

Peter Wriggers

“Multiscale analysis applied to material modeling”

The presentation is aimed to cover areas related to modelling of material behavior using different numerical schemes. Special emphasis is laid on homogenization procedures and multiscale approaches that include inelastic microstructural deformations and development 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 Fig. 1 below. Additionally the simulation of a micro crack at polycrystal level can be seen in Fig. 2 using XFEM. Included in this presentation is the design of macroscopic constitutive equations with only few parameters that are obtained from homogenization of polycrystalline assemblies. 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 ceramic to ductile materials.

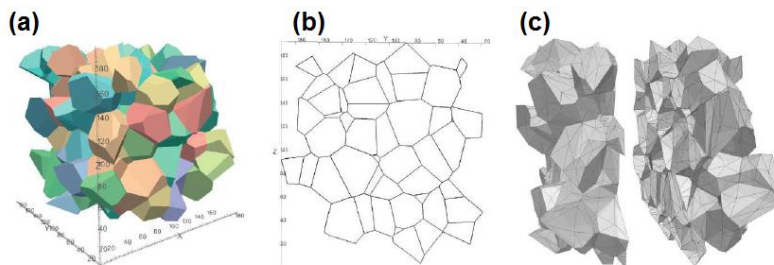


Figure 1: Polycrystal and discretization. (a) Polycrystal consisting of VORONOI cell grains. (b) Cut through polycrystalline structure. (c) Three-dimensional view into the cut polycrystal.

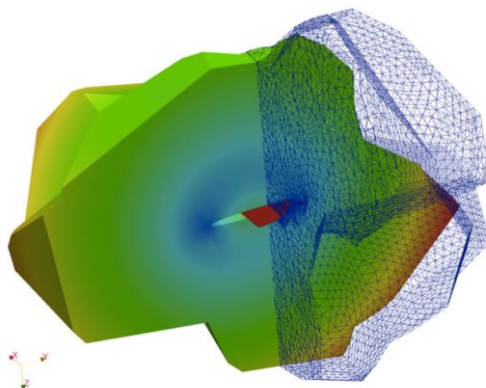


Figure 2: Micro crack in a polycrystal.



Professor Dr.-Ing. habil. P. Wriggers studied Civil Engineering from 1970-1976 at the University of Hannover, he obtained his Dr.-Ing degree at the University of Hannover in 1980 on “Contact-impact problems”. From 1983-84 he was Visiting Scholar at the UC Berkeley, USA. After that he worked as Lecturer at the Institute of Mechanics and Computational Mechanics at the University Hannover where he finished his Habilitation in 1986 on “Consistent linearizations in continuum mechanics”. In 1990 he was appointed as Full Professor at the Institute of Mechanics at TH Darmstadt. There he acted from 1996 to 1998 as director of the Center for Scientific Computing. In 1998 Prof. Wriggers changed to the University of Hannover where he held the chair for Mechanics in Civil Engineering from 1990 to 2008. Since 2008 he is director of the Institute of Continuum Mechanics in the Faculty of Mechanical Engineering at the Leibniz Universität Hannover. From 2003 to 2004 he held the position of “Linkage Professor” at the University of Newcastle in NSW, Australia. He still is conjoint professor at that school. Peter Wriggers is member of the “Braunschweigische Wissenschaftliche Gesellschaft”, the Academy of Science and Literature in Mainz, and the German National Academy of Engineering “acatech”. He was President of GAMM (International Association for Applied Mathematics and Mechanics) from 2008-2010, President of GACM (German Association of Computational Mechanics) from 2008-2012 and is Vice-President of IACM (International Association of Computational Mechanics). Furthermore he acts as Editor-in-Chief for the International Journal “Computational Mechanics” and is member of more than 15 Editorial Boards. He was awarded the Fellowship of IACM and received the “Computational Mechanics Award” of IACM, the “Euler Medal” of ECCOMAS, the “IACM Award” of IACM and the Zienkiewicz Medal of the Polish Association of Computational Mechanics. In 2013 he received honorary doctorate degrees from the University of Technology Poznan, Poland, and the Ecole National Supérieure Cachan, France. Among his research interests are development of new techniques and algorithms in computational mechanics, contact mechanics, multi-scale modelling of heterogeneous materials and contact problems and development of finite element and discrete element technologies.