on geometric tangent Dubins path is proposed in this paper. First, the constraints need to be satisfied for threat-free path planning are presented, and the problem model of missile path planning is constructed. Then, the geometric tangent between two threat circles is taken advantage of guiding the missile to avoid the threat, and the basic turn and straight line path is generated based on Dubins path. At last, the adaptability of the proposed algorithm in complex battlefield environment is verified by simulations. The results show that the Dubins path avoidance method	https://www.webofscience.com/wos/woscc/full-record/WOS:000500983600032

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			based on geometric tangent can meet the requirements of flight path, obstacle avoidance and real-time planning, which make it have a strong application prospect.	
4	Вплив параметрів траєкторії польоту на дальність промаху та живучість протикорабельних ракет	The influence of trajectory design parameters on miss distance and survivability of anti-ship missiles. Dung, BQ; Tinh, CH; Thuc, NC; Dan, D. 21ST INTERNATIONAL CONFERENCE ON CONTROL, AUTOMATION AND SYSTEMS. IEEE. 2021. Page 1496-1501.	In this paper, we synthesize the sinusoidal biased proportional navigation guidance (PNG) law for enhancing the survivability of anti-ship missiles against the interception of anti-air missiles (AAM). The magnitude and frequency of the sinusoidal acceleration can be seen as trajectory design parameters of the guidance law. The closed-form solution of the command acceleration is found to show how the key parameters influence the performance of the guidance law. To evaluate the influence of trajectory design parameters as well as dynamics parameters on both the miss distance and the survivability of anti-ship missiles, we use the homing loop model which consists of the canonical fifth-order binomial dynamics and the proposed guidance law. The simulation is implemented in Matlab based on the homing model for drawing the miss distance curves of both anti-ship missiles and anti-air missiles. The simulation results show that the magnitude, frequency, and time constants greatly influence the miss distance and survivability of the anti-ship missiles (ASM). Finally, the suggestions for choosing suitable parameters are also presented.	https://www.webofscience.com/wos/woscc/full-record/WOS:000750950700200
5	Оцінка нахилу обтічника, що змінюється в часі, для протикорабельних ракет з пасивним самонаведенням	Time-Varying Radome Slope Estimation for Passive Homing Anti-Ship Missiles. Ra, WS; Ahn, S.; Lee, Y.; Whang, IH (Whang, Ick-Ho). 58TH CONFERENCE ON DECISION AND CONTROL. IEEE. 2019.	This paper addresses a time-varying radome slope (RS) estimation problem for passive homing anti-ship missiles. Apart from conventional approaches, the non-linear characteristics of the radome aberration error is taken into account for modeling the RS dynamics. In addition, it is shown that the acceleration dither is necessary for ensuring the observability of the RS estimation with passive seeker measurements. Based on this observation, a linear RS measurement equation is set up by analyzing the seeker response to the high-frequency acceleration dither. Thus, the RS estimation problem can be easily resolved by designing a time-varying Kalman filter. Since the proposed approach adopts a simple linear filter structure, it is suitable for an in-flight real-time RS estimation. Through the computer simulation for a typical ASM-target engagement scenario, the usefulness of the suggested scheme is demonstrated.	https://www.webofscience.com/wos/woscc/full-record/WOS:000560779004086
Телекомунікації				
1	Заглушення радіолокаторів, що загострюють доплерівський промінь	Deception Jamming Against Doppler Beam Sharpening Radars.	Missile seekers are becoming increasingly more capable of using Doppler Beam Sharpening (DBS) modes as part of the homing cycle, which requires new countermeasures against this mode. One type of countermeasure, is to create false targets within the seeker DBS image. This paper proposes a jamming technique to generate false targets at a	https://www.webofscience.com/wos/woscc/full-record/WOS:000525419700022

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		Frazer, G.; Balleri, A.; Jacob, G. 2020. Volume 8. Page 32792-32801.	precise location within a seeker DBS image, by both delaying and adding a Doppler shift to received waveforms. The effects of tracking errors on the position of the false target are analysed, both analytically and with simulations and used to assess the practical implementation of the jamming scheme. An experimental DBS system was built to test the effectiveness of the jamming scheme against a platform moving in steps and assess errors caused by incorrectly estimating the seeker trajectory.	
