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Poroelasticity derived via asymptotic homogenization - Mathematical modelling and numerical simulations. State of the art, further perspectives, and extension to poroelastic composites

The mechanical behavior of a solid elastic structure interplaying with fluid percolating its pores can be studied via the Theory of Poroelasticity. There exists a large variety of scenarios of interest that can be treated by means of a poroelastic modeling approach, including soil mechanics, (bio) artificial constructs and biological tissues, such as bone, organs, healthy and malignant (tumorous) cell aggregates. Here, we (a) revisit the equations of poroelasticity derived via asymptotic homogenization [I], (b) focus on recent applications of the theory [II, V], and (c) we discuss recent advances on the subject which are relevant for linear and nonlinear poroelastic composites [III, IV]. These latter are materials where the average distance between the various matrix constituents is comparable with the porescale.

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