Giorgio Palma

Curriculum Vitae

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Research Output

Bibliometric indicators are assessed as of the date on which this CV is submitted. The journal quartile (based on SCImago Journal Rank, SJR, from SCImago) and the Journal Impact Factor (based on Web of Science) are reported for the year in which each contribution was published.

A. Peer-reviewed Journal Articles

[A1] Serani, A., Palma, G., Diez, M., A Nonlinear Extension of Parametric Model Embedding for Dimensionality Reduction in Parametric Shape Design, International Journal for Numerical Methods in Engineering 127, no. 20 (2026): e70437, https://doi.org/10.1002/nme.70437, Publisher: **WILEY, 111 RIVER ST, HOBOKEN, USA, NJ, 07030-5774, ISSN / eISSN:0029-5981 / 1097-0207.**

Research focus: The paper develops the Nonlinear Parametric Model Embedding (NLPME) method, an advanced nonlinear dimensionality-reduction approach for simulation-based design optimization. The research addresses the complexity of high-dimensional design spaces by overcoming the limitations of traditional linear methods such as PCA/POD. It substantially reduces the number of design variables while maintaining high geometric reconstruction fidelity and full compatibility with CAD/CAE workflows.

Personal contribution: Developed and ran the code for geometry generation using the Open CASCADE CAD kernel; filtered and processed the dataset; critically reviewed and refined the manuscript.

Number of citations: 0

Journal quartile: Q1

Journal Impact Factor: 3.3

[A2] Palma, G., Serani, A., Stern, F., Diez, M., System identification of high-speed planing hulls with Bayesian Hankel extended dynamic mode decomposition with control, Journal of Hydrodynamics, 2026, 38(4), pp. 696–714, https://doi.org/10.1007/s42241-026-0075-0, Publisher: **SPRINGER, ONE NEW YORK PLAZA, SUITE 4600 , NEW YORK, United States, NY, 10004,** ISSN / eISSN: **1001-6058 / 1878-0342**.

Research focus: The paper presents a data-driven, equation-free system-identification framework, BHeDMDc (Bayesian Hankel extended Dynamic Mode Decomposition with Control). It addresses real-time reduced-order modelling (ROM) of high-speed planing vessels subject to strongly nonlinear and impulsive phenomena, such as slamming in rough, irregular seas. By expanding the observable space through time delays and nonlinear transformations, including signal rectification, and probabilistically quantifying uncertainty in the model hyperparameters, the method solves both the forward problem (predicting motions and loads from incident waves) and the inverse problem (estimating hydrodynamic and impulsive forces from onboard motion data). It is therefore well suited to digital-twin and structural-health-monitoring applications.

Personal contribution: As first author and corresponding author, I developed the theoretical formulation and algorithmic extension of BHeDMDc, integrating Hankel extensions, nonlinear observables, control inputs, and Bayesian uncertainty quantification. I developed and fully implemented the numerical code, managed and post-processed high-fidelity CFD simulation data for the planing hull (GPPH), conducted numerical test campaigns for both forward and inverse

problems, defined and analysed error and performance metrics (NRMSE, NAMMAE, JSD), and wrote the entire scientific manuscript.
Number of citations: 0
Journal quartile: Q1
Journal Impact Factor: 3.5

[A3] Serani, A., Palma, G., Wackers, J., Diez, M., A Machine Learning Enabled MDO for Bio-Inspired Autonomous Underwater Gliders, Structural and Multidisciplinary Optimization, **69**, 230 (2026). https://doi.org/10.1007/s00158-026-04421-8, Publisher: **SPRINGER , ONE NEW YORK PLAZA, SUITE 4600 , NEW YORK, United States, NY, 10004,** ISSN / eISSN:**1615-147X / 1615-1488.**
Research focus: The paper addresses naval architecture through the design of innovative underwater vehicles. It investigates the multidisciplinary design optimization (MDO) of a bio-inspired Autonomous Underwater Glider (AUG), integrating key aspCFU including external-hull hydrodynamics, hydrostatic trim, structural integrity, and internal arrangement (packaging). Machine learning and Parametric Model Embedding are used to reduce the design space and predict hydrodynamic loads (lift, drag, and pressure distributions). This represents a significant methodological advance for modern ship design and autonomous marine systems engineering.
Personal contribution: I played a central role in developing the bi-level optimization framework. I also helped define the parametric model of the manta-ray-inspired geometry, implemented the hydrostatic and structural analyses for internal sizing, and reviewed the original manuscript.

[A4] Palma, G., Serani, A., and Diez, M, 2026. Data-driven uncertainty-aware seakeeping prediction of the Delft 372 catamaran using ensemble Hankel dynamic mode decomposition, Journal of Hydrodynamics, https://doi.org/10.1007/s42241-026-0015-z, Publisher: **SPRINGER, ONE NEW YORK PLAZA, SUITE 4600 , NEW YORK, United States, NY, 10004,** ISSN / eISSN: **1001-6058 / 1878-0342**.
Research focus: The paper addresses naval architecture by investigating the hydrodynamics and seakeeping performance of a multihull vessel, the Delft 372 catamaran. It predicts ship motions (pitch and heave), total resistance, and accelerations in irregular waves using data-driven models based on dynamic mode decomposition. The integration of innovative machine-learning techniques and uncertainty quantification meets current needs for digitalization and decision support in the maritime sector.
Personal contribution: As first author and corresponding author, I conceived and developed the methodological framework based on an ensemble extension of Hankel Dynamic Mode Decomposition with Control (HDMDc). I implemented the algorithms for Bayesian and frequentist inference, analysed and reduced the experimental data acquired at CNR-INM facilities, and validated the results against computational fluid dynamics (CFD) simulations. I also wrote the manuscript and led the critical discussion of the results.
Number of citations: 4
Journal quartile: Q1
Journal Impact Factor: 3.5

[A5] Palma, G., Santic, I., Serani, A., Minno, L., and Diez, M., System identification of a moored ASV with recessed moon pool via deterministic and Bayesian Hankel-DMDc, Journal of Marine Science and Engineering 2025, 13(12), 2267, DOI: https://doi.org/10.3390/jmse13122267, Publisher: **MDPI, MDPI AG, Grosspeteranlage 5, BASEL, Switzerland, CH-4052,** ISSN / eISSN: **2077-1312**.

Research focus: The paper addresses key naval-architecture topics, particularly system identification for an autonomous surface vehicle. Its main scientific focus is data-driven modelling of the nonlinear dynamic response of a moored vessel with a recessed moon pool. The research responds to the need for accurate and efficient reduced-order models (ROMs) for seakeeping that can operate in real time in support of control and digital-twinning applications, while maintaining operational safety in irregular seas.
Personal contribution: As first author and corresponding author, I conceived and implemented the framework based on Hankel Dynamic Mode Decomposition with Control (HDMDc) and its Bayesian extension (BHDMDc). My main contribution was developing a methodology that, for the first time, generalizes ship-dynamics prediction to sea states not represented in the training set. I analysed the experimental data collected in the CNR-INM towing tank, integrated uncertainty-quantification techniques to make the model robust to hyperparameter selection, and statistically validated the results using advanced metrics. I also wrote and revised the manuscript.
Number of citations: 3
Journal quartile: Q2
Journal Impact Factor: 2.8

[A6] Palma, G., Serani, A., Aram, S., Wundrow, D. W., Drazen, D., and Diez, M., 2025. Bayesian Hankel dynamic mode decomposition for ship motion digital twinning, Applied Ocean Research, 165, 104863., DOI: https://doi.org/10.1016/j.apor.2025.104863, Publisher: **ELSEVIER SCI LTD, 125 London Wall, London, England, EC2Y 5AS,** ISSN / eISSN: **0141-1187 / 1879-1549**.
Research focus: The study concerns the development of digital twins for predicting ship motions in waves, a key aspect of operational efficiency and navigational safety in naval architecture. It focuses on nowcasting the seakeeping performance of the 5415M ship model (a destroyer) in very severe irregular seas (Sea State 7), using dynamic-mode-decomposition methods. The integration of data-driven models addresses the maritime sector's current drive towards digitalization and the development of advanced platform-control and management systems.
Personal contribution: As first author, I proposed and validated a Bayesian extension of Hankel Dynamic Mode Decomposition for ship digital-twinning applications. I developed a data-lean methodology capable of operating in real time. I managed the comparison between deterministic and probabilistic formulations, showing that the Bayesian approach improves short-term forecast accuracy and provides a reliable relationship between estimated uncertainty and forecast error. I also wrote and revised the manuscript.
Number of citations: 8
Journal quartile: Q1
Journal Impact Factor: 4.4

[A7] Palma, G., Serani, A., Aram, S., Wundrow, D. W., Drazen, D., and Diez, M., 2025. Model-free system identification of surface ships in waves via Hankel dynamic mode decomposition with control, Ocean Engineering, 341(122539), DOI: https://doi.org/10.1016/j.oceaneng.2025.122539, Publisher: **PERGAMON-ELSEVIER SCIENCE LTD, THE BOULEVARD, LANGFORD LANE, KIDLINGTON, OXFORD, ENGLAND, OX5 1GB,** ISSN / eISSN: **0029-8018 / 1873-5258**.
Research focus: The study addresses system identification and prediction of surface-ship motions in real sea conditions, central topics in naval architecture. It investigates seakeeping in adverse conditions (Sea State 7), including near-resonant roll, using the 5415M ship model to analyse

strongly nonlinear hydrodynamic responses. For the first time, a method based on dynamic mode decomposition with control was used to obtain a data-driven reduced-order model of ship dynamics. The approach efficiently incorporates the effCFU of waves and rudder action, directly supporting onboard safety, design, and decision-making needs addressed by international standards (IMO and NATO).
Personal contribution: As first author, I introduced and validated Hankel Dynamic Mode Decomposition with Control (Hankel-DMDc) and its Bayesian extension as data-driven methods for ship dynamics. The system state is expanded through time-delay embedding to capture nonlinear and chaotic features of ship motion without requiring an a priori physical model. I also wrote the manuscript and its revisions.
Number of citations: 15
Journal quartile: Q1
Journal Impact Factor: 5.5

[A8] Serani, A., Palma, G., Wackers, J., Quagliarella, D., Gaggero, S., and Diez, M., 2025. Extending Parametric Model Embedding with Physical Information for Design-space Dimensionality Reduction in Shape Optimization, Engineering with Computers, DOI: https://doi.org/10.1007/s00366-025-02211-2, Publisher: **SPRINGER, ONE NEW YORK PLAZA, SUITE 4600, NEW YORK, United States, NY, 10004,** ISSN / eISSN: **0177-0667 / 1435-5663**.
Research focus: The study addresses a key naval-architecture challenge: shape optimization with complex, high-dimensional geometric parameterizations. It proposes innovative approaches to generate reduced design spaces that account not only for geometric variability but also directly incorporate the system's physical response, such as hydrodynamic loads and resistance. Applications to naval case studies—including optimization of the 5415M destroyer hull, an autonomous underwater glider, and a marine propeller—demonstrate that physical information can be incorporated into dimensionality reduction without prohibitive computational cost. This yields reduced spaces in which shape optimization can be performed more effectively and efficiently, supporting modern ship design.
Personal contribution: I contributed to defining the autonomous underwater glider case study and developed and implemented its geometric parameterization and internal sizing.
Number of citations: 5
Journal quartile: Q1
Journal Impact Factor: 4.9