2	Динамічні послідовні характеристики ефективної площі розсіювання кутового відбивача в антенній решітці	Dynamic sequential radar cross section properties of airborne corner reflector in array. Wu, LG; Hu, SL; Xu, JH; Liu, Z. IET RADAR SONAR AND NAVIGATION. 2023. Volume 17. Issue 9. Page 1405-1419.	With the spread of airborne corner reflector (ACR) in the field of shipborne equipment, radar guided anti-ship missile is facing new challenges. In order to achieve the mastery of the jamming principle of this apparatus, the paper studied its motion properties and sequential Radar Cross Section (RCS) properties. Firstly, the motion model of the ACR was obtained under certain constraints, by deriving the centroid dynamics equation and rotation dynamics equation according to the theoretical mechanics. Then, the dynamic sequential RCS model of ACR array was established by combining the motion model with the modified geometric optics method and coherent synthesis method. Through the simulation and analysis of the motion model, it was found that the flight process of the ACR can be divided into two stages: fast falling and steady falling. In the fast falling stage, the variables of the ACR system change rapidly, while the ACR rotates slowly and falls smoothly in the steady falling stage. From simulation of dynamic sequential RCS model, the results showed that the obvious depolarisation effect is occur in the fast falling stage. Further statistical analysis showed that, the omnidirectivity of single ACR is well from the dynamic perspective, meanwhile array placement can effectively enhance RCS amplitude and improve the probability density distribution.	https://www.webofscience.com/wos/woscc/full-record/WOS:001018753300001
3	Вимірювання поперечного перерізу радіолокаційного обладнання та зображення, пов'язані з цільовим судном у морському середовищі	RADAR Cross Section Measurement And Imaging RRelated To Ship Target In The Sea Environment. Li, XZ; Lu, YG; Xu, ZM; Yao, JP. INTERNATIONAL CONFERENCE ON IDENTIFICATION, INFORMATION AND KNOWLEDGE IN THE INTERNET OF THINGS. 2019. Volume 147. Page 550-555.	Study on electromagnetic scattering related to ship target in the sea environment is always an important topic in anti-ship missile radar seeker detection. A airborne radar has developed for radar cross section (RCS) measurements and imaging Studied the target tracking algorithm, which is based on the Global Position System and video image, by this means, the stable tracking technique based on mobile platform was solved. Compared the measured data with the numerical results, the result shows a good agree. It is indicated that the system can be used to measure and analyze wideband electromagnetic scattering characteristic for arbitrary shape targets.	https://www.webofscience.com/wos/woscc/full-record/WOS:000470960800085

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
4	Радіолокаційне моделювання зовнішніх пасивних перешкод	Radar simulation imaging of outboard passive jamming. Bai, J.; Deng, B.; Wang, HQ. INTERNATIONAL CONFERENCE ON MICROWAVE AND MILLIMETER WAVE TECHNOLOGY. 2022.	Anti-ship missiles remain a major threat to surface ships. The outboard passive jamming is an important means for ships to counter radar guided anti-ship missiles. Therefore, it is essential to study the electromagnetic scattering characteristics and radar imaging results of the passive jamming. In this paper, the electromagnetic scattering characteristics of a ship target and a passive jammer are analyzed by using electromagnetic calculation simulation. The radar imaging results in THz band of the two targets are analyzed by using electromagnetic calculation data.	https://www.webofscience.com/wos/woscc/full-record/WOS:000964446500200
5	Дослідження з повного цифрового моделювання бою протикорабельних ракет на основі даних про характеристики цілей	Research on all digital simulation of anti-ship missile combat based on target characteristic data. Yan, YY; Wang, XT; Zou, Y.; Gao, HM. INTERNATIONAL CONFERENCE ON MICROWAVE AND MILLIMETER WAVE TECHNOLOGY. IEEE. 2020.	In this paper, an anti-ship missile combat experiment based on target characteristic data is simulated by all digital simulation. The main technological process is setting of the simulation environment to the simulation of missile launch, radar scanning sea surface, the simulation of target echo, the generation of clutter, and the analysis of the echo received by the radar seeker, the trajectory is modified, and finally the target is hit. Finally, according to the actual battlefield environment, the function test of the whole simulation system is carried out. The experimental results show that the whole simulation system can simulate the whole ballistic process of missile from launching to hitting the target, and the system has good reliability and stability	https://www.webofscience.com/wos/woscc/full-record/WOS:000670496600390
Інструменти				
