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EDITORIAL

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The present volume of the Journal of Applied Mechanics is a special issue, consisting of ten original papers which were presented during the sixth Workshop on Continuum Mechanics held in Witzenhausen, Germany, in August 2013. The goal of this workshop is to bring together different groups that work in the field of applied mechanics—with a special focus on modeling the constitutive behavior of various materials. Furthermore, it offers a platform of discussion and exchange even for young scientists in the early stage of their career. Therefore, the whole spectrum of Continuum Mechanics is included. The presentations held at the workshop and the articles published in this volume cover the range from experimental mechanics and theoretical modeling to numerical applications.

Several of the included articles are concerned with the experimental and theoretical description of polymers. The articles by Rabanizada et al., Mittermeier et al. and Goldschmidt and Diebels focus on different aspects of aging of polymers. In the first of these papers, the authors treat an experimental investigation of chemical aging—while a detailed model of physical aging phenomena is presented in the second one. In the third contribution, the influence of moisture content on the mechanical properties of a polyurethane system is studied. Focusing on the aspect of modeling, these papers take into account aspects of multiphase Continuum Mechanics, i.e., the reasons for the aging processes under consideration are described by additional variables controlled by evolution and/or field equations. Therefore, the numerical treatment of these problems requires efficient multi-field algorithms. In this context, Osorno et al. propose a finite difference scheme for the calculation of the permeability in porous fluid-saturated media.

This is also the case for electro-mechanically coupled problems treated in the articles by Gleim et al. and by Erbts et al. Both papers address the interaction between the supply of electric energy and the change of the thermo-mechanical properties of metals. On the one hand, a space-time Galerkin formulation is proposed to solve the problem in a monolithic and robust way. On the other hand, an iterative procedure for the numerical solution of the corresponding multi-field formulation turns out to be an efficient solution strategy.

Since all nonlinear constitutive models have to be implemented into numerical schemes, which have to be linearized in the context of Newton-like methods, Rothe and Hartmann study the possibilities of automatic differentiation for the computation of consistent tangent operators. The method turns out to be very useful for developing and testing new constitutive models. Such procedures might be applicable in the completely new approach toward the description of plasticity presented by Schröder and Kuhl. Here, the advantages and the drawbacks of a variational formulation of the plasticity model are discussed.

Finally, the papers by Jung et al. and Roland et al. treat the description of the effective behavior of micro-heterogeneous materials. On the one hand, a mechanism-based model is proposed to model the effective

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deformation behavior of metal foams. On the other hand, a detailed numerical study of the eutectic of an Al-Si alloy is performed based on real CT data and on a corresponding stochastic model.

The selection of the present articles represents the wide range of applicability of Continuum Mechanics and offers some insight into current topics of interest—such as multi-field problems, modeling of micro-structured materials and efficient numerical methods.