[A9] Palma, G., Bardazzi, A., Lucarelli, A., Pilloton, C., Serani, A., Lugni, C., and Diez, M., 2025, Analysis, Forecasting, and System Identification of a Floating Offshore Wind Turbine Using Dynamic Mode Decomposition, Journal of Marine Science and Engineering, 13(4), 656. DOI: https://doi.org/10.3390/jmse13040656, Publisher: **MDPI, MDPI AG, Grosspeteranlage 5, BASEL, Switzerland, CH-4052,** ISSN / eISSN: **2077-1312**.
Research focus: The paper extends dynamic-analysis methodologies based on DMD and DMD with control to offshore structures. It addresses the complex dynamics of a floating offshore wind turbine (FOWT), analysing the interaction between platform motions and environmental loads (waves and wind). The study focuses on coupled aero-hydro-servo-elastic response, a frontier topic in modern marine engineering aimed at sustainable energy and the design of complex offshore

structures in deep water. Reduced-order models for forecasting and system identification are essential for structural-health monitoring and control optimization of these systems.
Personal contribution: As first author, I designed and conducted the numerical and methodological study based on Dynamic Mode Decomposition (DMD), including deterministic, control-augmented (DMDc), and Bayesian variants. I also wrote the manuscript and coordinated the integration of the research team's interdisciplinary expertise.
Number of citations: 14
Journal quartile: Q2
Journal Impact Factor: 2.8

[A10] Palma, G., Burghignoli, L., Poggi, C., and Serafini, J., 2024, Multipolar expansion for aircraft noise equivalent sources, Aerospace Science and Technology, Volume 155, Part 2, 109629. DOI: https://doi.org/10.1016/j.ast.2024.109629, Publisher: **ELSEVIER FRANCE-EDITIONS SCIENTIFIQUES MEDICALES ELSEVIER, 65 RUE CAMILLE DESMOULINS, CS50083, ISSY-LES-MOULINEAUX, FRANCE, 92442,** ISSN / eISSN: **1270-9638 / 1626-3219**.
Research focus: Although focused on aeronautics, the paper is methodologically relevant to advanced modelling and computational-complexity reduction in engineering. It addresses aircraft noise pollution by proposing a multipole-expansion method for defining equivalent sources. The approach substantially reduces computational costs for noise propagation from the near field to the far field. Developing fast, accurate tools to predict environmental impact is also relevant to modern ship design, particularly for radiated noise from vessels and its effCFU on marine ecosystems.
Personal contribution: As first author and corresponding author, I conceived and developed the mathematical framework for identifying the coefficients of equivalent multipole sources. I implemented a physics-informed regression framework to ensure that the expansion complies with the physical properties of the acoustic field, overcoming the limitations of standard interpolation techniques. I validated the method on complex case studies, demonstrating that the proposed model reconstructs the entire acoustic field with very few parameters. I also coordinated the manuscript preparation and the discussion of the method's accuracy and computational efficiency.
Number of citations: 5
Journal quartile: Q1
Journal Impact Factor: 5.8

[A11] Palma, G., Meloni, S., Camussi, R., Iemma, U., and Bogey, C., 2024, Subsonic Jet Noise Prediction in Near and Far Field with Optimized Wave-Packet Approach, AIAA Journal, 62:11, 4144-4152, DOI: https://doi.org/10.2514/1.J064232, Publisher: **AMER INST AERONAUTICS ASTRONAUTICS, 1801 ALEXANDER BELL DRIVE, STE 500, RESTON, USA, VA, 22091-4344,** ISSN / eISSN: **0001-1452 / 1533-385X.**
Research focus: This publication demonstrates expertise in advanced turbulent-flow analysis and acoustic-radiation phenomena, both relevant to naval architecture. It focuses on predicting noise generated by subsonic jets through optimization of wave-packet models. Accurate modelling of the near and far fields of turbulent flows is important for designing low-acoustic-signature marine propulsion systems and mitigating the environmental noise impact of modern vessels.

Personal contribution: As first author, I conducted the entire study on systematic optimization of the wave-packet model parameters to ensure optimal performance in both the near and far fields. I developed the methodological framework using data from high-fidelity large-eddy simulations (LES) of a free jet at Mach 0.9. I also analysed the results and wrote the manuscript.
Number of citations: 1
Journal quartile: Q1
Journal Impact Factor: 2.8

[A12] Palma, G., Centracchio, F., Burghignoli, L., Cioffi, I., and Iemma, U., 2024, Numerical Optimization of Metasurface Cells for Acoustic Reflection, AIAA Journal, 62:3, 1136-1147, DOI: https://doi.org/10.2514/1.J063399, Publisher: **AMER INST AERONAUTICS ASTRONAUTICS , 1801 ALEXANDER BELL DRIVE, STE 500, RESTON, USA, VA, 22091-4344,** ISSN / eISSN: **0001-1452 / 1533-385X.**
Research focus: The paper demonstrates advanced expertise in physical modelling and numerical optimization, with applications to acoustic-field control, an increasingly relevant topic in naval architecture. It focuses on designing unit cells for spatially periodic metasurfaces capable of manipulating sound-wave reflection. Such technologies offer innovative approaches to acoustic treatment in confined spaces (such as engine rooms) and to reducing the external acoustic signature of surface ships and submarines. They provide reduced thickness compared with conventional absorptive materials and improved effectiveness across a range of operating frequencies.
Personal contribution: As first author, I defined and implemented the geometric parameterization of the cells and the numerical optimization procedure for modular cell design, broadening the operating-frequency range of the metasurfaces beyond the limitations of standard designs. I managed the acoustic-simulation workflow to identify geometries capable of introducing controlled phase shifts in the reflected field, and validated the optimized set of cells through detailed numerical analyses. I also wrote the manuscript, emphasizing the method's generalizability to complex engineering applications.
Number of citations: 6
Journal quartile: Q1
Journal Impact Factor: 2.8

[A13] Colombo, G., Palma, G., and Iemma, U., 2024, Numerical Aeroacoustic Assessment of a Metacontinuum Device Impinged by a Laser-Generated Sound Source, Journal of Engineering, 5421663, 11 pages, 2024. DOI: https://doi.org/10.1155/2024/5421663, Publisher: **WILEY, 111 RIVER ST, HOBOKEN, USA, NJ, 07030-5774,** ISSN / eISSN: **2314-4904 / 2314-4912.**
Research focus: The paper is relevant to naval architecture because it focuses on numerical modelling and validation of advanced devices for controlling acoustic fields in complex fluid-dynamic environments. It investigates the response of a metacontinuum exposed to a point sound source, simulating conditions involving a moving medium. These studies are important for naval applications, including innovative hull coatings to reduce acoustic signatures, protect sonar sensors, and control radiated noise.
Personal contribution: As co-author, I contributed to developing the theoretical and numerical framework for the metacontinuum model in the space-time domain needed to assess the device's aeroacoustic performance. This enabled proper simulation of the interaction between the acoustic

wave and the treated surface in the presence of convection. I helped critically analyse the data to assess the device's effectiveness in correcting wavefront distortions caused by fluid motion. I also contributed to the manuscript and to the discussion of the numerical model's robustness.
Number of citations: 4
Journal quartile: Q2
Journal Impact Factor: 2.3

[A14] Palma, G., and Iemma, U., 2023, A metacontinuum model for phase gradient metasurfaces, Scientific Reports, 13, 13038 (2023). DOI: https://doi.org/10.1038/s41598-023-39956-z, Publisher: ***NATURE PORTFOLIO, HEIDELBERGER PLATZ 3, BERLIN, Germany, 14197,*** *ISSN / eISSN:* ***2045-2322.***
Research focus: The paper is relevant to naval architecture because it introduces computationally efficient methods for analysing innovative acoustic devices. It proposes a metacontinuum model based on transformation acoustics to describe phase-gradient metasurfaces through macroscopic properties (anisotropic inertia and bulk modulus). Such models are important for developing smart hull coatings capable of controlling sound reflection and transmission to protect onboard sonar sensors and reduce acoustic signatures over a broad frequency range.
Personal contribution: As first author and corresponding author, I conceived and analytically derived the metacontinuum model, incorporating thermal and viscous dissipation for the first time through a complex speed of sound. I implemented the model in a finite-element method (FEM) environment and numerically validated it against real geometries and equivalent-impedance models. I assessed its performance in both external-acoustics configurations and ducts, demonstrating that the proposed approach captures metamaterial physics with reduced computational cost. I also coordinated the writing of the full manuscript.
Number of citations: 6
Journal quartile: Q1
Journal Impact Factor: 3.8

[A15] Palma, G., Meloni, S., Camussi, R., Iemma, U., and Bogey, C., 2023, Data-Driven Multiobjective Optimization of Wave-Packets for Near-Field Subsonic Jet Noise, AIAA Journal, 61:5, 2179-2188 DOI: https://doi.org/10.2514/1.J062261, Publisher: **AMER INST AERONAUTICS ASTRONAUTICS, 1801 ALEXANDER BELL DRIVE, STE 500, RESTON, USA, VA, 22091-4344,** ISSN / eISSN: **0001-1452 / 1533-385X.**
Research focus: Although applied to aeronautics, the work is relevant to naval architecture because it develops reduced-order models for characterizing noise sources in turbulent flows. This topic is directly applicable to naval hydroacoustics and to interactions between propulsion systems (such as waterjets or propellers) and hull structures. Efficient calibration of near-field models is important for assessing fluctuating loads and acoustic scattering at wetted surfaces, which affect onboard comfort, acoustic signature, and the structural integrity of modern vessels.
Personal contribution: As first author, I conceived and implemented the multi-objective optimization framework based on the Deterministic Particle Swarm Optimization (DPSO) algorithm. My main contribution was a calibration strategy that simultaneously uses pressure data at different radial distances from the jet, accurately representing both hydrodynamic and radiated components. I analysed the Pareto front to identify optimal solutions that maximize model fidelity in the near-field region, which is essential for acoustic scattering from surfaces,

and validated the process against high-resolution LES databases. I also wrote the manuscript and discussed the results.
Number of citations: 10
Journal quartile: Q1
Journal Impact Factor: 2.1

[A16] Burghignoli, L., Rossetti, M., Centracchio, F., Palma, G. and Iemma, U., 2022, Adaptive RBF with hyperparameter optimisation for aeroacoustic applications, International Journal of Aeroacoustics, 21 (1-2), 22–42. DOI: https://doi.org/10.1177/1475472X221079545, Publisher: **SAGE PUBLICATIONS INC, 2455 TELLER RD, THOUSAND OAKS, USA, CA, 91320** ISSN / eISSN: **1475-472X / 2048-4003.**
Research focus: This publication demonstrates solid expertise in developing adaptive surrogate models and simulation-based design (SBD) optimization techniques, which are important in naval architecture. It focuses on radial basis functions (RBFs) to substantially reduce the computational cost of high-fidelity simulations during surrogate-model construction and optimization, a central challenge in designing hulls and appendages. The ability to account for uncertainty and dynamically optimize the design space is directly applicable to naval hydroacoustics and hull hydrodynamic optimization, balancing accuracy and computational speed in industrial design processes.
Personal contribution: As co-author, I contributed to developing and validating the surrogate-modelling approach based on stochastic RBFs with uncertainty quantification. I actively participated in analysing surrogate-model performance in complex acoustic-shielding case studies and helped define adaptive-sampling procedures to efficiently explore high-dimensional design spaces.
Number of citations: 12
Journal quartile: Q2
Journal Impact Factor: 1.0

[A17] Palma, G., Burghignoli, L., Centracchio, F. and Iemma, U., 2021, Innovative acoustic treatments of nacelle intakes based on optimised metamaterials, Aerospace, 8 (10). DOI: https://doi.org/10.3390/aerospace8100296, Publisher: **MDPI, MDPI AG, Grosspeteranlage 5, BASEL, Switzerland, CH-4052,** ISSN / eISSN: **2226-4310**.
Research focus: The paper is methodologically relevant to naval architecture, focusing on the design of advanced acoustic treatments using optimized metamaterials. It addresses the challenge of manipulating acoustic fields in ducts with flow, a key issue in controlling noise from marine ventilation and propulsion systems. Compact, efficient sound-absorbing surfaces can help reduce onboard noise and the acoustic signature of vessels, supporting an integrated and multidisciplinary approach to platform design.
Personal contribution: As first author and corresponding author, I conceived and developed the framework for designing and optimizing metamaterial-based acoustic treatments. I developed the numerical model for the metamaterial cells and implemented a multi-objective optimization procedure to maximize noise attenuation while minimizing geometric footprint. I analysed the system's acoustic response under different operating conditions, demonstrating the improved performance of the optimized treatments compared with conventional solutions, and coordinated the writing of the manuscript.

