Editorial

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Biographical notes: Antonio F. Miguel currently holds an Associate Professor position (with Habilitation) with the Department of Physics, School of Science and Technology, University of Évora, Portugal, and a senior researcher at Institute of Earth Sciences (pole of Evora), Portugal. He received his BSc and MSc from the University of Évora, Portugal. In 1994, he attended graduate school at WU-R, the Netherlands, completing his PhD in 1998. His research covers interdisciplinary physics and applied physics: fluid dynamics, thermodynamics, heat transfer, design of complex flow systems, and pedestrian dynamics.

Luiz Alberto Oliveira Rocha is an Invited Professor in the Mechanical Engineering Graduate Program at Federal University of Rio Grande do Sul, Brazil, and is a senior invited researcher at Institute of Earth Sciences (pole of Evora), Portugal. He works in thermodynamics, fluid mechanics, and heat transfer, mainly on the following topics: energy and exergy analysis, alternative/renewable energies, and constructal theory and design.

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Andreas Öchsner is a Full Professor of Lightweight Design and Structural Simulation and the Vice Dean for Research at Esslingen University of Applied Sciences, Germany. After completing his Dipl-Ing in Aeronautical Engineering at the University of Stuttgart in 1997, he served as a research and teaching assistant at the University of Erlangen-Nuremberg from 1997 to 2003 while pursuing his Doctor of Engineering Sciences (Dr-Ing). From 2003 to 2006, he was an Assistant Professor in the Department of Mechanical Engineering and Head of the Cellular Metals Group affiliated with the University of Aveiro, Portugal. He spent seven years (2007–2013) as a Full Professor in the Department of Applied Mechanics, Technical University of Malaysia. From 2014 to 2017, he was a Full Professor at the School of Engineering, Griffith University, Australia, and the Head of Discipline and Program Director of Mechanical Engineering.

Fluid flow and heat transfer are key concepts in many areas of natural science and engineering. Advances in these fields are critical in the design, analysis, and optimisation of a wide range of systems and processes, with applications ranging from power production, environmental engineering, renewable energy, and energy efficiency, to medical applications, and so on. A broad range of research is covered by fluid flow and heat transfer, including theoretical mathematical modelling, numerical simulation, and experimental investigations.

This special issue is dedicated to current achievements in this very broad topic and features a selection of papers presented during the special session 'Fluid flow, energy transfer, and design' of the 19th International Conference on Diffusion in Solids and Liquids (DSL-2023) held in Heraklion, Crete (Greece). The goal of the papers in this special issue, *New Trends and Advances in Fluid Flow and Heat Transfer* is to provide the reader with an overview of the work about trends and advances in fluid flow and heat transfer presented at the special session.

The paper of Razera et al. (2024) studied numerically the structural design of a system with mixed convection heat transfer flows over heated semi-elliptical devices arranged in a horizontally oriented channel. It is a multi-objective problem that is evaluated using the technique for order preference by similarity to the ideal solution. This method enabled the attainment of recommendations for designing the intruded fins, considering numerous circumstances where fluid dynamic and thermal goals are dominating.

Cunegatto et al. (2024) investigated the optimisation of the geometry of a passive micromixer. In light of the constructal design method, computational fluid dynamics is used for simulations of created second-order metamodels, which are then used in the technique for multi-objective optimisation. The micromixer has five degrees of freedom, which is used to maximise the mixing ratio while minimising the pressure drop across it. The integrative methodology employed in this study yielded a precise selection of the best options for micromixer design.

Thermal energy storage can help reduce energy consumption in HVAC systems by addressing the temporal delay between production and demand. Latent thermal energy storage (LTES) systems using phase change materials (PCMs) are a promising alternative to classic sensible heat storage methods. The paper of Naldi et al. (2024) investigates experimentally the energy performance of an LTES. Identifying the correct water mass flow rate optimises heat transmission and maximises thermal energy utilisation in the LTES.

Samad et al. (2024) performed a study on an air-cooled condenser with porous lattice P-cell structures on the air side made from an aluminium alloy (AlSi10Mg) powder by selective laser melting. The interior flow channels for increased R134a condensation were constructed with triangular cross-sections. Experiments were done to assess the condenser's thermohydraulic performance. Among other findings, the viability of employing SLM to create a strong air-cooled condenser for high-pressure operation is demonstrated.

Kurz et al. (2024) conducted a study involving the application of shallow water equations to represent the flow of incompressible fluid in dam breaches. The solution is obtained through the finite element method (FEM). The characteristic-based split (CBS) scheme is employed for temporal resolution, incorporating modifications to the advective term. Spatial interpolation is carried out using linear triangular elements on unstructured meshes. The water flow is analysed in the four different forms of dam breaches.

The editors express our gratitude to the authors for their hard work in preparing the manuscripts. We thank the reviewers for their thoughtful comments. Thanks are also due to Anne and Albert Ang, submission manager and webmaster of IJHM. Last but not least, we are very grateful to Professor Liang Yan, the Editor-in-Chief of the *International Journal of Hydromechatronics* (*IJHM*), for his ongoing valuable assistance and help. We hope that the studies in this special issue will spur additional basic research in the fields of fluid flow and heat transfer.