

Analysis and control in poroelastic systems with applications to biomedicine

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Abstract

Abstract: Fluid flows through deformable porous media are relevant for many applications in biology, medicine and bio-engineering, including tissue perfusion, fluid flow inside cartilages and bones, and design of bioartificial organs. Mathematically, they are described by quasi-static nonlinear poroelastic systems, which are implicit, degenerate, coupled systems of partial differential equations (PDE) of mixed parabolic-elliptic type. We answer questions related to tissue biomechanics via well-posedness theory, sensitivity analysis, and optimal control for the poroelastic PDE coupled systems mentioned above. One application of particular interest is perfusion inside the eye and its connection to the development of neurodegenerative diseases.