Number of citations: 10
Journal quartile: Q2
Journal Impact Factor: 2.66

[A18] Palma, G. and Burghignoli, L., 2020, On the integration of acoustic phase-gradient metasurfaces in aeronautics, International Journal of Aeroacoustics, 19 (6-8), 294–309. DOI: https://doi.org/10.1177/1475472X20954404, Publisher: **SAGE PUBLICATIONS INC, 2455 TELLER RD, THOUSAND OAKS, USA, CA, 91320,** ISSN / eISSN:**1475-472X / 2048-4003.**
Research focus: The paper is methodologically relevant to naval architecture, especially hydroacoustics and acoustic-signature control. It establishes a rigorous analytical link between transformation acoustics (TA) and the generalized Snell's law (GSL), applying these concepts to optimize acoustic treatments for ducts with flow. These methods can be transferred to naval applications such as silencing propulsion systems and intake ducts, and developing innovative hull coatings that manipulate sound-wave reflection to reduce environmental noise, lower sonar detectability, or protect onboard sensors.
Personal contribution: As first author, I conceived and carried out the analytical demonstration unifying phase-gradient metasurface models with the transformation-acoustics framework. I developed and implemented the simulation-based design (SBD) optimization procedure for an acoustic lining in a two-dimensional duct with flow. My main contribution concerned analysis of noise directivity, demonstrating how the reflected wavefront can be controlled through constructive and destructive interference, overcoming limitations of conventional absorptive materials. I also coordinated and wrote the manuscript in full.
Number of citations: 18
Journal quartile: Q2
Journal Impact Factor: 1.115

[A19] Iemma, U. and Palma, G., 2020, Design of metacontinua in the aeroacoustic spacetime, Scientific Reports, 10 (1). DOI: https://doi.org/10.1038/s41598-020-74304-5, Publisher: **NATURE PORTFOLIO, HEIDELBERGER PLATZ 3, BERLIN, Germany, 14197,** ISSN / eISSN: **2045-2322.**
Research focus: Although originating in aeroacoustics, this work also addresses key issues in naval architecture. It proposes a general method, based on the formal invariance of the wave equation in space-time, for designing acoustic metacontinua that operate effectively in fluid flows. With appropriate adaptation and further development, this methodology could support hull coatings—such as acoustic cloaking devices—that retain their concealment or sensor-protection properties during navigation, when relative motion exists between the fluid and the structure, overcoming the limitations of conventional designs.
Personal contribution: As co-author, I made a substantial contribution to developing the mathematical formulation based on space-time coordinate transformations. I also helped translate the theoretical framework into a robust numerical model and implemented simulations to validate the method. In particular, I managed the case study on acoustic cloaking of a cylinder in a flow, analysing how changes in the metacontinuum's mechanical properties (density anisotropy and bulk modulus) can compensate for convective effCFU. I also contributed to the critical analysis of the results and to conclusions on the method's applicability to complex engineering scenarios.
Number of citations: 28

Journal quartile: Q1
Journal Impact Factor: 4.38

[A20] Iemma, U., and Palma, G. 2019, Convective correction of metafluid devices based on Taylor transformation, Journal of Sound and Vibration, 443, pp. 238-252. DOI: https://doi.org/10.1016/j.jsv.2018.11.047, Publisher: **ACADEMIC PRESS LTD- ELSEVIER SCIENCE LTD, 24-28 OVAL RD, LONDON, ENGLAND, NW1 7DX,** ISSN / eISSN: **0022-460X / 1095-8568.**
Research focus: This work is highly relevant to naval architecture, particularly the development of metamaterials and metacontinua for hydroacoustics and the control of vessel acoustic signatures. It introduces a method based on Taylor transformation to correct the mechanical properties of metafluid devices (such as cloaks or acoustic lenses) so that they operate properly in non-uniform flows. With further development, this approach could support innovative hull coatings that function effectively during navigation, compensating for relative motion between the fluid and hull to protect onboard acoustic sensors and mitigate radiated noise.
Personal contribution: As co-author, I contributed to the theoretical framework based on applying the inverse Taylor transformation to the static design space. I also helped validate the method numerically through simulations of aeroacoustic cloaking of a cylinder immersed in a non-uniform flow. I implemented the numerical model to calculate the corrected metafluid properties (density anisotropy and bulk modulus), demonstrating how the technique preserves device performance compared with conventional designs that neglect flow effCFU. I also contributed to data analysis and manuscript preparation, with particular attention to generalizing the method to engineering applications.
Number of citations: 25
Journal quartile: Q1
Journal Impact Factor: 3.429

[A21] Palma, G., Mao, H., Burghignoli, L., Göransson, P., and Iemma, U., 2018, Acoustic metamaterials in aeronautics, Applied Sciences (Switzerland), 8 (6), art. no. 971. DOI: https://doi.org/10.3390/app8060971, Publisher: **MDPI, MDPI AG, Grosspeteranlage 5, BASEL, Switzerland, CH-4052,** ISSN / eISSN: **2076-3417.**
Research focus: As a systematic review of the scientific literature, this paper analyses state-of-the-art technologies for acoustic-field control that are relevant to naval architecture. It examines subwavelength absorption, acoustic cloaking, and wavefront manipulation—concepts that underpin innovative hull coatings, sonar protection, and the mitigation of radiated and onboard noise. The review provides a methodological basis for incorporating advanced materials into modern ship design, with a focus on reducing environmental impact and managing acoustic signatures.
Personal contribution: As first author, I conceived and coordinated the review structure and conducted an extensive critical analysis of the international literature. My contribution included classifying and comparing different types of metamaterials (locally resonant, membrane/plate-type, space-coiling, and sonic-crystal designs), highlighting their potential and physical limitations. I also managed the manuscript's drafting and revision, integrating the co-authors' interdisciplinary contributions and defining future research directions.
Number of citations: 90
Journal quartile: Q1

Journal Impact Factor: 2.2

[A22] Iemma, U., and Palma, G., 2017, On the use of the analogue transformation acoustics in aeroacoustics, Mathematical Problems in Engineering, art. no. 8981731. DOI: https://doi.org/10.1155/2017/8981731, Publisher: **HINDAWI LTD, ADAM HOUSE, 3RD FLR, 1 FITZROY SQ, LONDON W1T 5HF, ENGLAND**, ISSN / eISSN: **1024-123X / 1563-5147.**
Research focus: The paper explores the theoretical and numerical foundations of acoustic modelling in the presence of flow, a core topic in naval hydroacoustics. It examines the physical consistency of coordinate transformations used to design metamaterials, such as cloaks and lenses, by assessing whether the resulting flow field satisfies the fluid-dynamics equations. This expertise is essential for designing low-signature devices and surface treatments for hulls and appendages.
Personal contribution: As co-author and corresponding author, I contributed to developing the analytical framework for assessing the consistency of analogue transformation acoustics with potential-flow theory. My work included implementing a method based on generating curved structured grids to map material properties and conducting numerical tests to verify formal equation invariance in the presence of convection. I actively helped demonstrate that conformal transformations used to manipulate acoustic flows violate the physical constraints of the background fluid. I also contributed to the manuscript and analysis of the results.
Number of citations: 19
Journal quartile: Q2
Journal Impact Factor: 1.145

B. Book Chapters

[B1] Centracchio, F., Burghignoli, L., Rossetti, M., Palma, G., Iemma, U., 2022, Comparison of Active Metamodelling Techniques in Multidisciplinary Optimisation Frameworks. In Knoerzer, D., Periaux, J., Tuovinen, T. (eds) Advances in Computational Methods and Technologies in Aeronautics and Industry. Computational Methods in Applied Sciences, vol 57. Springer, Cham. DOI: https://doi.org/10.1007/978-3-031-12019-0_14. ISBN: 978-3-031-12018-3
Research focus: This work is relevant to naval architecture through its examination of multidisciplinary design optimization (MDO) methods applied to fluid dynamics. It addresses the high computational cost of high-fidelity solvers by rigorously comparing dynamic surrogate-modelling techniques based on radial basis functions (RBFs) and artificial neural networks (ANNs). These tools accelerate simulation-based design (SBD), allowing complex design spaces—such as those involving complete hulls and appendages—to be explored and optimized using fewer costly numerical evaluations while retaining the accuracy required for robust design.
Personal contribution: As co-author, I contributed to developing the framework for comparing different active surrogate-modelling techniques. My work focused on analysing and implementing function-adaptive strategies for algorithmic self-tuning to improve model adaptation to data. I helped define adaptive domain-sampling procedures to identify regions where the objective function is most uncertain. I also participated in numerical testing and critical assessment of the

results, analysing surrogate-model accuracy and computational efficiency within the optimization cycle.
Number of citations: 1

C. Papers in International Conference Proceedings (name in bold indicates the presenter)

[C1] **Palma, G.**, Pellegrini, R., De Marco, R., Diez, M., Ship Motion Digital Twinning of the R/V Gaia Blu: a Closer Look at the Gaia-Twin Campaign. In 17th World Congress on Computational Mechanics (WCCM) 10th European Congress on Computational Methods in Applied Science and Engineering (ECCOMAS), 19-24 July 2026, Munich, Germany.
Research focus: The work focuses on ship dynamics and digital-twin technologies for lifecycle management and operational optimization. It presents predictive models for real-time nowcasting of ship attitude and motions (heave, roll, pitch, yaw, velocities, and accelerations), demonstrated on board the research vessel R/V Gaia Blu. Advanced data-driven and equation-free methods, including Hankel Dynamic Mode Decomposition (HDMD), are applied alongside studies of manoeuvrability and system identification in severe sea states—central naval-architecture topics for navigational safety and vessel operational efficiency.
Personal contribution: As first author, I led the development of the HDMD-based predictive model for analysing the dynamics of the research vessel R/V Gaia Blu. My specific contribution was implementing an uncertainty-aware formulation to improve forecast reliability and decision support. I also coordinated data collection during oceanographic campaigns aboard the vessel in the Mediterranean Sea (June and October–November 2025), integrating and synchronizing time series from onboard systems (positioning, anemometry, attitude, and accelerations) for real-time input to the nowcasting algorithm. I also wrote the manuscript.
Number of citations: 0

[C2] **Palma, G.**, Serani, A., Stern, F., Diez, M., Model-free System Identification of Displacement and Planing Mono- and Multihull Vessels in Irregular Waves by Uncertainty-aware Hankel Extended DMD. In 36th Symposium on Naval Hydrodynamics, June 14-19, 2026, Busan, South Korea.
Research focus: This work is directly relevant to naval architecture, addressing the unsteady hydrodynamic response of several vessel types—displacement and planing, monohull and multihull—in irregular waves. It proposes an advanced framework, Uncertainty-aware Hankel extended Dynamic Mode Decomposition with control (UHeDMDc), for system identification and the construction of reduced-order models (ROMs). These models act as surrogates for computational fluid dynamics (CFD) simulations or experimental fluid dynamics (EFD) tests and provide predictive capabilities suitable for real-time deployment, an important consideration for ship safety and operational optimization in real sea conditions.
Personal contribution: As first author, I conceived and proposed the data-driven UHeDMDc framework for predicting ship hydrodynamic response. I extended classical dynamic mode decomposition (DMD) to handle strong nonlinearities and memory-dependent phenomena, incorporating an ensemble-based formulation for uncertainty quantification. I analysed four distinct case studies, demonstrating the method's effectiveness for different hull configurations

and operating regimes, and interpreted the results in terms of hydrodynamic performance in waves. I also wrote the manuscript.
Number of citations: 0

