Macroscopic characterization of fluid-saturated microstructures within the framework of the Theory of Porous Media.

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ABSTRACT

Porous media often have a very complex heterogeneous microstructure. Even today, the simulation of such materials with respect to a full resolution of the microstructure is almost impossible due to exceeding computational costs.

The Theory of Porous Media (TPM) is a possible single scale formulation to control this problem. This theory allows the representation of all involved constituents via a continuum mechanical homogenization including volume fractions and internal interaction quantities as friction forces or mass exchanges, see [1], [2] and [3].

An alternative is the incorporation of a homogenization procedure within a multiscale approach. Assuming a scale separation between the two appearing scales, the micro- and macroscale, and applying a FE^2-scheme allows for the resolution of representative volume elements which are attached to each macroscopic point, see [4]. A crucial point of this method is the appropriate choice of characteristics for the unit cell on the microscale. Especially in the application to coupled problems these properties are important for the quality of the overall results, cf. [5].

A promising approach to benefit from both methods is to use the TPM within a multiscale analysis [6]. Following this idea, the talk focuses on the determination of appropriate saturated porous unit cells to obtain representative properties for the macroscale. The influence of different macroscopic quantities driving the deformation of the unit cell and variations in size and morphology are investigated.

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