1	Методи діагностики несправностей двигуна системи заряджання артилерії в складних шумних середовищах	Fault Diagnosis Methods for an Artillery Loading System Driving Motor in Complex Noisy Environments. Huang, WK; Li, Y.; Tang, JS; Qian, LF. SENSORS. 2024. Volume 24. Issue 3, 847.	With the development of modern military technology, electrical drive technology has become a power source for modern artillery. In fault monitoring of a driving motor mounted on a piece of artillery, various sensors are susceptible to interference from the complex environment, both inside and outside the artillery itself. In this study, we creatively propose a fault diagnosis model based on an attention mechanism, the AdaBoost method and a wavelet noise reduction network to address the difficulty in obtaining high-quality motor signals in complex noisy interference environments. First, multiple fusion wavelet basis, soft thresholding, and index soft filter optimization were used to train multiple wavelet noise reduction networks that could recover sample signals under different noise conditions. Second, a convolutional neural network (CNN) classification module was added to construct end-to-end classification models that could correctly identify faults. The above basis classification models were then integrated into the AdaBoost method with an improved attention mechanism to develop a fault diagnosis model suitable for complex noisy environments. Finally, two experiments were conducted to validate the proposed method. Under motor signals with varying signal-to-noise ratios	https://www.webofscience.com/wos/woscc/full-record/WOS:001160391400001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			(SNRs) noises, the proposed method achieved an average accuracy of 92%, surpassing the conventional method by over 8.5%.	
2	Спільна оцінка оперативної ситуації та метод розподілу вогневої потужності на основі вдосконаленої моделі потенційної енергії	Joint operational situation assessment and firepower allocation method based on enhanced potential energy model. Xu, YT; Yuan, JB; Zhou, W.; Yu, M. MEASUREMENT SCIENCE AND TECHNOLOGY. 2024. Volume 35. Issue 8, 086208.	The assessment of battlefield situations and the allocation of firepower are pivotal prerequisites for conducting joint operational planning. In response to the challenges posed by multi-service joint operations, this paper presents a methodology based on enhanced operational potential energy model for the assessment of battlefield situations and the generation of optimal firepower allocation plan. We focuses on the three-fold factors influencing operational effectiveness: spatial, informational, and environmental factors, and completes the enhanced operational potential energy model by integrating the assessment of joint operational situations and the generation of optimal firepower allocation plans. Finally, the effectiveness of this methodology is demonstrated through operational simulations in a joint anti-ship combat scenario.	https://www.webofscience.com/wos/woscc/full-record/WOS:001233385000001
3	Зручний метод випробування стійкості до віддачі артилерії великого калібру	A convenient method for testing recoil resistance of large caliber artillery. Li, DH; Duan, F.; Peng, P.; Di, CG. INTERNATIONAL CONFERENCE ON SENSORS AND INSTRUMENTS. 2021. Volume 11887, 118870Y.	Discuss the existing problems of the traditional method of calculating recoil resistance of large caliber artillery by measuring recoil displacement and pressure in the working chamber of the recoil brake. Through the analysis of the recoil movement process, a recoil resistance test model is established, and a convenient recoil resistance test method based on recoil acceleration is proposed. The simulation result shows that the proposed recoil resistance test method is feasible. A comparative verification test is designed, and two recoil resistance test methods are used to simultaneously measure the recoil resistance curve under the same firing state. The live ammunition experiment shows that the maximum relative deviation of the maximum recoil resistance obtained by the two methods is only 6.6%, and the proposed test method is easy to implement and low cost, which satisfies the needs of the firing scene to quickly evaluate the maximum recoil resistance.	https://www.webofscience.com/wos/woscc/full-record/WOS:000759196800033
Матеріалознавство				
1	Дослідження коефіцієнта проникнення композиту на основі вольфрамового волокна та цирконію з металевою скляною матрицею	Penetration Gain Study of a Tungsten-Fiber/Zr-Based Metallic Glass Matrix Composite. Zhou, F.; Du, CX.; Du, ZH; Gao, GF; Cheng, C.; Wang, XD. CRYSTALS. 2022. Volume 12. Issue 2, 284.	A tungsten fiber/Zr-based bulk metallic glass matrix composite (Wf/Zr-MG) is a potential penetrator material. To compare and analyze the penetration behavior of Wf/Zr-MG and a tungsten heavy alloy (WHA), a penetration experiment into the 30CrMnMo homogeneous armor target plate (RHA) is conducted in the present paper, by using a phi 37 mm smooth bore artillery with an impact velocity of 1550 +/- 40 m/s. Unlike the penetrator made of WHA, the self-sharpening phenomenon was observed in the nose of the Wf/Zr-MG rod. The experimental results indicate that the penetration ability of Wf/Zr-MG rod is approximately 10% higher than that of the WHA rod when the impact velocity is 1550 +/- 40 m/s. The combined findings on the microscopic	https://www.webofscience.com/wos/woscc/full-record/WOS:000762268300001

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			morphology, composition, hardness distribution around the crater, and the macroscopic structure of the penetrator residual show that under this impact velocity, the Wf/Zr-MG material shows amorphous gasification. The Wfs outside the rod shows bending and backflow, resulting in the maintenance of the self-sharpening nose of the penetrator during the penetration process. Moreover, the hardness peak around the crater formed by the Wf/Zr-MG rod is lower, and the penetration crater is straighter, indicating that the Wf/Zr-MG rod has a stronger slag removal ability, lower penetration resistance, and higher penetration efficiency. It is an ideal penetrator material.	