[C3] Palma, G., Meloni, S., Bogey, C., Burghignoli, L., Poggi, C., Serafini, J., A novel multipolar expansion for acoustic footprint reduced order modeling. In 10th CEAS Aerospace Europe Conference, 28th AIDAA Congress, 10th Aerospace & Defense Meeting, 1-4 December 2025, Turin, Italy, doi:10.21741/9781644904251-51.
Research focus: This work has methodological significance for naval architecture, particularly hydroacoustics and acoustic-signature management. It proposes a method based on a physics-informed multipole expansion to generate equivalent sources that represent complex acoustic fields at very low computational cost. The technique can be applied directly to predicting noise radiated by marine propellers and characterizing the acoustic footprint of surface and underwater vessels. Accurate, efficient reduced-order models are essential for assessing environmental noise impact and optimizing hull and appendage designs for low-noise performance.
Personal contribution: As first author, I conceived and developed the mathematical architecture of the physics-informed multipole expansion. I integrated equivalent-source theory with high-fidelity large-eddy simulation (LES) data and implemented the algorithm to decompose the field into monopole, dipole, and quadrupole contributions. I applied the method to complex case studies, including jet noise and blade–vortex interaction (BVI), demonstrating accurate reconstruction of the acoustic footprint within timeframes suitable for preliminary design and operational monitoring. I also coordinated the paper's preparation and presentation of the results.
Number of citations: 0

[C4] Serani, A., Palma, G., Wackers, J., and Diez, M., 2025, June, Preliminary Design Optimization for Internal Arrangement and Hull Geometry of a Bio-Inspired Autonomous Underwater Glider through Machine Learning. In XI International Conference on Computational Methods in Marine Engineering (MARINE 2025), 23-25 June 2025, Edinburgh, Scotland, UK, DOI: 10.23967/marine.2025.034;
Research focus: This work is directly relevant to naval architecture because it addresses the design and optimization of autonomous underwater gliders (AUGs). It integrates machine learning and multi-fidelity modelling to optimize the hull geometry, inspired by manta-ray morphology, and the internal payload arrangement. Core topics include hydrodynamics (efficiency, drag reduction, and manoeuvrability), hydrostatic design (buoyancy, centre-of-gravity positioning for attitude control, and buoyancy margins), and structural design. The use of advanced CFD solvers (RANS through OpenFOAM) and multidisciplinary design optimization (MDO) methods demonstrates the application of state-of-the-art tools to innovative marine design.
Personal contribution: I played a central role in developing the bi-level optimization framework. I also helped define the parametric model of the manta-ray-inspired geometry and implemented hydrostatic and structural analysis procedures for internal sizing. I contributed to analysing the optimal vehicle configuration, checking its consistency with hydrostatic constraints and mission objectives, and participated in the scientific discussion and manuscript review.
Number of citations: 0

[C5] Palma, G., Serani, A., Diez, M., Milano, C., Wang, Z., Park, S., Sarigul, D. O., and Stern, F., 2025, October. Bayesian Hankel Extended Dynamic Mode Decomposition for System Identification of

High-Speed Planing Hulls. In 2025 International Conference on Fast Sea Technology (FAST 2025), 29 October 2025, Norfolk, VA, U.S.A., DOI: https://doi.org/10.5957/FAST-2025-071.
Research focus: This work is highly relevant to the IIND-01/A disciplinary sector, specifically the hydrodynamics of high-speed planing hulls. It models the dynamic response of a generic prismatic planing hull (GPPH) in irregular waves. Advanced data-driven, model-free system-identification techniques—specifically Bayesian Hankel extended Dynamic Mode Decomposition with control (BHeDMDc)—reconstruct hull motions and forces in real time, even in the presence of strong nonlinearities associated with slamming in irregular seas. This approach is important for developing active-control systems and improving the safety and comfort of high-speed vessels in open water.
Personal contribution: As first author, I led the methodological development of the BHeDMDc framework, integrating Hankel extensions to account for system memory, nonlinear observables to model impulsive forces and motions, and Bayesian probabilistic uncertainty quantification. I processed data from numerical campaigns involving planing hulls, implemented the time-series prediction algorithms, and validated the model for both the forward problem (motion prediction) and the inverse problem (identification of forces acting on the hull). I also analysed the results and wrote the final manuscript.
Number of citations: 3

[C6] Colombo, G., Palma, G., Burghignoli, L., and Iemma, U., 2024, June. Numerical assessment of the correction defect induced by spacetime coordinate transformations in the design of a convective meta-device. In 30th AIAA/CEAS Aeroacoustics Conference, 4-7 June 2024, Rome, Italy.
Research focus: The study analyses the accuracy of coordinate transformations (Taylor and space-time transformations) used to adapt acoustic metamaterials to moving-flow conditions. Quantifying the resulting correction defect in terms of sound-field intensity and directivity is important for designing acoustic cloaks and other coatings intended to manipulate acoustic-scattering signatures. The work is relevant to naval architecture, particularly hydroacoustics, and could be transferred to onboard sensor protection following further development and adaptation.
Personal contribution: As co-author, I contributed to the theoretical framework for coordinate transformations and to the numerical framework used to simulate the cloaking device and assess its sensitivity to operating parameters. I helped implement numerical simulations and process the data to map the applicability limits of the analytical corrections, and contributed to discussion of the results.
Number of citations: 0

[C7] **Palma, G.**, Serani, A., Aram, S., Wundrow, D. W., Drazen, D., and Diez, M., 2025, June. Ship Motion Digital Twinning via Dynamic Mode Decomposition Approaches. In XI International Conference on Computational Methods in Marine Engineering (MARINE 2025), 23 – 25 June 2025, Edinburgh, Scotland, UK
Oral presentation only.

[C8] Meloni, S., Centracchio, F., Camussi, R., Iemma, U., Palma, G. and Bogey, C., 2024, June, An extensive near-field noise prediction of a subsonic jet using data-driven surrogate model based on neural networks. In 30th AIAA/CEAS Aeroacoustics Conference, 4-7 June 2024, Rome, Italy.
Research focus: The study develops artificial-neural-network (ANN) models to predict noise generated by turbulent flows, incorporating key parameters such as turbulence intensity and

boundary-layer thickness. These methods can be transferred directly to the study of noise radiated by marine propellers and waterjet propulsion systems, where understanding near-field noise and identifying turbulent sources are essential to reducing environmental noise impact and vessel detectability.

Personal contribution: As co-author, I contributed to developing the methodological framework for training data-driven surrogate models. I analysed the numerical database generated through high-fidelity LES and validated the neural networks' ability to capture nonlinear acoustic-field variations as a function of nozzle-exit boundary-layer conditions. I helped assess model performance in reconstructing pressure spectra and sound directivity and participated in discussion of the results.

Number of citations: 0

[C9] De Paola, E., Stoica, L.G., Di Marco, A., Camussi, R., Palma, G., Burghignoli, L., Iemma, U., Visingardi, A., Flamini, L., Pepelas, N., and Rusconi, F., 2024, June, Aerodynamic and Aeroacoustic Assessment of a Three-Propeller DEP Configuration: Insights from the VENUS Project. In 30th AIAA/CEAS Aeroacoustics Conference, 4-7 June 2024, Rome, Italy.

Research focus: This work is relevant to naval architecture, particularly hydrodynamics and hydroacoustics in complex propulsion systems. It experimentally investigates aerodynamic and acoustic interactions between multiple propellers in a distributed electric propulsion (DEP) configuration and the lifting surfaces. Such studies are important for designing innovative electrically or hybrid-propelled vessels, where interactions among propeller wakes, appendages, and the hull directly affect propulsion efficiency, vibration, and radiated noise. Microphone-array data processing (beamforming) and pressure-fluctuation characterization are key tools for reducing the acoustic signature of modern hulls.

Personal contribution: As co-author, I contributed to processing and interpreting the data collected during the extensive wind-tunnel experimental campaign and participated in discussion of the results.

Number of citations: 1

[C10] Palma, G., Burghignoli, L., and Iemma, U., 2023, September. Numerical modelling of a phase gradient lining using a metafluid model. In 10th Convention of the European Acoustics Association (Forum Acusticum 2023)**,** 11-15 September 2023, Turin, Italy.

Research focus: This work addresses naval hydroacoustics and environmental noise protection. It proposes acoustic metamaterials, modelled as metafluids with optimized inertia tensors and bulk moduli, for the internal lining of ducts. Although applied to aeronautical ducts in this study, the method can be transferred to the design of silencers and acoustic treatments for marine ventilation systems and engine exhaust and intake ducts. The ability to modify sound directivity and attenuate specific propagation modes is important for onboard acoustic comfort and reducing noise radiated into the surrounding environment.

Personal contribution: As first author, I developed the metafluid-theory-based numerical model to simulate interaction between the acoustic field and the phase-gradient lining. I implemented a simulation-based numerical optimization procedure to calibrate the metamaterial properties and minimize acoustic emission. I modelled the potential flow and duct modes, analysing how local impedance changes caused by the metadevice can redirect sound energy and reduce propagation.

I also analysed the numerical results, demonstrating the effectiveness of the phase-gradient lining in attenuating relevant tonal components.
Number of citations: 0

[C11] **Palma, G**., Flanagan, L., Burghignoli, L., and Kennedy, J., 2023, September. Numerical and experimental investigation of a phase gradient metasurface lining. In 10th Convention of the European Acoustics Association (Forum Acusticum 2023)**,** 11-15 September 2023, Turin, Italy.
Research focus: This work is of interest to naval architecture (IIND-01/A), particularly passive noise control in enclosed spaces and reduction of acoustic signatures. It investigates phase-gradient metasurfaces used as wall linings to absorb and manipulate sound waves. These technologies offer an advanced solution for acoustic treatment of marine ventilation ducts and sound insulation in machinery spaces, where compactness and strong low-frequency performance—characteristic of subwavelength metamaterials—are critical to onboard comfort and safety.
Personal contribution: As first author, I coordinated the study, led the numerical-modelling phase, and provided a proof of concept for integrating these devices into complex engineering systems. I implemented a reduced-order model (ROM) based on metacontinuum theory to simulate space-coiling cells using the finite element method (FEM). I also analysed results from the experimental campaign conducted in a grazing impedance tube, examining transmission coefficients and comparing measurements with numerical predictions. I wrote the manuscript as well.
Number of citations: 0

[C12] Stoica, L., G., Di Marco, A., and Camussi, R., de Paola, E., Iemma, U., Burghignoli, L., Palma, G., Paletta, N., Pepelas, N., Beretta, J., Visingardi, A., Pagano, A., Mingione, G., Izzo, C., Andreutti, G., Barbarino, M., Quagliarella, D., Vitagliano, P., Pasta, R., Flamini, L., and Rusconi, F., 2023, September. Venus project: investigation of distributed propulsion noise and its mitigation through wind tunnel experiments and numerical simulations. In 10th Convention of the European Acoustics Association (Forum Acusticum 2023)**,** 11-15 September 2023, Turin, Italy.
Research focus: This work addresses emerging naval-architecture topics related to innovative propulsion and noise-impact reduction. It investigates the integrated aerodynamic and acoustic design of distributed-propulsion systems, analysing interactions between multiple propellers and lifting surfaces. Such studies are important for new classes of electrically propelled vessels and the optimization of podded or waterjet propulsion systems, where wake management and interference between propulsion units determine hydrodynamic efficiency, onboard vibration, and underwater radiated noise.
Personal contribution: As co-author, my work specifically concerned designing and optimizing a noise-reduction device under strict budget and space constraints. I developed an optimization framework for microperforated panels with cavities arranged in series and parallel, to achieve high attenuation with reduced, subwavelength thickness, while incorporating geometric and manufacturing-cost constraints.
Number of citations: 5

