Nonlinear thermoporoelasticity for a thermodynamically consistent ablation framework

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Abstract: Mathematical modeling of cardiac ablation is a very challenging problem, as it involves a wide range of different physics, such as mechanics, fluid dynamics, and heat transfer. In this talk we will see how to apply the theory of nonlinear thermoporoelastic media to model cardiac ablation in a way that is valid under large deformations. This approach generalizes previous ablation models, as it unifies them within a single thermodynamical framework. It further allows for a more precise modeling of the perfusion-driven heat sink.

This models poses several modeling and numerical difficulties, so beyond a detailed explanation of the model we will focus on (i) the computation of a reference configuration that is equilibrium and (ii) a numerical scheme that adequately captures the mechanical feedback on the porous media. Numerical tests will be used to verify the proposed theory.