2	Вплив температури сопла на мікроструктури та фізичні властивості деталей з нержавіючої сталі 316L, адитивно виготовлених методом екструзії матеріалу	Influence of nozzle temperatures on the microstructures and physical properties of 316L stainless steel parts additively manufactured by material extrusion. Musa, NH; Mazlan, NN; Yusuf, SM; Redzuan, FLBM; Nordin, NA; Mazlan, SA. RAPID PROTOTYPING JOURNAL. 2024. Volume 30. Issue 10. Page 2021-2032.	Purpose - Material extrusion (ME) is a low-cost additive manufacturing (AM) technique that is capable of producing metallic components using desktop 3D printers through a three-step printing, debinding and sintering process to obtain fully dense metallic parts. However, research on ME AM, specifically fused filament fabrication (FFF) of 316L SS, has mainly focused on improving densification and mechanical properties during the post-printing stage; sintering parameters. Therefore, this study aims to investigate the effect of varying processing parameters during the initial printing stage, specifically nozzle temperatures, T-n (190 degrees C-300 degrees C) on the relative density, porosity, microstructures and microhardness of FFF 3D printed 316L SS. Design/methodology/approach - Cube samples (25 x 25 x 25 mm) are printed via a low-cost Artillery Sidewinder X1 3D printer using a 316L SS filament comprising of metal-polymer binder mix by varying nozzle temperatures from 190 to 300 degrees C. All samples are subjected to thermal debinding and sintering processes. The relative density of the sintered parts is determined based on the Archimedes Principle. Microscopy and analytical methods are conducted to evaluate the microstructures and phase compositions. Vickers microhardness (HV) measurements are used to assess the mechanical property. Finally, the correlation between relative density, microstructures and hardness is also reported. Findings - The results from this study suggest a suitable temperature range of 195 degrees C-205 degrees C for the successful printing of 316L SS green parts with high dimensional accuracy. On the other hand, T-n = 200 degrees C yields the highest relative density (97.6%) and highest hardness (292HV) in the sintered part, owing to the lowest porosity content (<3%) and the combination of the finest average grain size (similar to 47 m) and the presence of Cr23C6 precipitates. However, increasing T-n = 205 degrees C results in increased porosity percentage and grain coarsening, thereby	https://www.webofscience.com/wos/woscc/full-record/WOS:001294348700001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
			reducing the HV values. Overall, these outcomes suggest that the microstructures and properties of sintered 316L SS parts fabricated by FFF AM could be significantly influenced even by adjusting the processing parameters during the initial printing stage only. Originality/value - This paper addresses the gap by investigating the impact of initial FFF 3D printing parameters, particularly nozzle temperature, on the microstructures and physical characteristics of sintered FFF 316L SS parts. This study provides an understanding of the correlation between nozzle temperature and various factors such as dimensional integrity, densification level, microstructure and hardness of the fabricated parts.	