[C13] Palma, G., Burghignoli, L., and Iemma, U., 2023, July. A framework for micro-perforated absorbers optimization. In 29th International Congress on Sound and Vibration (ICSV29), 9 - 13 July 2023, Prague.
Research focus: This work relates to hydroacoustics and onboard noise control in naval architecture. It presents a numerical optimization framework for designing advanced

microperforated absorbers (MPAs), overcoming the limitations of traditional homogeneous layouts. These technologies are valuable for acoustic treatment of sensitive spaces and ventilation ducts, where fire resistance, durability in saline environments, and the absence of particle release (a common issue with conventional sound-absorbing materials) are essential. The framework optimizes low-frequency performance and bandwidth, which are critical to reducing tonal noise generated by onboard machinery.
Personal contribution: As first author, I conceived and implemented the full optimization framework based on the Transfer Matrix Method (TMM). I developed an extended analytical model based on Maa's theory that accommodates complex configurations, including series/parallel arrangements and variable-section perforations. I integrated the model with numerical optimization algorithms to identify optimal construction parameters (hole diameter, panel thickness, and cavity depth) under prescribed geometric constraints. I validated the model against published data, demonstrating its ability to tailor absorption spectra to specific noise-insulation requirements.
Number of citations: 1

[C14] Colombo, G., Palma, G., Burghignoli, L., Iemma, U., 2023, Spacetime acoustic analogy for the assessment of convective correction of metacontinua, In 29th International Congress on Sound and Vibration (ICSV29), 9 - 13 July 2023, Prague.
Research focus:
Personal contribution:
Number of citations: 3

[C15] Vulpio, I., Burghignoli, L., Palma, G., Iemma, U., Serani, A. and Diez, M., 2023, June. An evolutionary variant of Q-learning applied to derivative-free optimization. In 2023 AIAA Aviation and Aeronautics Forum and Exposition (AIAA AVIATION Forum), 12-16 June 2023, San Diego, CA, USA.
Research focus: This work is methodologically relevant to naval architecture because it develops advanced multidisciplinary design optimization (MDO) tools. It proposes a machine-learning algorithm based on Evolutionary Q-learning for derivative-free optimization problems with high computational cost and multidimensional search spaces. Such algorithms are valuable for hull-form optimization, complex propulsion-system configuration, and weight management, where objective functions require expensive CFD simulations and identifying the global minimum is important to vessel efficiency and safety.
Personal contribution: As co-author, I contributed to developing and validating the EVQL algorithm, focusing on integrating evolutionary strategies to accelerate learning and improve accuracy. I helped define the reward parameters and carried out comparative numerical experiments against state-of-the-art algorithms.
Number of citations: 0

[C16] Colombo, G., Palma, G., Burghignoli, L., and Iemma, U., 2023, June. Assessment of the convective correction defect of metacontinua using spurious sources in the aeroacoustic spacetime. In 2023 AIAA Aviation and Aeronautics Forum and Exposition (AIAA AVIATION Forum), 12-16 June 2023, San Diego, CA, USA.
Research focus: This work is relevant to naval architecture through its focus on hydroacoustics and acoustic-cloaking technologies. It addresses performance degradation of metamaterials when the

surrounding fluid moves relative to the device, as occurs when a ship or submarine is under way. Design approaches based on Taylor and Prandtl–Glauert space-time coordinate transformations can recover some performance compared with designs that neglect fluid motion, although the correction is imperfect. The study quantifies and characterizes the resulting error sources in aeronautical applications, with strong potential for transfer to naval applications.

Personal contribution: As co-author, I contributed to the theoretical framework for isolating spurious terms in the equations of motion under convective conditions. I also helped numerically model the scattered field from cylinders coated with metamaterials, implementing different analytical corrections and evaluating the residual error. I participated in frequency-domain data analysis and in defining new metrics for acoustic directivity, and contributed to the critical discussion of the results and the final manuscript.

Number of citations: 3

[C17] **Palma, G.**, Meloni, S., Camussi, R., Iemma, U., and Bogey, C., 2023, June. Subsonic installed jet noise scattering prediction using BEM and an optimized wave-packet model. In 2023 AIAA Aviation and Aeronautics Forum and Exposition (AIAA AVIATION Forum), 12-16 June 2023, San Diego, CA, USA.

Research focus: This work is directly relevant to naval hydroacoustics, addressing interactions between propulsion-related acoustic sources and reflecting surfaces. The methodology combines low-order source models with boundary element method (BEM) solvers and can be applied to studying scattering of propeller- or waterjet-generated noise by the hull and appendages. It supports accurate prediction of sound-pressure levels near the hull, assessment of interference with onboard sensors, and optimization of shapes to reduce the overall acoustic signature, at computational costs compatible with preliminary design.

Personal contribution: As first author, I developed a wave-packet source model capable of representing both the hydrodynamic and acoustic nature of pressure fluctuations. I optimized the model parameters using high-fidelity LES databases, integrated the source into the BEM code, and conducted numerical simulations to validate predictions of installation effCFU. I analysed the results and wrote the scientific paper.

Number of citations: 1

[C18] **Palma, G.**, Pasquali, C., Poggi, C., Burghignoli, L., and Serafini, J., 2022, June, A greenery-based solution for low-noise delivery hub for unmanned aerial transport. In Second International Symposium on Noise from UAVs UASs and eVTOLs (Quiet Drones 2022), 27-30 June 2022, Online Symposium.

Research focus: This work concerns the design of logistics-interface infrastructure and mitigation of environmental noise impact. It develops a model to study the acoustic shielding performance of natural barriers using an equivalent-porous-medium approach. The method is applicable to port and coastal engineering for low-noise logistics hubs and passenger terminals, where green solutions can reduce noise pollution from loading/unloading operations and automated transport systems (UAVs/UGVs) in port areas.

Personal contribution: As first author, I developed the conceptual-design framework for the delivery hub. My main contribution was modelling natural barriers as porous media; I also implemented and ran BEM–FEM-coupled numerical simulations to assess shielding effectiveness (insertion loss) under different operating scenarios. I analysed the spectral results and defined

design constraints to ensure compliance with noise-pollution regulations in urban and industrial areas. I also wrote the manuscript.
Number of citations: 0

[C19] **Palma, G.,** Meloni S., Camussi R., Iemma, U., and Bogey C.,2022, June. A Multi-Objective Optimization of a Wave-Packet Model Using Near-Field Subsonic Jet Data. In 28th AIAA/CEAS Aeroacoustics 2022 Conference, 14-17 June 2022, Southampton, England, UK.
Research focus: This work is relevant to naval architecture in hydroacoustics and fluid–structure interaction. It develops a wave-packet model to describe large-scale turbulent structures responsible for pressure fluctuations in a jet. Although applied to subsonic jets, the methodology can be transferred to naval-propulsor wakes (propellers and waterjets) and their impact on the hull. Accurate near-field pressure modelling through multi-objective optimization is essential for predicting propulsor-induced hull vibration and noise radiated into accommodation and other sensitive spaces.
Personal contribution: As first author, I conceived and implemented the multi-objective optimization framework for calibrating the source-model parameters. I processed pressure data from high-fidelity LES, defined objective functions to balance near-field and far-field accuracy, analysed the results, and wrote the scientific paper in full.
Number of citations: 3

[C20] Colombo, G., Palma, G., and Iemma, U., 2022, September. Validation of analytic convective corrections for metacontinua in the aeroacoustic spacetime. In 28th International Congress on Sound and Vibration (ICSV28), 24 - 28 July 2022, Singapore.
Research focus: The study validates space-time transformations (Taylor and Prandtl–Glauert) for analytically correcting metamaterial designs so that they retain their sound-wave manipulation properties when moving relative to the surrounding fluid. It is relevant to naval hydroacoustics because, with appropriate adaptation, it can be applied to acoustic devices such as cloaks and absorbers operating in a moving medium. These methods are important for low-acoustic-signature hull design and hydrophone optimization, where fluid motion and acoustic propagation interact and cannot be treated independently.
Personal contribution: As co-author, I contributed to the theoretical development and numerical validation of the acoustic-metafluid model under convective conditions. I implemented analytical corrections in the numerical solver and defined comparative tests at different Mach numbers. I also analysed and discussed the results and contributed to writing the paper.
Number of citations: 5

[C21] Vulpio, I., Burghignoli, L., Palma, G., Iemma, U., Serani, A. and Diez, M., 2022, July. Use of Reinforcement Learning for Multifidelity Optimization in Multiply-connected Trust Regions. In 28th International Congress on Sound and Vibration (ICSV28), 24 - 28 July 2022, Singapore.
Research focus: This work has methodological significance for naval architecture, addressing multidisciplinary design optimization (MDO). It introduces a framework combining reinforcement learning with surrogate models of different fidelities. This approach is valuable for naval design, including hull and appendage optimization, where low-cost, lower-fidelity data (such as potential-flow models) must be combined with more accurate but expensive data (CFD RANS/LES). Trust regions help minimize the number of costly simulations required.

Personal contribution: As co-author, I contributed to developing the learning algorithm for managing trust regions. My work focused on devising the strategy for intelligently selecting sample points to construct the surrogate model.
Number of citations: 1

[C22] **Palma, G.,** Burghignoli, L., Marchese, V. and Iemma, U., 2022, July. Implementation of a dual surface regularization technique in aca-based bem solver. In 28th International Congress on Sound and Vibration (ICSV28), 24 - 28 July 2022, Singapore.
Research focus: This work is methodologically relevant to naval architecture because it develops efficient numerical solvers for hydroacoustics and external fluid dynamics. It optimizes the boundary element method (BEM), a standard tool for studying acoustic scattering and hydrodynamic loads on hulls and appendages. Adaptive Cross Approximation (ACA) reduces memory requirements for high-frequency problems, while the Dual Surface method regularizes the solution by eliminating spurious-frequency instabilities. These features support accurate simulations of complex naval geometries with lower computational cost and runtime.
Personal contribution: As first author, I developed the algorithms and integrated ACA and Dual Surface techniques into the in-house BEM solver. I implemented the hierarchical matrix-block structure for low-rank compression and formulated a regularization of the exterior problem that avoids hypersingular integrals, which are typical of the Burton–Miller method. I validated the solver on classical benchmarks (a rigid sphere), demonstrating accuracy and convergence at critical frequencies while substantially improving computational efficiency.
Number of citations: 1

[C23] Centracchio, F., Burghignoli, L., Palma, G., Cioffi, I. and Iemma, U., 2021, August. Noise shielding surrogate models using dynamic artificial neural networks. In 50th International Congress and Exposition of Noise Control Engineering (INTER-NOISE 2021), 1 - 5 August 2021, Online.
Research focus: This work forms part of a research line on digitalization and simulation-based design in naval architecture. It develops dynamic surrogate models based on machine-learning architectures. Such methods are important for complex optimization problems in which repeated evaluations of objective functions—such as resistance or acoustic signature—using CFD or BEM codes would be prohibitively expensive. Self-tuning neural networks can be used to build efficient digital twins for real-time prediction of vessel performance.
Personal contribution: As co-author, I contributed to defining the computational framework and analysing the sensitivity of the network hyperparameters, including the number of neurons and hidden layers.
Number of citations: 3

[C24] **Palma, G.**, Centracchio, F., and Burghignoli, L., 2021, July. Optimized metamaterials for enhanced noise shielding of innovative aircraft configurations. In 27th International Congress on Sound and Vibration (ICSV27), 11-16 July 2021, Online.
Research focus: This work has cross-cutting methodological relevance to naval architecture, focusing on advanced materials for acoustic-field control. It develops an approach based on metacontinua, in which macroscopic material properties are engineered to achieve unconventional refraction and reflection. In naval applications, these methods can support next-generation anechoic coatings and acoustic-cloaking systems, redirecting incident waves and

substantially reducing a vessel's acoustic signature by optimizing the spatial distribution of material properties.
Personal contribution: As first author, I conceived and implemented the numerical optimization framework for synthesizing phase-gradient metasurfaces and benchmarked the approach. I developed a computational model based on equivalent metafluids to overcome the computational limits of direct microstructure simulation. I used optimization algorithms to determine the optimal distributions of bulk modulus and mass density, validated the device's ability to redirect wave energy away from sensitive regions, analysed the results, and wrote the manuscript.
Number of citations: 8

