Computer Modeling in Engineering & Sciences

Tech Science Press

https://doi.org/10.32604/cmes.2026.083154

EDITORIAL

Introduction to the Special Issue on Scientific Computing and Its Application to Engineering Problems

Higinio Ramos[1,2,*] **and M Chandru**[3,*]

[1]Department of Applied Mathematics, University of Salamanca, Salamanca, Spain
[2]Escuela Politécnica Superior de Zamora, University of Salamanca, Campus Viriato, Zamora, Spain
[3]Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology, Vellore, India

*Corresponding Authors: Higinio Ramos. Email: higra@usal.es; M Chandru. Email: leochandru@gmail.com

Received: 30 March 2026; Accepted: 02 April 2026; Published: 27 April 2026

Scientific computing has become a cornerstone of modern scientific discovery and engineering innovation. With the rapid advancement of computational power and numerical algorithms, problems that were once analytically intractable can now be studied through accurate simulations and large-scale numerical experiments. Scientific computing provides a bridge between mathematical theory, computational algorithms, and real-world engineering applications, enabling researchers to model complex phenomena such as fluid flow, structural deformation, wave propagation, stochastic processes, and nonlinear dynamical systems. The special issue entitled "Scientific Computing and Its Application to Engineering Problems" was conceived to bring together high-quality research contributions that demonstrate the role of computational mathematics in solving challenging engineering problems. The issue highlights both theoretical advances in numerical methods and their practical deployment in real-world engineering scenarios, with emphasis on robustness, computational efficiency, stability, and scalability.

Engineering systems are inherently complex, often governed by nonlinear differential equations, stochastic influences, multiscale interactions, and complicated geometries. Analytical solutions to such systems are rarely available, and even when they exist, they may not be suitable for practical engineering design or optimization. Scientific computing addresses this gap by providing numerical tools for approximation, simulation, and prediction. The motivation behind this special issue stems from the growing demand for reliable and efficient computational frameworks capable of supporting emerging technologies such as smart infrastructure, autonomous navigation, environmental monitoring, advanced manufacturing, and energy systems.

The contributions included in this special issue reflect the breadth and depth of contemporary research in scientific computing applied to engineering problems. A study on the numerical simulation of acoustic wave equations in isotropic-heterogeneous media demonstrates the use of parallel computing architectures, achieving significant computational acceleration through GPU-based implementations [1]. This highlights the growing importance of high-performance computing in solving large-scale engineering problems. Structural analysis is further advanced through the development of a new isogeometric finite element method that integrates B-spline geometry with classical finite element analysis to achieve higher-order continuity and improved computational accuracy [2]. Such approaches enhance precision in modeling complex structural systems.

Scientific computing also plays a critical role in fluid dynamics and environmental modelling. One of the articles examines the radiative flow of Casson–micropolar fluid between parallel plates while incorporating

pollutant concentration and particle deposition effects [3]. Numerical simulations are used to analyze the influence of various physical parameters on velocity, temperature, and concentration fields, offering valuable insights for environmental engineering and industrial heat and mass transfer processes. Advancements in state estimation and navigation are also prominently featured. Robust navigation filters based on the maximum correntropy criterion combined with variational Bayesian inference have been proposed to improve adaptability in the presence of non-Gaussian noise [4]. Complementary work develops a multi-kernel bandwidth-based maximum correntropy extended Kalman filter for GPS navigation, achieving enhanced estimation accuracy and robustness in dynamic environments [5].

In the domain of statistical process control, a contribution derives explicit formulations for the average run length of a modified Exponentially Weighted Moving Average control chart under seasonal autoregressive models [6]. By employing integral equation techniques, the study provides both theoretical insight and computational tools for monitoring industrial processes characterized by autocorrelation and seasonal variation. Further, Coastal and offshore engineering applications are addressed through a study investigating the interaction of oblique waves with dual curved-leg pontoon floating breakwaters using advanced numerical modelling techniques [7]. The work evaluates hydrodynamic performance and wave attenuation characteristics for different configurations, demonstrating that optimized structural design can significantly enhance wave dissipation while maintaining structural stability. Recent work also explores the optimization of conformal lattice structures through an angle-constrained optimization approach, enabling the design of lightweight yet mechanically robust lattice-based components [8]. This contribution reflects the growing intersection of computational methods with advanced manufacturing and materials engineering.

The articles in this special issue collectively highlight emerging trends in scientific computing, including the integration of data-driven approaches with traditional numerical models, the increasing use of high-performance computing and parallel architectures, and the growing importance of advanced geometric modelling techniques. These developments underscore the expanding role of scientific computing in enabling innovation across engineering disciplines.

All submitted manuscripts underwent a rigorous peer-review process in accordance with the standards of Computer Modeling in Engineering & Sciences. The editorial team carefully evaluated each contribution to ensure scientific quality, originality, and relevance to the theme of the special issue. The final selection of papers represents a balanced combination of theoretical innovation and practical engineering applications.

The guest editors express their sincere gratitude to all authors who contributed their high-quality research to this special issue. We also thank the reviewers for their constructive comments and careful evaluations, which significantly improved the clarity and quality of the published articles. Finally, we acknowledge the editorial office for their continuous support and professional handling of the submission and publication process.

Acknowledgement: The authors acknowledge the use of ChatGPT (OpenAI) for assistance in drafting and refining the language of this editorial manuscript. All content was reviewed and approved by the authors, who take full responsibility for the final version.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Altybay A, Tokmagambetov N. Numerical simulation and parallel computing of acoustic wave equation in isotropic-heterogeneous media. Comput Model Eng Sci. 2024;141(2):1867–81. doi:10.32604/cmes.2024.054892.
2. Su P, Chen J, Yang R, Xiang J. A new isogeometric finite element method for analyzing structures. Comput Model Eng Sci. 2024;141(2):1883–905. doi:10.32604/cmes.2024.055942.

3. Alhamzi G, Alkahtani B, Dubey R, Kalleshachar V, Nizampatnam N. Impact of pollutant concentration and particle deposition on the radiative flow of Casson-micropolar fluid between parallel plates. Comput Model Eng Sci. 2025;142(1):665–90. doi:10.32604/cmes.2024.055500.
4. Jwo D, Chang Y, Cho T. A robust GNSS navigation filter based on maximum correntropy criterion with variational Bayesian for adaptivity. Comput Model Eng Sci. 2025;142(3):2771–89. doi:10.32604/cmes.2025.057825.
5. Biswal A, Jwo D. Multi-kernel bandwidth based maximum correntropy extended Kalman filter for GPS navigation. Comput Model Eng Sci. 2025;144(1):927–44. doi:10.32604/cmes.2025.067299.
6. Supharakonsakun Y, Areepong Y, Silpakob K. Explicit ARL computational for a modified EWMA control chart in autocorrelated statistical process control models. Comput Model Eng Sci. 2025;145(1):699–720. doi:10.32604/cmes.2025.067702.
7. Palanisamy J, Muthusamy C, Ramos H. Numerical modelling of oblique wave interaction with dual curved-leg pontoon floating breakwaters. Comput Model Eng Sci. 2025;145(2):2017–38. doi:10.32604/cmes.2025.071958.
8. Yan J, Xu W, Wang F, Huo S, Yan K. A novel angle-constrained optimization method of conformal lattice structures. Comput Model Eng Sci. 2026;146(2):1–10. doi:10.32604/cmes.2026.076948.