Naval engineering and ship control special edition III

Martelli, M.; Geertsma, R. D.

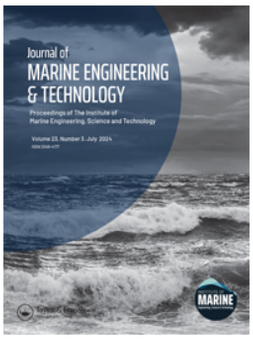
DOI
10.1080/20464177.2024.2345220

Publication date
2024

Document Version
Final published version

Published in
Journal of Marine Engineering and Technology

Citation (APA)
Martelli, M., & Geertsma, R. D. (2024). Naval engineering and ship control special edition III. *Journal of Marine Engineering and Technology*, *23*(3), 155-156. https://doi.org/10.1080/20464177.2024.2345220



Taylor & Francis
Taylor & Francis Group

Journal of Marine Engineering & Technology

ISSN: 2046-4177 (Print) 2056-8487 (Online) Journal homepage: www.tandfonline.com/journals/tmar20

Naval engineering and ship control special edition III

M. Martelli & R. D. Geertsma

To cite this article: M. Martelli & R. D. Geertsma (2024) Naval engineering and ship control special edition III, Journal of Marine Engineering & Technology, 23:3, 155-156, DOI: 10.1080/20464177.2024.2345220

To link to this article: https://doi.org/10.1080/20464177.2024.2345220

Published online: 07 May 2024.

JOURNAL OF MARINE ENGINEERING & TECHNOLOGY
2024, VOL. 23, NO. 3, 155–156
https://doi.org/10.1080/20464177.2024.2345220

Taylor & Francis
Taylor & Francis Group

Naval engineering and ship control special edition III

M. Martelli [a] and R. D. Geertsma [b,c]

[a]Department of Naval Architecture, Electric, Electronic and Telecommunication Engineering, University of Genova, Genova, Italy; [b]Faculty of Military Sciences, Netherlands Defence Academy, Royal Netherlands Naval Academy, Den Helder, Netherlands; [c]Department of Maritime & Transport Technology, Delft University of Technology, Delft, Netherlands

ABSTRACT
The third Naval Engineering and Ship Control special edition of the Journal of Marine Engineering and Technology aims to present cutting-edge research on naval engineering and ship control, as was presented during the International Naval Engineering Conference and Exhibition (INEC) and the International Ship Control Systems Symposium (iSCSS), held together in Delft in 2022.

ARTICLE HISTORY
Received 15 April 2024
Accepted 16 April 2024

KEYWORDS
Cybersecurity; alternative fuels; autonomous ships; ship control system; iSCSS

1. Introduction

The third Naval Engineering and Ship Control special edition of the Journal of Marine Engineering and Technology aims to present cutting-edge research on naval engineering and ship control, as was presented during the International Naval Engineering Conference and Exhibition (INEC) and the international Ship Control Systems Symposium (iSCSS), held together in Delft in 2022.

This special issue illustrates the three challenges that we are facing in the maritime domain. First of all, we need to ensure that our ships are more interconnected to increase our effectiveness. However, this increasingly leads to new cybersecurity and safety challenges that need to be addressed. Both the issues of cybersecurity and safe navigation are addressed in this special issue.

Second, the maritime domain needs to contribute to the energy transition. Alternative fuels such as hydrogen, which can be taken onboard in different forms, will play a crucial role in this transition. For naval platforms, maintaining endurance for extended forward presence is a key issue that drives fuel choice. Therefore, increasing power system efficiency and developing effective and efficient electrical power systems is key in maintaining and improving continued power for worldwide naval and maritime operations. The future DC electrical power system, which can deliver this effective and efficient power supply has to be able to deal with two specific aspects of naval vessels: highly dynamic loads to increasingly electriuc sensor and wepon systems and system resilience. The development of methods to evaluate and test system architecture and control through simulations, hardware-in-the-loop and e;ectrical testbeds is coverend in this issue.

The final challenge for the maritime domain is the reduced availability of ship staff and the need to reduce the amount of people sent in harm's way for naval operations. We therefore need to develop techniology to reduce our crews and operate partly or completely anonymous. Both the development of methods to dock autonomously with an underactuated vessel and methods to detect and avoid obstacles with robust path planning are addressed. Ultimately this will lead to the application of ship control and naval engineering for safe and secure maritime operations, with a reduced impact on our planet.

2. Topics in this special issue

2.1. Cybersecurity and digital systems

Longo et al. (2023) investigated an approach capable of hijacking a state-of-the-art collision avoidance algorithm by feeding it with rogue data. The effects of such a cyber-attack are shown on three different COLREG scenarios: head-on, crossing, and overtaking. The study additionally highlights the susceptibility of forthcoming navigation systems to security breaches.

Palbar Misas et al. (2023) engaged with navigators to evaluate the effect of increasing automation levels on safe navigation during system failures, for example caused by cyber attacks. This was done using tabletops, questionnaires and full bridge simulator exercises. Through this engagement, authors found that future navigators will need specific training to be equipped with new skills to improve their interaction with digital systems.