[C25] Palma. G., Cioffi, I., Centracchio, F., Burghignoli, L., and Iemma, U., 2019, May. Steering of Acoustic Reflection from Metasurfaces through Numerical Optimization. In 25th AIAA/CEAS Aeroacoustics Conference, 20-23 May 2019, Delft, Netherlands.
Research focus: The study develops a numerical optimization method for designing metasurfaces that manipulate reflected wavefronts according to the generalized Snell's law. It is highly relevant to naval architecture, especially hydroacoustics and acoustic signatures. Transfer of the method to naval applications could support stealth hull design and submarine coatings, where redirecting sound energy (e.g. sonar pulses) into non-specular directions can reduce detectability. The approach overcomes constraints of conventional geometries and offers compact, subwavelength solutions that can be integrated into hull structures.
Personal contribution: As first author, I designed and implemented the numerical optimization procedure for synthesizing the geometric parameters of elementary cells (space-coiling units). I developed a computational model to map metasurface phase response and integrated a search algorithm to maximize reflection efficiency at prescribed anomalous angles. I tested design robustness across frequencies, showing that optimization can broaden the operating range beyond standard analytical configurations, and wrote the full paper.
Number of citations: 4

[C26] Iemma, U. and **Palma, G.,** 2019, July. SpaceTime-bending transformations in aeroacoustics. In 26th International Congress on Sound and Vibration (ICSV 2019), 7-11 July 2019, Montreal, Canada.
Research focus: This work introduces methodological innovation in continuum mechanics and wave-field modelling (disciplinary sector IIND-01/A). It reinterprets acoustic convection in terms of curvature in aeroacoustic space-time, using tools from Lorentzian differential geometry. This provides a rigorous theoretical basis for studying signal and disturbance propagation around moving bodies—including ships and submarines—and relates spatial variation in the fluid velocity potential to the metric properties of the space through which the wave propagates. This expertise is valuable for advanced prediction models in which the interaction between vehicle kinematics and the wave field is dominant.
Personal contribution: As co-author, I contributed to defining the analytical framework for constructing the metric associated with the fluid velocity field.
Number of citations: 4

[C27] Iemma, U. and **Palma, G.**, 2019, July. Optimization of metasurfaces for the design of noise trapping metadevices. In 26th International Congress on Sound and Vibration (ICSV 2019), 7-11 July 2019, Montreal, Canada.

Research focus: The study describes metamaterial-based devices for controlling acoustic disturbances in ducts through anomalous reflections induced by surface phase gradients. This methodology can be applied to innovative hydroacoustic silencers for intake ducts, exhaust systems, and onboard ventilation systems, helping reduce noise emitted into the external environment.
Personal contribution: As co-author, I contributed to the numerical model used to simulate the acoustic field in a duct containing phase-gradient metasurfaces and carried out numerical simulations. I validated the modular metadevice concept and analysed how the geometric configuration affCFU wave trapping. I also wrote the manuscript.
Number of citations: 9

[C28] Iemma, U., **Palma, G.**, Rice, H., and Burghignoli, L., 2018 July. Numerical acoustic characterisation of a Kelvin cell structure under normal and grazing incidence. In 25th International Congress on Sound and Vibration 2018 (ICSV 2018), 8-12 July 2018, Hiroshima, Japan.

Research focus: The study analyses highly porous lattices designed to combine very low weight with acoustic-manipulation capabilities. These methods can be applied in naval architecture to develop advanced multifunctional materials that provide both structural support and acoustic or vibration-signature reduction, for example in bulkheads, hull coatings, or machinery mounts. Understanding their interaction with grazing flows is also important when designing surfaces exposed to hydrodynamic flow, such as hulls and appendages.
Personal contribution: As co-author, I helped define the parametric-analysis framework and carried out frequency-domain numerical acoustic simulations using the finite element method (FEM). I also contributed to discussion of the results and manuscript preparation.
Number of citations: 0

[C29] Iemma, U. and Palma, G., 2017 August. Analogue transformation acoustics in aeronautics. In 46th International Congress and Exposition on Noise Control Engineering (INTER-NOISE 2017), August 27–30, 2017, Hong Kong, China.
Research focus: The work explores the theoretical and numerical foundations of acoustic modelling in flows, a key topic in naval hydroacoustics. It examines the physical consistency of coordinate transformations used to design metamaterials such as cloaks and lenses by assessing whether the resulting flow field satisfies fluid-dynamics equations. This expertise is essential for designing low-signature devices and surface treatments for hulls and appendages.
Personal contribution: As co-author and corresponding author, I contributed to developing the analytical framework for assessing the consistency of analogue transformation acoustics with potential-flow theory. I implemented a method using curved structured grids to map material properties and carried out numerical tests to verify formal equation invariance in the presence of convection. I helped demonstrate that conformal transformations used to manipulate acoustic flows violate the physical constraints of the background fluid. I also contributed to the manuscript and analysis of the results.
Number of citations: 6

[C30] Iemma, U. and **Palma, G.**, 2017, July. Aeroacoustic Design of Metafluid Devices. In 24th International Congress on Sound and Vibration (ICSV 2017), 23-27 July 2017, London, UK.

Research focus: The work introduces design criteria for advanced hydroacoustic devices operating in flow. It addresses the limitations of Standard Transformation Acoustics (STA), which cannot be applied when the medium or obstacle is moving. The proposed method adjusts the mechanical properties of metafluids (bulk modulus and density) to preserve device performance, for example in cloaking or shielding, under convective conditions. It can be transferred to acoustic scattering from moving hulls and to the development of appendages that are acoustically invisible to sonar.
Personal contribution: As co-author, I contributed to the theoretical framework based on Taylor coordinate transformations for deriving convective corrections. My work covered both theory and computation: I helped implement an original integral formulation of the problem (Boundary Integral Equation), solved using an extended boundary element method (BEM). I also carried out simulations, analysed the results, and contributed to writing the manuscript.
Number of citations: 8

[C31] Iemma, U., Marchese, V., Serani, A., and Palma, G., 2016, July. Optimal design of phononic crystals using higher-order boundary elements and a swarm optimization scheme. In 23rd International Congress on Sound and Vibration (ICSV23), 10-14 July 2016, Athens, Greece.
Research focus: The study investigates the effect of periodic structures on acoustic-field control through a simulation-based design optimization (SBDO) approach to identify optimal structural geometric parameters.
Personal contribution: As co-author, I contributed to integrating the BEM solver with the Deterministic Particle Swarm Optimization (DPSO) algorithm. I also helped analyse the results and prepare the manuscript.
Number of citations: 0

Qualifications

D. Professional Experience

[D1] **Associate Professor, University of Cagliari, Department of Mechanical, Chemical and Materials Engineering**, Via Marengo 2, 09123 Cagliari, Italy; course taught: Naval Architecture, 120 teaching hours, 12 CFU credits, disciplinary sector IIND-01/A (scientific-disciplinary group 09-IIND-01), within the Bachelor's degree programme in Naval Engineering at the Olbia campus; 1 October 2026–present.

[D2] **Casual Work Agreement, National Research Council (CNR), Institute of Marine Engineering (CNR-INM)**, formerly the Italian Ship Model Basin (INSEAN), Via di Vallerano 139, 00128 Rome, Italy; development and testing of subroutines for real-time prediction of heterogeneous variables in the ship's digital twin within the PLUM project (Predictive Learning and Uncertainty for Marine Digital Twins). Activities included curating and organizing data from experiments and/or operations of the research vessel Gaia Blu; developing subroutines for system-state prediction, system identification, and real-time knowledge extraction; and defining and conducting tests to assess accuracy and execution speed; 10 March–10 September 2026.

[D3] **Level III Researcher (fixed-term contract), National Research Council (CNR), Institute of Marine Engineering (CNR-INM)**, formerly the Italian Ship Model Basin (INSEAN), Via di Vallerano 139, 00128 Rome, Italy; research on data-driven models and digital twins for marine and maritime

engineering, including prediction-uncertainty estimation; participation in research projCFU funded by the Ministry of University and Research through the National Recovery and Resilience Plan (NRRP/PNRR), by national research projCFU of significant interest (PRIN), and by the US Navy Office of Naval Research; 1 March 2024–28 February 2026.

[D4] **Adjunct Lecturer, University of Tuscia, Department of Economics, Engineering, Society and Business (DEIM)**; course: Fluid Machinery and Propulsion, 72 teaching hours, 9 CFU credits, disciplinary sector ING-IND/08 (scientific-disciplinary group 09/IIND-01), within the Industrial Engineering degree programme, Aeronautical Maintenance Sciences and Technologies curriculum; academic year 2023–2024.

[D5] **Research Fellow, Roma Tre University, Department of Civil, Computer Science and Aeronautical Technologies Engineering**, Via della Vasca Navale 79, 00146 Rome, Italy; development of advanced methods for dynamic and adaptive surrogate modelling based on experimental and simulation databases; 1 January 2023–28 February 2024.

[D6] **Research Fellow, Roma Tre University, Department of Engineering**, Via della Vasca Navale 79, 00146 Rome, Italy; implementation of parallel-computing techniques on distributed, shared-memory, and GPU-based architectures for a boundary-integral-equation solver based on hierarchical matrices, and integration into the AcouSTO+ computing environment; 1 December 2019–31 December 2022.

[D7] **Researcher (coordinated and continuous collaboration contract), Department of Engineering**, Via della Vasca Navale 79, 00146 Rome, Italy; implementation of hierarchical-matrix management in a BEM code; 1 April 2018–31 January 2019.

[D8] **Occasional consultancy contract, RadioLabs – University–Industry Consortium – Radio Communications Laboratories**, Corso d'Italia 19, 00198 Rome, Italy; modelling train dynamics and simulating data from inertial sensors; 1–31 October 2016.

[D9] **Visiting PhD student, Trinity College Dublin, Department of Mechanical, Manufacturing & Biomedical Engineering**, Parsons Building, Dublin 2, Ireland; research on acoustic metamaterials for aeronautical applications, development of numerical simulation methods, and experimental activities from design through additive-manufacturing production and impedance-tube testing under flow; participation in projCFU funded by the European Commission under Horizon 2020; 7 January–18 February 2019.

[D10] **Visiting Student, Boston University, College of Engineering**, 44 Cummington Mall, Boston, MA 02215, USA; work towards the MSc thesis in Aeronautical Engineering on acoustic metamaterials for aeronautical applications; 22 September 2015–29 February 2016.

E. Awards

[E1] **Lazio Region, performance-based grants for researchers and research fellows** to strengthen their professional position and enhance the Lazio research system; Policy Objective 4, "A More Social Europe"; specific objective f; European Social Fund Plus (ESF+) Programme 2021–2027 (SIGEM

code 22009D). Awarded funding of EUR 2,000 under Executive Decision G12467 of 27 September 2022.

[E2] **Roma Tre University, Department of Engineering, PhD scholarship**, 32nd doctoral cycle; 1 November 2016–31 October 2019.

[E3] **Roma Tre University, Department of Engineering, International Mobility Scholarship**, academic year 2015–2016.

F. Honours and Recognition

[F1] **Research Task Group AVT-351, "Enhanced Computational Performance and Stability & Control Prediction for NATO Military Vehicle" (2020–2024);** nominated for a Panel Excellence Award.

[F2] **Research Task Group proposal AVT-436, following on from Exploratory Team AVT-ET-256, "Stability & Control and Loads Predictions of NATO Military Vehicles" (2025);** Research Group Co-Chair.

