COMPUTATIONAL FLUID MECHANICS FOR MEDICAL INTERVENTIONS

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ABSTRACT

Computational Fluid Mechanics (CFM) has become an essential tool for understanding biomechanics and is increasingly central to the design and delivery of medical interventions. Data-enhanced CFM now spans physics-informed neural networks, image-based reconstruction of patient-specific geometries, surrogate and reduced-order models. This Minisymposium aims to bring together researchers working at the interface of CFM, data-driven optimisation methods, and clinical medicine, with the explicit goal of bridging methodological developments and real-world medical impact. Topics of interest include but are not limited to: image-to-mesh uncertainty; patient-specific inlet/outlet condition uncertainty; assumed material property; Fluid–structure coupling instability and hemodynamic/mechanical validation. Contributions are particularly encouraged that demonstrate close collaboration with clinicians, address regulatory and validation requirements, engage with industry partners developing medical technologies. Methodological contributions are equally welcomed, including hybrid physics–data models, machine-learning-accelerated solvers, multiscale and multiphysics frameworks, image-to-simulation pipelines, and verification, validation, and uncertainty quantification tailored to medical applications. By bringing together computational methodologists, biomedical engineers, and clinical researchers, the session will foster cross-disciplinary discussion on how to accelerate the path from algorithmic innovation to bedside impact. We invite contributions presenting novel methods, large-scale validation studies, and translational case studies that illustrate the role of data-enhanced CFM in shaping the next generation of medical interventions. The Minisymposium will provide a forum for state-of-the-art results, identification of open challenges, and the building of international collaborations across this rapidly evolving field.

REFERENCES

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