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MIXED-DIMENSIONAL MODELS FOR IN-SILICO BIOMECHANICS

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ABSTRACT

Mixed-dimensional PDEs represent coupled problems involving lower-dimensional manifolds or sub-manifolds of one or many domains. From a mathematical approximation perspective, mixed-dimensional PDEs (MD-PDEs) are connected to reducing the complexity of modeling and computations by utilizing model order reduction techniques. These techniques exploit the heterogeneity of scales present in different components or regions of the overall problem. In simpler terms, MD-PDEs often arise when applying dimensional or topological model order reduction. This modeling approach has been applied to real problems of paramount importance in the sciences, including materials science, geo-sciences, and life sciences. For instance, one successful example of MD-PDEs is the simulation of blood flow and transport in complex vascular networks spanning different spatial scales, from small perforating arteries and arterioles, through capillaries, up to venules [1]. The computational modeling framework needs to account for the specificities of the scales involved with sufficient detail while being efficient and accurate. Other notable examples in the context of biomechanics include the simulation of biomedical devices or the enhancement of advanced imaging techniques such as magnetic resonance elastography. In this mini-symposium, we aim to address the forefront of current research on MD-PDEs, focusing on the mathematical formulation and the approximation of advanced applications in biomechanics.

REFERENCES

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