G. Research Project Leadership and Responsibilities, Industrial Contracts, Work Packages and Tasks

[G1] **CNMS – Sustainable Mobility Center (National Centre for Sustainable Mobility), Spoke 3: Waterways;** funding body: Ministry of University and Research; programme: National Recovery and Resilience Plan (PNRR), Mission 4, Component 2, Investment 1.4 (M4C2), public call for proposals to strengthen research infrastructure and establish national R&D champions in selected Key Enabling Technologies (MUR Decree DD No. 3138 of 16 December 2021, corrected by DD No. 3175 of 18 December 2021), project CN00000023, CUP B43C22000440001. Total funding: EUR 319,922,088.03; Spoke 3 funding: EUR 12,730,267.00; Open Call funding: EUR 2,285,714.00; CNR funding: EUR 2,391,537.00. Funding allocated to the operating unit: INM funding of EUR 1,909,121.72. **Task Leader for Task 4.2**, "Digital Twin technologies for hydrodynamic and structural ship responses, maintenance, and safe operations"; activities focus on developing and testing learning models for digital twins of seakeeping and manoeuvrability.

[G2] **CNMS – Sustainable Mobility Center (National Centre for Sustainable Mobility), Spoke 3: Waterways;** funding body: Ministry of University and Research; programme: National Recovery and Resilience Plan (PNRR), Mission 4, Component 2, Investment 1.4 (M4C2), public call for proposals to strengthen research infrastructure and establish national R&D champions in selected Key Enabling Technologies (MUR Decree DD No. 3138 of 16 December 2021, corrected by DD No. 3175 of 18 December 2021), project CN00000023, CUP B43C22000440001. Total funding: EUR 319,922,088.03; Spoke 3 funding: EUR 12,730,267.00; Open Call funding: EUR 2,285,714.00; CNR funding: EUR 2,391,537.00. Funding allocated to the operating unit: INM funding of EUR 1,909,121.72. **Task Leader for Task 4.3**, "Data integration and Decision Support System"; the task concerns the design and implementation of an ICT data-integration platform and development of a decision-support system.

H. Participation in Research ProjCFU and Industrial Contracts

[H1] **ML-4D – Hydro-Structural Data-Driven MF-MDA of High-Speed Small Crafts via Multi-Loop Digital Design;** funding body: US Department of the Navy, Office of Naval Research, University of Iowa sub-award, Grant No. 14260318. Total project funding: USD 1,750,000; CNR funding: USD 250,000. Activities: implementation and validation of analytical and numerical models for simulation and study of design-relevant phenomena; design and implementation of algorithms and computational codes for data analysis and technical problem-solving; processing of complex datasets, including input-data preparation, monitoring of computations, and critical interpretation of results; preparation of specialist reports, technical documents, and publications to communicate results; active participation in working groups and joint activities with external organizations, providing technical support towards shared objectives. From 1 April 2025–present. *Related scientific output:* international conference proceedings [A2, C2, C5].

[H2] **DAPHNE – Data-Driven, Physics-Based, and Equation-Free Multi-Fidelity Reduced Order Models for Fast and Accurate Predictions of Naval Ship Transient Maneuvers in Calm Water and Waves;** funding body: US Department of the Navy, Office of Naval Research Global, Grant No. N62909-24-1-2102. Total project funding: USD 249,000. Activities: implementation and validation of analytical and numerical models for simulation and study of design-relevant phenomena; design and implementation of algorithms and computational codes for data analysis and technical problem-solving; processing of complex datasets, including input-data preparation, monitoring of computations, and critical interpretation of results; preparation of specialist reports, technical documents, and publications to communicate results; active participation in working groups and joint activities with external organizations, providing technical support towards shared objectives. From 19 August 2024–present. *Related scientific output:* peer-reviewed journal articles [A4, A5, A6, A7, A9] and international conference proceedings [C1, C2, C5, C7].

[H3] **FORWARD – Improving Knowledge, Prediction, and Forecasting of Ships in Waves via Hybrid Machine Learning Methods;** funding body: US Department of the Navy, Office of Naval Research Global, Grant No. N62909-21-1-2042. Total project funding: USD 180,000. Activities: development, testing, and optimization of methods based on modal decomposition, applied to test cases relevant to the NATO Applied Vehicle Technology (AVT) community. 1 March–1 July 2024. *Related scientific output:* peer-reviewed journal articles [A5, A6, A7] and international conference proceedings [C1].

[H4] **PLUM – Predictive Learning and Uncertainty for Marine Digital Twins;** funding body: internally funded project of the National Research Council – Institute of Marine Engineering. Activities: implementation and validation of analytical and numerical models for simulation and study of design-relevant phenomena; design and implementation of algorithms and computational codes for data analysis and technical problem-solving; processing of complex datasets, including input-data preparation, monitoring of computations, and critical interpretation of results; preparation of specialist reports, technical documents, and publications to communicate results; active participation in working groups and joint activities with external organizations, providing technical support towards shared objectives. From 15 November 2025–present. *Related scientific output:*

peer-reviewed journal articles [A2, A4, A5, A6, A7, A9] and international conference proceedings [C1, C2, C4, C5, C7].

[H5] **GAIA-TWIN – Digital Twinning of Research Vessel Gaia Blu for Enhanced Ship Response Monitoring and Prediction;** funding body: internally funded project of the National Research Council – Institute of Marine Engineering. Research-unit member; participation in data-collection campaigns; development of algorithms and computational code for data acquisition and analysis; development of code for data-driven predictions; processing of complex datasets, including input-data preparation, monitoring of computations, and critical interpretation of results; preparation of specialist reports, technical documents, and publications to disseminate results. From 7 June 2025–present. *Related scientific output:* international conference proceedings [C1, C7].

[H6] **CNMS – Sustainable Mobility Center (National Centre for Sustainable Mobility), Spoke 3: Waterways;** funding body: Ministry of University and Research; programme: National Recovery and Resilience Plan (PNRR), Mission 4, Component 2, Investment 1.4 (M4C2), public call for proposals to strengthen research infrastructure and establish national R&D champions in selected Key Enabling Technologies (MUR Decree DD No. 3138 of 16 December 2021, corrected by DD No. 3175 of 18 December 2021), project CN00000023, CUP B43C22000440001. Total funding: EUR 319,922,088.03; Spoke 3 funding: EUR 12,730,267.00; Open Call funding: EUR 2,285,714.00; CNR funding: EUR 2,391,537.00. Funding allocated to the operating unit: INM funding of EUR 1,909,121.72. Research-unit member; development of computational code for data-driven predictions; processing of complex datasets, including input-data preparation, monitoring of computations, and critical interpretation of results; preparation of specialist reports, technical documents, and publications to disseminate results. At the National Research Council – Institute of Marine Engineering; 1 March 2024–28 February 2026. *Related scientific output:* peer-reviewed journal articles [A4, A5, A6, A7, A9] and international conference proceedings [C1, C2, C5, C7].

[H7] **BIODRONES – Biomimetic and Innovative Optimized Hydrodynamic Concepts of High-Efficiency Underwater Gliding Drones for Ocean Research;** funding body: Ministry of University and Research (co-funded); programme: PRIN – ProjCFU of Relevant National Interest, 2022 Call, project 20227JNM52, CUP B53D23005560006. Total project funding: EUR 255,294 (EUR 197,481 from MUR); funding allocated to the operating unit: EUR 89,833 (EUR 66,899 from MUR). Research-unit member; development of code for automatic generation of parametric geometries and of the design and optimization workflow for biomimetic underwater gliders; preparation of specialist reports, technical documents, and publications to disseminate results. At the National Research Council – Institute of Marine Engineering; 1 March 2024–28 February 2026. *Related scientific output:* peer-reviewed journal articles [A3, A8] and international conference proceedings [C4].

[H8] **ENODISE – ENabling Optimized DISruptivE Airframe-propulsion Integration Concepts;** funding body: European Commission; programme: Horizon 2020, H2020-EU.3.4 – Societal Challenges – Smart, Green and Integrated Transport; call: H2020-MG-2019-TwoStages; topic: LC-MG-1-5-2019 – Advancements in aerodynamics and innovative propulsion systems for quieter and greener aircraft; funding scheme: RIA – Research and Innovation Action. Total project funding: EUR 5,000,000; funding allocated to the operating unit: EUR 350,000; Grant Agreement No. 860103. Research-unit member at Roma Tre University; 1 June 2020–28 February 2024. https://cordis.europa.eu/project/id/860103*Related scientific output:* peer-reviewed journal

articles [A10, A11, A15] and international conference proceedings [C3, C8, C16, C18]. https://cordis.europa.eu/project/id/860103

[H9] **VENUS – inVestigation of distributEd propulsion Noise and its mitigation through wind tUnnel experiments and numerical Simulations;** funding body: European Commission; programme: Horizon 2020, H2020-EU.3.4 – Societal Challenges – Smart, Green and Integrated Transport; call: H2020-CS2-CFP10-2019-01; topic: JTI-CS2-2019-CFP10-THT-08 – Experimental and numerical noise assessment of distributed propulsion configurations; funding scheme: RIA – Research and Innovation Action. Total project funding: EUR 2,282,875; funding allocated to the operating unit: EUR 750,500; Grant Agreement No. 886019. Research-unit member; development and use of computational codes for the design and optimization of innovative acoustic treatments for distributed-propulsion wings; complex-dataset processing; preparation of specialist reports, technical documents, and publications to disseminate results. At Roma Tre University; 1 April 2020–30 September 2023. https://cordis.europa.eu/project/id/886019*Related scientific output:* international conference proceedings [C9, C12, C13]. https://cordis.europa.eu/project/id/886019

[H10] **ANIMA – Aviation Noise Impact Management through Novel Approaches;** funding body: European Commission; programme: Horizon 2020, H2020-EU.3.4 – Societal Challenges – Smart, Green and Integrated Transport; call: H2020-MG-2017-SingleStage-INEA; topic: MG-1-2-2017 – Reducing aviation noise; funding scheme: RIA – Research and Innovation Action. Total project funding: EUR 7,479,618; funding allocated to the operating unit: EUR 308,250; Grant Agreement No. 769627. Research-unit member at Roma Tre University; 1 October 2017–31 December 2021. https://cordis.europa.eu/project/id/769627*Related scientific output:* peer-reviewed journal articles [A16], book chapters [B1], and international conference proceedings [C17, C21]. https://cordis.europa.eu/project/id/769627

[H11] **ARTEM – Aircraft Noise Reduction Technologies and Related Environmental Impact;** funding body: European Commission; programme: Horizon 2020, H2020-EU.3.4 – Societal Challenges – Smart, Green and Integrated Transport; call: H2020-MG-2017-SingleStage-INEA; topic: MG-1-2-2017 – Reducing aviation noise; funding scheme: RIA – Research and Innovation Action. Total project funding: EUR 7,498,742.50; funding allocated to the operating unit: EUR 339,817.50; Grant Agreement No. 769350. Research-unit member; development and use of computational codes for the design, optimization, and response prediction of innovative acoustic metamaterials; complex-dataset processing; preparation of specialist reports, technical documents, and publications to disseminate results. At Roma Tre University; 1 December 2017–31 May 2022. https://cordis.europa.eu/project/id/769350*Related scientific output:* peer-reviewed journal articles [A17] and international conference proceedings [C22, C23]. https://cordis.europa.eu/project/id/769350

[H12] **AERIALIST – Advanced Aircraft-Noise-Alleviation Devices Using Metamaterials;** funding body: European Commission; programme: Horizon 2020, H2020-EU.3.4 – Societal Challenges – Smart, Green and Integrated Transport; call: H2020-MG-2016-Two-Stages; topic: MG-1-4-2016-2017 – Breakthrough innovation; funding scheme: RIA – Research and Innovation Action. Total project funding: EUR 2,424,330; funding allocated to the operating unit: EUR 485,000; Grant Agreement No. 723367. Research-unit member; development and use of computational codes for the design, optimization, and response prediction of innovative acoustic metamaterials; complex-

dataset processing; preparation of specialist reports, technical documents, and publications to disseminate results. At Roma Tre University; 1 June 2017–31 May 2020. https://cordis.europa.eu/project/id/723367*Related scientific output:* peer-reviewed journal articles [A12, A13, A14, A18, A19, A20, A21, A22] and international conference proceedings [C6, C10, C11, C15, C19, C24, C25, C26, C27, C28, C29]. https://cordis.europa.eu/project/id/723367

I. Editorial and Scientific Committee Appointments

[I1] **Editorial Board Member of International Journals**

a. Guest Editor for the journal Applied Science, for the Special Issue entitled "Advancements in Aerodynamics and Aeroacoustics: Addressing Installation EffCFU", with a particular focus on innovative aeronautical configurations and technologies to mitigate noise caused by installation effCFU and interactions between the propulsion system and the airframe.

