Minisymposium 8 - Homogenisierung und Anwendungen

From Discrete to Continuum Models in Mechanobiology

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In the last years, mechanobiology has drawn a lot of attention in the physical sciences from an experimental and theoretical viewpoint. Systems are investigated on different scales ranging from single molecules up to whole organisms.

One central problem in mechanobiology is the derivation of appropriate constitutive relations for continuous models, which should account for such different effects as growth in cell cultures or active contraction of polymer-fibres in migrating cells. Many systems can be described relative easily with discrete models on a microscopic scale, e.g. single cells in cell cultures or polymer fibres in cells. Whereas continuous macroscopic descriptions are usually less straight forward.

As constitutive relations are usually given in terms of free energies, Γ-convergence is the ideal framework for rigorously bridging the gap between discrete microscopic and continuous macroscopic models. For simple cases also homogenisation formulas can be applied, which allow an explicit calculation of the involved stress tensors. As examples, the mechanics of growing cell cultures and actively moving cells (Keratocytes) will be discussed.