
Preface to the UKACM 2023 Special Issue

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It is with pleasure to present the UKACM 2023 special issue. The 2023 Annual Conference of the UK Association for Computational Mechanics (UKACM 2023) was hosted by the University of Warwick during 19-21 April 2023 and was attended by researchers from over 30 UK and overseas institutions. With over 70 presentations including keynotes, invited talks and topical sessions as well as Q&As, the conference provided an excellent forum for exchanging ideas on recent advances in different areas related to computational mechanics methods. Following the conference, selected authors were invited to extend their conference papers and submit them for publication in a special issue of the European Journal of Computational Mechanics. The completed special issue includes four papers on different computational mechanics topics.

The first paper by Ricketts et al. (2024) investigates the impact of spatially varying boundary conditions due to material heterogeneity in the numerical simulations. It proposes a novel method to apply heterogeneous boundary conditions, especially focusing on moisture transport in unsaturated soils. The method uses Gaussian random fields to model material variability and applies scaled boundary conditions using macro-elements to account for local effects. This approach is validated through simulations, showing that it leads to more natural and realistic system responses compared to traditional methods. The method can be integrated into existing computational codes and is adaptable to various physical systems.

The second paper by Wirawan et al. (2024) proposes a fast fracture plane orientation angle (FPOA) search algorithm for the Puck 3D failure criterion used to assess the failure of composite materials. Traditional methods for determining the FPOA, like the Stepwise Search Method (SSM), are

computationally expensive. The proposed algorithm significantly reduces the computational time by up to 5 times compared to the SSM while maintaining accuracy. It achieves this by utilizing fewer iterations and implementing a more efficient search process. The algorithm was integrated into the finite element analysis code and validated through simulations, demonstrating its effectiveness in predicting failure in composite materials.

The third paper by Haskins et al. (2024) explores methods to estimate passive drag during swimming using both experimental towing and computational simulations via OpenFOAM. Ten athletes were towed at various velocities, with drag forces measured and compared to existing literature. Simulations were run using the immersed boundary method (IBM), and results were generally consistent but slightly over-predictive compared to experimental data. The study highlights the importance of geometry accuracy and mesh refinement in the simulations. It concludes that IBM is a promising tool for passive drag estimation, despite some limitations, and suggests improvements for future work on active drag prediction.

The fourth and last paper of the special issue by Thomas and Ahangar Asr (2024) explores the impact of branched cut-off walls on seepage and uplift forces in dam foundations through numerical modeling. By incorporating branches at various angles on either side of a 12-meter deep vertical cut-off wall, the study demonstrates that the branches reduce seepage and uplift pressure under the dam. The optimal angle for reducing seepage is found to be within the 60–70 degrees range, with the best position being at the dam's heel. Further analyses showed that altering the branch length and position also significantly affected seepage and uplift pressure, offering practical solutions for improving dam stability.

We would like to express our appreciation to all the authors for their valuable contributions and to the reviewers for their careful and constructive feedback, which have helped bring this special issue to completion. We hope that the papers included offer useful insights and serve as a helpful resource for further research and progress in the field of computational mechanics.

References

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