[I2] **Reviewer for Scholarly Journals**

a. Scientific Reports (Nature)
b. Journal of Sound and Vibration (Elsevier)
c. AIAA Journal (American Institute of Aeronautics and Astronautics)
d. Acta Acustica (EDP Sciences)
e. Applied Sciences (MDPI)
f. International Journal of Mechanical Sciences (Elsevier)
g. Ocean Engineering (Elsevier)
h. Energy (Elsevier)
i. Journal of Ship Research (SNAME)

J. Scientific Event Organization

[J1] **Co-Chair, 28th AIAA/CEAS Aeroacoustics 2022 Conference**, 14-17 June 2022, Southampton, England, UK, Session: Jet Aeroacoustics VI: Jet Noise Modeling.

[J2] **Co-Chair**, **26th International Congress on Sound and Vibration (ICSV 2019)**, 7-11 July 2019, Montreal, Canada, Session: Structured Session T05 Ss03 - Sound Propagation In Curvilinear Spacetime.

K. Technical Committees and Working Groups

[K1] **Co-Chair, NATO Science and Technology Organisation, Applied Vehicle Technology Panel, Research Task Group AVT-436 "Stability & Control and Loads Predictions of NATO Military Vehicles" (2026–present); responsible for all group activities, with particular focus on maritime vehicles.**

[K2] **Technical Team Member, NATO Science and Technology Organisation, Applied Vehicle Technology Panel, Exploratory Team AVT-ET-256 "Stability & Control and Loads Predictions of NATO Military Vehicles" (2025); particularly involved in activities concerning maritime vehicles.**

[K3] **Technical Team Member, NATO Science and Technology Organisation, Applied Vehicle Technology Panel, Research Task Group AVT-399 "Assessment of Experiments and Prediction Methods for Naval Ship Transient Maneuvers in Calm Water and Waves" (2025–present).**

[K4] **Technical Team Member, NATO Science and Technology Organisation, Applied Vehicle Technology Panel, Research Task Group AVT-404 "Enhanced Design Processes of Military Vehicles through Machine Learning Methods" (2025–present); responsible for group activities, with particular focus on maritime vehicles.**

[K5] **Technical Team Member, NATO Science and Technology Organisation, Applied Vehicle Technology Panel, Research Task Group AVT-351 "Enhanced Computational Performance and Stability & Control Prediction for NATO Military Vehicle" (2020–2024); particularly involved in activities concerning maritime vehicles.**

[K6] **Technical Team Member**, NATO Science and Technology Organization, Applied Vehicle Technology, **AVT-318 "Low noise aeroacoustic design for turbofan powered NATO air vehicles"** (2019-2023);

M. Invited Presentations at International Conferences

[M1] Palma, G., Serani, A., Aram, S., Wundrow, D. W., Drazen, D., and Diez, M., 2025, June. Ship Motion Digital Twinning via Dynamic Mode Decomposition Approaches. In XI International Conference on Computational Methods in Marine Engineering (MARINE 2025), 23 – 25 June 2025, Edinburgh, Scotland, UK; invited by Dr. Laura Mainini

[M2] Serani, A., Palma, G., Wackers, J., and Diez, M., 2025, June, Preliminary Design Optimization for Internal Arrangement and Hull Geometry of a Bio-Inspired Autonomous Underwater Glider through Machine Learning. In XI International Conference on Computational Methods in Marine Engineering (MARINE 2025), 23-25 June 2025, Edinburgh, Scotland, UK. Invited by Dr. Andrea Serani

[M3] Colombo, G., Palma, G., and Iemma, U., 2022, September. Validation of analytic convective corrections for metacontinua in the aeroacoustic spacetime. In 28th International Congress on Sound and Vibration (ICSV28), 24 - 28 July 2022, Singapore; invited by Prof. Woon Siong Gan

[M4] Palma, G., Centracchio, F., and Burghignoli, L., 2021, July. Optimized metamaterials for enhanced noise shielding of innovative aircraft configurations. In 27th International Congress on Sound and Vibration (ICSV27), 11-16 July 2021, Online; invited by Prof. Woon Siong Gan

[M5] Iemma, U. and Palma, G., 2019, July. SpaceTime-bending transformations in aeroacoustics. In 26th International Congress on Sound and Vibration (ICSV 2019), 7-11 July 2019, Montreal, Canada; invited by Prof. Woon Siong Gan

[M6] Iemma, U. and Palma, G., 2019, July. Optimization of metasurfaces for the design of noise trapping metadevices. In 26th International Congress on Sound and Vibration (ICSV 2019), 7-11 July 2019, Montreal, Canada; invited by Prof. Woon Siong Gan

[M7] Iemma, U., Palma, G., Rice, H., and Burghignoli, L., 2018 July. Numerical acoustic characterisation of a Kelvin cell structure under normal and grazing incidence. In 25th International Congress on Sound and Vibration 2018 (ICSV 2018), 8-12 July 2018, Hiroshima, Japan; invited by Prof. Woon Siong Gan

[M8] Iemma, U. and Palma, G., 2017, July. Aeroacoustic Design of Metafluid Devices. In 24th International Congress on Sound and Vibration (ICSV 2017), 23-27 July 2017, London, UK; invited by Prof. Woon Siong Gan

[M9] Iemma, U., Marchese, V., Serani, A., and Palma, G., 2016, July. Optimal design of phononic crystals using higher-order boundary elements and a swarm optimization scheme. In 23rd International Congress on Sound and Vibration (ICSV23), 10-14 July 2016, Athens, Greece. ; invited by Prof. Woon Siong Gan

N. Other Invited Presentations

[N1] "Adaptive multi-fidelity surrogate modeling for the efficient exploration of design and operational spaces", seminar for students enrolled in the MSc programme in Aeronautical Engineering, Department of Civil, Computer Science and Aeronautical Technologies Engineering, Roma Tre University; invited by Professor Umberto Iemma, 11 May 2024.

O. Teaching Experience

[O1] **Associate Professor, University of Cagliari, Department of Mechanical, Chemical and Materials Engineering (DIMCM)**; course: Naval Architecture, 120 teaching hours, 12 CFU credits, disciplinary sector IIND-01/A (scientific-disciplinary group 09-IIND-01), within the Bachelor's degree programme in Naval Engineering at the Olbia campus.

[O2] **Adjunct Lecturer, University of Tuscia, Department of Economics, Engineering, Society and Business (DEIM)**; course: Fluid Machinery and Propulsion, 72 teaching hours, 9 CFU credits, disciplinary sector ING-IND/08 (scientific-disciplinary group 09/IIND-01), within the Industrial Engineering degree programme, Aeronautical Maintenance Sciences and Technologies curriculum; academic year 2023–2024.

[O3] **Teaching support**, Department of Engineering, Roma Tre University, for the Aircraft Structural Design course taught by Professor Umberto Iemma as part of the Bachelor's degree programme in Aeronautical Engineering, academic years 2016–2024.

[O4] **Teaching support**, Department of Engineering, Roma Tre University, for the Rational Mechanics course taught by Professor Umberto Iemma as part of the Bachelor's degree programme in Mechanical Engineering, academic years 2016–2024.

P. Student Supervision

[P1] **Master's degree or pre-reform degree students**

a. Giorgia Casini, academic year 2022–2023, thesis co-supervisor, Roma Tre University

b. Serghei Scibilia, academic year 2022–2023, thesis co-supervisor, Roma Tre University

c. Giulia Gargioli, academic year 2020–2021, thesis co-supervisor, Roma Tre University

d. Alessandro Onorati, academic year 2019–2020, thesis co-supervisor, Roma Tre University

[P2] **Bachelor's degree students**

a. Augusto Santopietro, academic year 2021–2022, thesis co-supervisor, Roma Tre University

b. Andrea Sette, academic year 2021–2022, thesis co-supervisor, Roma Tre University

c. Georgia Galvano, academic year 2019–2020, thesis co-supervisor, Roma Tre University

d. Diana Zagarella, academic year 2019–2020, thesis co-supervisor, Roma Tre University

e. Pierpaolo Rosati, academic year 2018–2019, thesis co-supervisor, Roma Tre University

f. Marta Silighini, academic year 2016–2017, thesis co-supervisor, Roma Tre University

g. Michele Caroppo, academic year 2016–2017, thesis co-supervisor, Roma Tre University

S. Education and Training

[S1] **PhD in Industrial Engineering, Roma Tre University**, Department of Engineering; doctoral thesis entitled "Aeroacoustics of metacontinua" (supervisor: Professor Umberto Iemma); 1 November 2016 – 21 April 2020 (XXXII doctoral cycle).

[S2] **Training course: "Introduction to Parallel Computing with MPI and OpenMP", CINECA Interuniversity Consortium for Automatic Computing**; 27–29 May 2019.

[S3] **Training course: "Introduction to modern Fortran", CINECA Interuniversity Consortium for Automatic Computing**; 26 February – 1 March 2018.

[S4] **MSc in Aeronautical Engineering, Roma Tre University**; thesis entitled "Development of tools for aeroacoustic analysis of periodic structures" (supervisor: Professor Umberto Iemma); final grade: 110/110 with honours; 1 October 2012 – 21 March 2016.

[S5] **English-language certification: TOEFL iBT, C1 level** (Reading: 30/30, Listening: 28/30, Speaking: 24/30, Writing: 27/30; final score: 109/120), May 2015.

[S6] **Degree in Mechanical and Industrial Engineering, Roma Tre University**; thesis entitled: "Ottimizzazione di sorgenti elementari per la stima del rumore prodotto da un turbofan" (Optimization of elementary sources for estimating turbofan noise) (supervisor: Professor Umberto Iemma; co-supervisor: Dr Lorenzo Burghignoli); final grade: 105/110; 1 October 2007–25 July 2012.

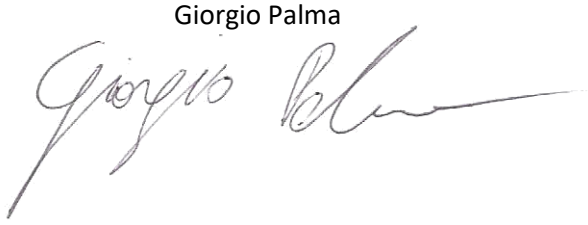
U. Professional Qualifications

[U1] **National Scientific Qualification for appointment as Associate Professor in Competition Sector 09/A1 – Aeronautical, Aerospace and Naval Engineering**; valid from 8 July 2024 to 8 July 2036.

[U2] **Qualified to practise as an engineer and registered with the Order of Engineers of the Province of Rome**; registration number A38612, Section A; Industrial sector.

Bibliometric Indicators

***h*-index**: 11 (Google Scholar) https://scholar.google.com/citations?user=lU3X3_MAAAAJ&hl=it&oi=ao
10 (Scopus) https://www.scopus.com/authid/detail.uri?authorId=57191197956
9 (Web of Science) https://www.webofscience.com/wos/author/record/1048761

I authorize the processing of the personal data contained in this CV pursuant to Legislative Decree 101/2018 and the GDPR (EU Regulation 2016/679).

Rome, 15 October 2026 Giorgio Palma