2.2. Alternative fuels, energy management and future energy challanges

Van Rheenen et al. (2023) studied how Green hydrogen combined with PEM fuel cell systems could be a viable option to meet the demand for alternative maritime fuels. Fifteen hydrogen carriers have been presented based on their maritime performance characteristics to determine their suitability for shipboard use.

Voth et al. (2024) proposes an outlook on the future challenge in modernising naval platforms to reduce energy consumption, increase endurance, enhance operational flexibility, and support forward presence.

Tschritter et al. (2024) present the results obtained using a medium voltage (MV) AC/DC testbed to examine predictive high ramp rate (PHRR) and advanced load shed (ALS) control algorithms.

CONTACT M. Martelli michele.martelli@unige.it Department of Naval Architecture, Electric, Electronic and Telecommunication Engineering, University of Genova, Via Montallegro 1, 16145 Genova, Italy

2.3. Autonomous ships

Bas de Kruif (2023) proposed a methodology to automatically approach a dock with an underactuated vessel. It comprises both the design of a time-dependent trajectory and the motion controller.

Garofano et al. (2023) investigated autonomous vessel obstacle avoidance using advanced techniques within the Guidance, Navigation, and Control (GNC) framework: a mixed integer linear programming (MILP) – based Guidance system for robust path planning and a multi-modal neural network for perception.

3. An Outlook on future development

Looking forward to further progress, we expect that future research activities will be devoted to leading the digital and green transitions. In particular, the paradigm of *Industry 5.0* will also be applied to a **sustainable, human-centric** and **resilient** maritime community. These three keywords applied to the maritime sector could be detailed in the following research areas:

Sustainable

- DC Microgrids
- Hybrid power systems
- Energy Storage
- Energy management
- Alternative fuels
- Novel power sources
- Energy efficiency
- Data exploration
- Cost Reduction
- Transient loads

Human centric

- Extended reality
- Digital training
- Decision support
- Level of autonomy
- Explainable AI
- FAIR Data
- Cooperative systems
- Human machine Balance
- Autonomous navigation

Resilient

- Network complexity
- Reliability and Availability
- Cyber security
- Connectivity
- Continuity of power
- Obsolescence
- Fault protection
- Predictable interaction
- Data fusion
- Fault tolerance
- Power quality
- Pulsed power loads

Acknowledgements

The collaborative efforts of authors, reviewers, and the editorial and production teams have contributed to this edition's success and excellence, and their dedication is truly commendable.

The initial acknowledgement from the guest editors is extended to the authors who generously shared their research, initially during the INEC and iSCSS conferences and later in the Journal of Marine Engineering and Technology (JMET), where their research was substantially expanded. As Guest Editors, we can appreciate the authors whose dedicated efforts have shaped this collection of papers. We express our gratitude for their hard work and commitment in bringing this Special Issue to fruition. Each article in this collection presents distinctive perspectives and methodologies, offering original insights into intelligent, safe and green shipping.

A noteworthy extension of gratitude is directed towards all reviewers, whose constructive contributions have played a pivotal role in elevating the overall quality of the research featured in this special edition III on naval engineering and ship control. The reviewers are recognised for their invaluable input, contributing to enhancing the academic content.

Last but not least, the JMET editorial team expresses their deep appreciation to the Taylor and Francis team for their unwavering support throughout the production process of this special issue.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

M. Martelli http://orcid.org/0000-0003-1309-3464

R. D. Geertsma http://orcid.org/0000-0001-5125-0358

References

de Kruif BJ. 2023. Autonomous docking of a feeder vessel. J Mar Eng Technol. doi: 10.1080/20464177.2023.2281742.

Garofano V, Hepworth M, Shahin R, Pang Y, Negenborn RR. 2023. Obstacle avoidance and trajectory optimization for an autonomous vessel utilizing MILP path planning, computer vision based perception and feedback control. J Mar Eng Technol. doi: 10.1080/20464177.2024.2330172.

Longo G, Martelli M, Russo E, Merlo A, Zaccone R. 2023. Adversarial waypoint injection attacks on Maritime Autonomous Surface Ships (MASS) collision avoidance systems. J Mar Eng Technol. doi: 10.1080/20464177.2023.2298521.

Palbar Misas JD, Hopcraft R, Tam K, Jones K. 2023. Future of maritime autonomy: cybersecurity, trust and mariner's situational awareness. J Mar Eng Technol. doi: 10.1080/20464177.2024.2330176.

Tschritter C, Johnston A, Wetz D, Vu L, Vu T, Nguyen T, Langston J, Ravindra H, Schoder K, Stanovich M, Steurer M, Schegan C, Heinzeld J. 2024. A prediction and load shed-based approach of controlling a medium voltage AC/DC testbed. J Mar Eng Technol. doi: 10.1080/20464177.2024.2340897.

Van Rheenen ES, Padding JT, Slootweg JC, Visser K. 2023. Hydrogen carriers for zero-emission ship propulsion using PEM fuel cells: an evaluation. J Mar Eng Technol. doi: 10.1080/20464177.2023.2282691.

Voth JM, Pence EG, Sorrentino V, Sturtevant GH. 2024. A moment of maritime opportunity? The U.S. Navy operational energy challenge. J Mar Eng Technol. doi: 10.1080/20464177.2024.2315648.