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An efficient collocation method for cardiac muscle simulations

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Numerical simulations in cardiac precision medicine [1] are promising tools for therapeutic intervention planning but, as they are computationally demanding, the applicability is limited.

Isogeometric analysis has already been proven as an effective technique for cardiac thin-film modeling [2] whereas further improvements in the spatial discretization of 3D topologies can still be addressed. To this end, we propose a new isogemetric collocation approach for electrophysiological analysis that can be extended to coupled electromechanical simulations, as shown in preliminary results.

Through numerical examples, we demonstrate that the strong formulation (i) unifies the various spatial discretization strategies employed for the ionic current term [3], (ii) easily models tissue composed by different cell types [4], and (iii), in staggered solution schemes, enables efficient schemes for the mechanical sub-problem coarsening.

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