Material Modeling based on Multiscale Analyis

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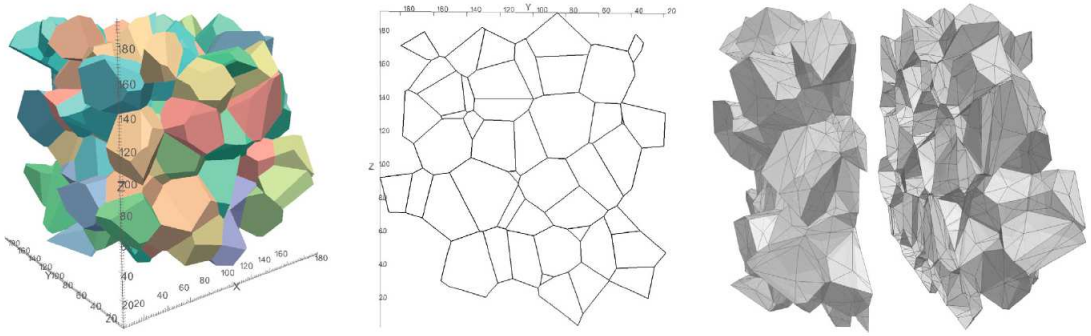
ABSTRACT

Modelling of material behaviour can be pursued using different theoretical approaches and numerical schemes. In this presentation special emphasis is laid on homogenization procedures and multi-scale approaches. These include inelastic microstructural deformations and possible developments of interface cracks. In detail the inelastic responses of polycrystals is investigated including induced anisotropy and nonlinear hardening. The necessary numerical procedures will be discussed and examples from different areas are introduced. A typical microstructure of a polycrystal and its discretization can be seen in Figure 1 below. The results on that scale are homogenized and lead to a set of constitutive paramenters that can be used at macroscopic scale. Here constitutive equations with as few parameters as possible are introduced. The results are validated at micro and macro scale by means of experiments. These include as well results from microstructural observation as from classical pull-out-tests. Typical and important industrial applications range from cermic to ductile materials.



(a) Polycrystal consisting of VORONOI cell grains

(b) Cut through polcrystalline structure

(c) Three-dimensional view into the cutted polycrystal

Figure 1: Polycrystal and discretization