RECENT DEVELOPMENTS IN MODEL ORDER REDUCTION FOR CARDIOVASCULAR MODELING

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ABSTRACT

Cardiovascular (CV) modeling is a critical interdisciplinary research field that enhances the understanding of physiological and flow-field characteristics, particularly in patient-specific contexts [1, 2]. However, the high computational demand associated with these simulations hinders their applicability in clinical real-time scenarios. To address this challenge, Model Order Reduction (MOR) techniques have emerged as a promising approach to obtaining precise results within a competitive time frame by approximating the full-order model, while retaining the essential dynamics of the system [3].

This minisymposium aims to explore recent advancements in MOR techniques specifically designed for patient-specific simulations of CV flows, highlighting their applications and potential clinical implications. Reduced simulations face various challenges, such as complex geometries, multiphysics and multiscale modeling, accurate boundary conditions, blood rheology, and other factors that necessitate the integration of numerical methods with sophisticated MOR techniques. Therefore, we invite discussions on a wide range of topics, including but not limited to advanced discretizations and numerical methods, surrogate modeling, reduced basis methods, proper orthogonal decomposition, non-linear MOR techniques, data assimilation, inverse problems, optimal flow control, and data-driven approaches. These topics should be explored in the context of their applications to cardiac electromechanics, blood fluid dynamics, and cardiovascular fluid-structure interaction (FSI) problems. By fostering collaboration and sharing novel insights, we aim to collectively advance the state-of-the-art in both MOR techniques and their application in cardiovascular research.

REFERENCES

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