Titel: Homogenization and Dimension Reduction in Textiles.

Joint work with Georges Griso and Stephan Wackerle

Abstract.

In this work, we investigate periodic structures made of fibers or yarns, like textiles and derive their macroscopic properties via simultaneous homogenization and dimension reduction. As reference domain we consider a canvas structure, which we assume to consist of periodically oscillating and isotropic beams with periodicity and radius of the same order. The beams are in contact and thereby the elasticity problem is restricted on a cone fulfilling non-penetration and gap conditions. To obtain different compactness results for all components of the displacement, we apply the decomposition of displacements for
thin structures, introduced by G. Griso in 2008. The derived estimates depend on the small parameters, the elastic energy, and the contact. Further we extend the fields into the full plate domain. We introduce an adapted unfolding operator with an incorporated dimension reduction from three to two dimensions. The properties of the unfolding operator together with the compactness results leads to its weak convergence, equivalent to the two-scale convergence. Consequently, the unfolded limits of the displacements, the strain tensor and contact condition yield homogenized 2D-model for a textile.