# Homogenization of nonlinear effects in poroelastic media with large contrast in skeleton elasticity and self-contact at pore level

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The paper contributes to the asymptotic homogenization-based multiscale modelling of some nonlinear effects in fluid-saturated porous structures consisting of a strongly heterogeneous elastic skeleton and one, or more fluid pore systems. Periodic microstructures are constituted by elastic skeleton composed of a stiffer core supporting very soft parts interacting directly with a viscous fluid flowing in the pore systems. The aim is to explore influence of the "large contrast" in the skeleton elasticity on the fluid-structure interaction (FSI) affected also by possible collapse of the pore lumen (at the microscopic level). The latter phenomena requires to consider the unilateral "self-contact" at the pore level [1]. The large contrast is related to the so-called scaling ansatz in the context of the asymptotic homogenization (AH); in the soft part of the skeleton, the elasticity is proportional to the scale parameter which is involved in the AH. Such a scaling ansatz of the mesoscopic material parameters can be justified using different micromodels associated with the two mesoscopic components [2]. By the consequence, in the "homogenization limit" the FSI is represented at the micro-scale (in contrast with the "standard"case of a given fixed elasticity), affecting also the (friction-less) unilateral formulation involving also the local pore pressure fluctuations. It is shown that the dynamic hydraulic permeability depends on the pore geometry and also on the soft elastic structure response, such that the derived homogenized model describing visco-poro-elastodynamics is featured by a strong wave dispersion. The model is extended for the nonlinearity due to respecting the equilibrium in the deforming configuration, c.f. [3, 4]. The considered porous material is motivated by the situation in perfused tissues under pulsating flow causing peristaltic deformation and, thereby, inducing a secondary pore fluid flow. Numerical issues and related model-order reduction challenges are discussed.

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