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L-scheme and Newton method based solvers for a nonlinear BIOT model

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Poromechanics, i.e. fully coupled porous media flow and mechanics have several societal important applications including geothermal energy, CO_2 sequestration or oil recovery. A typical mathematical model for poromechanics is the quasi-static, linear Biot model, see e.g. [4]. Nevertheless, the linearity assumption is not valid in many practical situations and extension of the model should be considered.

In this work we propose efficient numerical methods for a nonlinear Biot model [2]. The Bulk modulus (Lame coefficient) and the fluid compressibility are nonlinear functions satisfying certain assumptions. Different discretization methods will be considered [1, 8]. We use the L-scheme, see e.g. [5, 6] or the Newton method for linearization, either monolithically or combined with a fixed stress type splitting [1, 3, 4, 7].

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