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Multiscale Finite element models with Poromechanics for Myocardial Blood Perfusion

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Computational cardiac models are promising tools to enhance the design of clinical trials and aid cardiovascular surgeons in decision making during interventional therapies. Multiscale haemodynamic models are gaining popularity to evaluate perfusion in a virtual environment both in healthy and diseased patients. Failure of a heart is usually induced by a mismatch between blood perfusion and metabolic needs of the cardiomyocytes. Because heart failure is associated with blood perfusion and present day computational models do not address this failure mechanism, there is an urgent need for a computational strategy for blood perfusion in deforming myocardial tissue. The computational models on myocardial blood perfusion rely on the finite element method specifically to estimate how perfusion is altered in patients before during, and after various treatment modalities.
Upscaling of the vessel trees to a continuum opens the way to computation of coronary blood flow in a multi compartment poro-mechanical model of the beating heart. The porous mechanics models of myocardial perfusion approximate blood pressure and perfusion distributions reliably even on a coarse grid with first order elements. On the other hand, higher order elements are essential to mitigate errors in volumetric blood flow rate estimation. The aim of the study is to compare the multi scale finite element models used in computational analysis of myocardial perfusion with parameter optimization sensitivity analyses. The findings show how selection of appropriate models and their couplings can improve its applicability in the treatment development for cardiovascular conditions.

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Time Block Preference

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Participation

In person

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