Editorial : instabilities across the scales III

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Instabilities Across the Scales III

Hans-Bernd Mhlhaus^a, Esteban P. Busso^b, Akke S.J. Suiker^c & Lambertus J. Sluys^d

^a Earth Systems Science Computational Centre (ESSCC), School of Earth Science, The University of Queensland, Brisbane, 4072, Australia

^b Centre des Matriaux, Ecole des Mines de Paris, UMR CNRS 7633, B.P. 87-91003 Evry CEDEX, France

^c Department of the Built Environment, Eindhoven University of Technology, P.O. Box 513, 5600 MB Eindhoven, The Netherlands

^d Faculty of Civil Engineering and Geosciences, Delft University of Technology, P.O. Box 5048, 2600 GA Delft, The Netherlands

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EDITORIAL

Instabilities Across the Scales III

This special issue of *Philosophical Magazine* contains contributions from both the computational geology and mechanics of materials communities, and deals with the modelling and numerical simulation of instabilities that are generally understood to be the precursors of local material damage or failure. Even though these communities address problems associated with very different length and time scales, many of the analytical and numerical techniques and approaches used are surprisingly similar. At the scale of the earth crust, for instance, supercritical thermal gradients are known to give rise to thermo-mechanical instabilities, which cause the mantle materials to flow over time scales of up to hundred of millions of years. In contrast, instabilities in engineering materials, such as metallic alloys, develop as a result of highly localised deformation patterns at the scale of the material's microstructure (e.g. grain size) and over time scales ranging from fractions of a second to those typical of engineering component lifetimes. Such patterns are generally accompanied by inhomogeneous stress fields and may be triggered by material flows and a particular type of boundary conditions.

The 17 papers that make up the special issue discuss and review the state of the art models and computational procedures used for the simulation of instabilities at various length scales. These papers were invited contributions from a selection of those made at the recent international Symposium on Instabilities Across the Scales III, organised by the Associate Editors in Cairns, Australia, during 6–10 June 2011. The manuscripts submitted for the special issue followed the standard peer review procedures and requirements of *Philosophical Magazine*. This symposium is the third of a series which started in Cairns, Australia, in 2004, and was followed by a second event organised in 2007 in Delft, The Netherlands. Invited contributions to both of these first two symposiums were published in two other special issues of *Philosophical Magazine* (Vol. 86, Numbers 21–22, 2006; and Vol. 88, Numbers 28–29, 2008).

The special issue papers have been organised in terms of the length scales at which instabilities are addressed, starting with large geological scales, through intermediate scales associated with individual particles of granular materials, down to the micro scales representative of, for instance, crystallographic grains in polycrystals. It is hoped that this series of articles will provide readers with a useful up-to-date overview of recent advances in this exciting and challenging field, and continue to bring the computational geology and solid mechanics scientific communities closer together by sharing and exchanging experimental, analytical and numerical techniques to study and predict localisation and instability phenomena.

The Associate Editors of this special issue would like to thank the authors for their contributions to what we hope will be an important reference in the field for many years to come, and to the reviewers, who spent a considerable amount of time commenting on the scientific merits of the manuscripts. Financial support for the

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Hans-Bernd Mühlhaus
Earth Systems Science Computational Centre (ESSCC)
School of Earth Science
The University of Queensland,
Brisbane, 4072
Australia

Esteban P. Busso
Centre des Matériaux
Ecole des Mines de Paris
UMR CNRS 7633
B.P. 87-91003 Evry CEDEX
France

Akke S.J. Suiker
Department of the Built Environment
Eindhoven University of Technology
P.O. Box 513, 5600 MB Eindhoven
The Netherlands

Lambertus J. Sluys
Faculty of Civil Engineering and Geosciences
Delft University of Technology
P.O. Box 5048, 2600 GA Delft
The Netherlands

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