Homogenized models for the mechanical behavior of fibre-reinforced hydrogels

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Fibre-reinforced hydrogels (FIHs), composites of micro-fibre scaffolds and hydrogel, are a promising concept in tissue engineering that tries to mimic the natural composite structure of soft tissue. The filament spacing of the scaffold is usually in the range of μm while the overall size of an FIH is in the range of mm to cm. Due to this scale heterogeneity, the mechanical properties of FIHs are not yet fully understood and, as a consequence, there is an interest in investigating their effective properties.

In this talk, we consider highly heterogeneous two-component media composed of a connected fibre-scaffold with periodically distributed inclusions of hydrogel. While the fibres are assumed to be elastic, the hydromechanical response of hydrogel is modeled via *Biot's poroelasticity*. This leads to a coupled system of elliptic and parabolic equations.

We show that the resulting mathematical problem admits a unique weak solution and investigate the limit behavior of the solutions with respect to a scale parameter characterizing the heterogeneity of the medium. This is done in the context of the two-scale convergence method. In doing so, we arrive at an homogenized model.