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Engineering Power

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EDITOR-IN-CHIEF'S WORD

Dear readers,

It is my pleasure to present a new issue of Engineering Power, dedicated to contemporary developments in ship hydrodynamics and marine engineering. The papers published in this issue demonstrate the growing importance of advanced numerical methods, computational modelling, and interdisciplinary research in solving increasingly complex engineering challenges.

Modern marine engineering is undergoing rapid technological transformation driven by high-fidelity simulations, data-driven approaches, and continuous advances in computational science. The contributions collected in this issue reflect both the scientific depth and the practical relevance of these developments, while emphasizing the importance of innovation, reliability, and sustainability in the maritime sector.

I would like to thank all authors for their valuable contributions, as well as the reviewers and editorial team for their dedication and support. Special thanks go to the guest editor, Prof. Nastia Degiuli, PhD, for her excellent work and professional commitment in preparing this issue.

Editor-in-Chief
Vedran Mornar, President of the Croatian Academy of Engineering

EDITOR'S WORD

Dear readers,

I am very pleased to have Prof. Nastia Degiuli, PhD, as the guest editor of the new issue of the Engineering Power journal. Prof. Nastia Degiuli, PhD, is the editor-in-chief of the journal Brodogradnja, which is the highest-ranked journal published in Croatia according to the SCImago Journal Rank. In this issue of Engineering Power, you can read about the numerical determination of the nominal wake of the Japan Bulk Carrier at model scale, propeller open-water characteristics using geometries generated by an automated tool and three-dimensional scanning, high-fidelity propulsion modelling in ship hydrodynamics, meteorological forecast uncertainties in ship speed-loss predictions, and a comprehensive review of non-Newtonian fluid mechanics in engineering and marine applications. I hope you enjoy reading this issue.

Editor
Bruno Zelić, Vice-President of the Croatian Academy of Engineering

FOREWORD

With the rapid development of computational methods, ship hydrodynamics is increasingly driven by high-fidelity numerical simulations supported by validation. While experimental methods remain essential, advanced computational fluid dynamics now enables accurate resolution of complex flow phenomena around hulls and propellers. Key challenges include reliable prediction of the nominal wake, which governs propeller inflow and overall performance, and sensitivity to geometric representation, which can significantly affect open-water characteristics. Coupled simulation frameworks further improve accuracy by capturing hull-propeller interactions under steady and unsteady conditions. In addition, growing attention is given to uncertainty in operational environments, particularly the influence of weather forecast errors on ship speed and performance predictions. Interdisciplinary developments, such as non-Newtonian fluid mechanics, further expand applications in marine engineering. This edition presents five advances in numerical methods and modelling approaches for ship hydrodynamics and marine engineering that contribute to more accurate, reliable, and physically consistent prediction of propulsion performance and operational behaviour.

The first study [1] numerically determines the nominal wake of the Japan Bulk Carrier at model scale using the Reynolds Averaged Navier-Stokes equations with the Shear Stress Transport k-ω turbulence model, validates the results against experimental data, and reports generally good agreement, resulting in an overall deviation of −2.72 %. The second study [2] investigates propeller open-water characteristics using geometries generated by an automated tool and three-dimensional scanning, and demonstrates that the choice of geometric modelling approach significantly affects the predicted thrust, torque, and open water efficiency. The third study [3] presents a high-fidelity sliding mesh approach implemented in OpenFOAM that couples rigid-body motion with propeller rotation, validated against Duisburg Test Case data with accurate prediction of propulsion performance and characteristic frequencies. The fourth study [4] assesses the impact of meteorological forecast uncertainties on ship speed-loss predictions by comparing three computational approaches, and finds that errors in significant wave height have the strongest influence on speed prediction uncertainty, with model-dependent variations in sensitivity across different sea states. The fifth study [5] provides a comprehensive review of non-Newtonian fluid mechanics in engineering and marine applications, highlighting how rheological models and dimensionless analysis support key functions such as drag reduction, flow assurance, and damping.

References

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