3	Мікроструктура та зносостійкість покриттів TaC та Ta/TaC на сталі 30CrNi2MoVA	Microstructure and Wear Performance of TaC and Ta/TaC Coatings on 30CrNi2MoVA Steel. Yang, K.; Lv, XM; Lai, ZY; Chen, XH; Wei, DB; Li, SQ; Zhang, PZ. COATINGS. 2014. Volume 14. Issue 8, 1039.	To enhance the wear resistance of artillery barrels in harsh environments, TaC and Ta/TaC coatings were prepared on 30CrNi2MoVA steel using double-glow plasma surface metallurgy technology. These coatings, of which their surfaces consisted of almost pure TaC phases, showed defect-free interfaces with the substrate. The Ta/TaC coating demonstrated excellent integration, forming a nearly homogeneous structure. The coatings exhibited a gradient cross-sectional hardness, affecting a depth of approximately 20 mu m. The Ta transition layer significantly enhanced the microhardness and adhesive strength of the TaC coating, with about 16.7% and 68.5% increases in the Ta/TaC coating, respectively. Both coatings markedly improved the wear resistance, showing slight wear at room temperature and minor oxidative wear at high temperatures. The Ta/TaC coating had more stable friction coefficient curves and a lower specific wear rate, with an 11.4% wear rate of the substrate at 500 degrees C. Thermal mismatch and stress concentration under wear loads caused extensive cracks and edge chipping in the TaC coating. In contrast, the good compatibility between the Ta transition layer and the TaC layer allowed for cooperative deformation with the substrate, creating a plastic deformation zone that reduced internal stresses and stress concentration, maintaining the intact structure. This study provides insights into applying Ta/TaC coatings for artillery barrel protection and broadens the possible application scenarios of the preparation technology.	https://www.webofscience.com/wos/woscc/full-record/WOS:001305918400001
4	Трибологічне дослідження та дослідження теплопередачі покриттів з оксиду графену на нейлонових обертових стрічках в артилерійській системі	Tribological and Heat Transfer Investigation of Graphene Oxide Coatings on Nylon Rotating Bands in an Artillery System. Chen, HB; Meng, ZY; Yi, S.	Exploring ways to improve the performance of rotating bands is of great importance for enhancing the power of modern artillery. This study prepared graphene oxide-coated Nylon (GO-Nylon) and Nylon samples based on nylon rotating bands in artillery systems to investigate the feasibility of introducing GO-coated nylon rotating	https://www.webofscience.com/wos/woscc/full-record/WOS:001376464500001

	Назва публікації (укр.)	Дані про публікацію	Анотація (англ.)	Посилання
		NANOMATERIALS. 2024. Volume 14. Issue 23, 1943.	band materials to enhance their tribological and thermal properties. The friction behavior and thermal effects of these two surfaces were analyzed under different external loads and surface roughness conditions. The results show that the excellent thermal conductivity of GO effectively reduced temperature accumulation during friction. Under an external load of 8 N, the surface temperature of GO-Nylon decreased by 14% compared to the Nylon surface, and the coefficient of friction (COF) decreased by 21%. At the same time, a simulation model was established, and its calculation results were consistent with the experimental trends, providing a further explanation of the experimental phenomena. This research provides a basis for the application of graphene-based coatings in the defense industry and presents new ideas for the development of high-performance rotating band materials.	
5	Поверхневе легування сплавів BTi-62421S подвійним плазмовим розжарюванням: регулювання мікроструктурних властивостей	Double-Glow Plasma Surface Alloying of BTi-62421S Alloys: Regulation of Microstructure Properties. Nie, YJF; Zhang, ZM; Cheng, M.; Yan, ZM; Dong, BB. COATINGS. 2023. Volume 13. Issue 5.	In order to meet the design requirements of lightweight artillery and adopt the method of double-glow plasma nitriding to solve the problem of low hardness and poor abrasion resistance of Ti alloy, the BTi-62421S high-performance titanium (Ti) alloy was selected as the experimental material to replace gun steel. To study the effect of different nitrogen (N) concentrations on the heat resistance scouring performance of BTi-62421S high-performance Ti alloy and investigate the influence of alloying elements on the heat resistance scouring performance under the same parameters compared with the commonly used TC4 Ti alloy, argon was used as the protective gas by continuously increasing the N concentration (Ar/N-2 = 1:1, 1:2, 1:3). It was found that the honeycomb structure on the surface of the sample and the thickness of the coating increased continuously, reaching a thickness of 15 mu m, while the depth of the nitride particles extending from the coating to the substrate also increased, reaching a maximum depth of 26 mu m. The orientation of TiN changed from 37 degrees to 62 degrees. The hardness of the coating showed a negative correlation with the coefficient of frictional abrasion, which significantly improved the heat-resistant scouring performance of BTi-62421S high-performance Ti alloy.	https://www.webofscience.com/wos/woscc/full-record/WOS:000996271000001