

# INF-SUP THEORY FOR THE BIOT EQUATIONS. PART 1: ANALYSIS

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We present a new analysis for the quasi-static Biot equations, which models the flow of a Newtonian fluid inside an elastic porous medium. The main unknowns are the displacement of the elastic medium and the pressure of the fluid. The presented analysis is based on the Banach-Necas Theorem and thus implies existence of a unique solution for data with minimal regularity. Moreover, the resulting variational setting may guide the design and analysis of quasi-optimal finite element methods, which will be presented in another talk by Pietro Zanotti.

After an introduction to the Biot problem, we shall discuss the existing existence and uniqueness analysis for the Biot problem and their limitations. In particular, we consider the required data regularity and compare it with the naively expected regularity. From the gained insight, we will fix a norm for the ‘naive’ test-spaces and prove inf-sup stability of the bilinear form thereby fixing the norm on the trial spaces. It turns out that the controlled trial norm defines a slightly bigger trial space compared to previous results; an example shows that the inclusion is strict.

Last but not least, we shall present a regularity ‘shift’ theorem for certain parameter configurations.

*Joint work with Pietro Zanotti (Università degli Studi di Pavia, Italy).*