COMPUTATIONAL CARDIOLOGY: MATHEMATICAL MODELING, NUMERICAL METHODS AND SIMULATION

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ABSTRACT

Mathematical modeling and simulation are increasingly applied to enhance our understanding of the cardiovascular system, assist therapeutic planning and support clinical decision making [1, 2]. Indeed, the results of numerical simulations may allow to obtain clinically relevant quantities with higher resolution than conventional techniques, providing complementary insight to conventional diagnostic methods. In this respect, the development of digital twins of the heart and cardiovascular system may offer an invaluable platform for the virtual experimentation of therapies and medical devices, as well as allow highly personalized treatment based on physics-informed models of each individual patient. Models of this kind are particularly challenging due to the need to couple multiple physical models (including e.g. electrophysiology, biomechanics, fluid dynamics, perfusion models), which have different spatiotemporal characteristic scales and physical fidelity requirements, leading to mathematical systems which are multiphysics and multiscale [3].

This minisymposium welcomes contributions about recent developments in this area. These include novel approaches to mathematical modeling and numerical methods for the cardiovascular system, techniques for data assimilation and patient-specific personalization of computational models, and high-performance computing applied to cardiovascular simulations. Furthermore, we encourage contributions that demonstrate applications of computational methodologies to problems of clinical relevance.

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