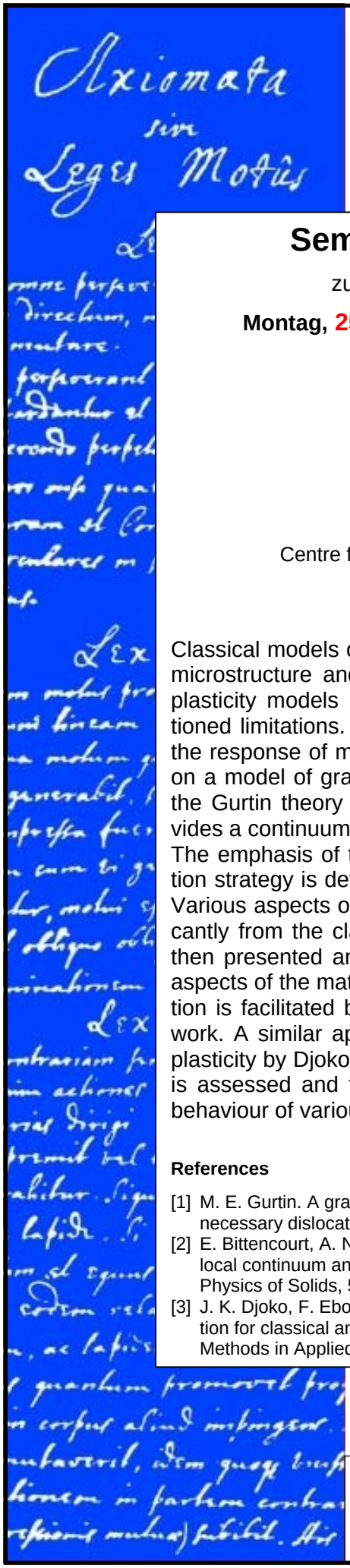

Friedrich-Alexander-Universität Erlangen-Nürnberg

Seminar über Fragen der Mechanik

zu folgendem Vortrag wird herzlich eingeladen

Montag, 25.05.2009, 16:00 Uhr, Egerlandstr. 5, Raum 0.044

Aspects of a model of gradient crystal plasticity

Andrew McBride

Centre for Research in Computational and Applied Mechanics,
University of Cape Town, South Africa

Classical models of crystal plasticity lack the ability to capture the formation of microstructure and do not accommodate softening. Several gradient crystal plasticity models have been advocated recently to overcome the aforementioned limitations. These models are of particular importance when predicting the response of material at the micron scale. The focus of this presentation is on a model of gradient crystal plasticity due to Gurtin [1]. The length scale in the Gurtin theory arises from a free energy dependent on a tensor that provides a continuum description of the Burgers vector.

The emphasis of this investigation is twofold. Firstly, a robust numerical solution strategy is developed drawing heavily on the work of Bittencourt et al. [2]. Various aspects of the implementation of the nonlocal theory that differ significantly from the classical are emphasised. A series of numerical examples is then presented and the effect of the nonlocal terms is elucidated. Secondly, aspects of the mathematical structure of the model are described. The description is facilitated by recasting the Gurtin model into a convex analytic framework. A similar approach was employed for an alternative model of gradient plasticity by Djoko et al. [3]. The ability of the model to accommodate softening is assessed and these results are confirmed via numerical experiment. The behaviour of various hardening rules is also discussed.

References

[1] M. E. Gurtin. A gradient theory of single-crystal viscoplasticity that accounts for geometrically necessary dislocations. Journal of the Mechanics and Physics of Solids, 50:5–32, 2002.

[2] E. Bittencourt, A. Needleman, M. E. Gurtin, and E. van der Giessen. A comparison of nonlocal continuum and discrete dislocation plasticity predictions. Journal of the Mechanics and Physics of Solids, 51:281–310, 2003.

[3] J. K. Djoko, F. Ebobisse, A. T. McBride and B. D. Reddy. A discontinuous Galerkin formulation for classical and gradient plasticity – Part 1: Formulation and analysis. Computer Methods in Applied Mechanics and Engineering, 196:3881–3897, 2007.

Prof. Dr.-Ing. P. Steinmann
Lehrstuhl für Technische Mechanik
Universität Erlangen-Nürnberg
Egerlandstraße 5, 91058 Erlangen

Dipl.-Math. techn. G. Possart
Tel. +49 9131 8528506
possart@ltm.uni-erlangen.de