

Znanstveno vijeće za tehnološki razvoj  
i  
Hrvatsko društvo za mehaniku



Zagreb, 22. listopada 2012.

Poštovane / poštovani,

U nastojanju da povećaju razmjenu znanstvenih i tehnoloških informacija s najrazvijenijim zemljama, Znanstveno vijeće za tehnološki razvoj Hrvatske akademije znanosti i umjetnosti u suradnji s Hrvatskim društvom za mehaniku organizira javna predavanja eminentnih svjetskih znanstvenika s ciljem upoznavanja najnovijih dostignuća i trendova razvoja različitim tehničkim područjima.

## POZIV

U **utorak 6. studenog 2012.** u 12.00 u sjedničkoj dvorani HAZU, Zrinski trg 11

***Prof. Siegfried Schmauder***

*University of Stuttgart, Germany,  
Institute for Materials Testing, Materials Science and Strength of Materials,  
Institute of Thermal Turbo machinery and Machinery Laboratory*

održat će predavanje pod naslovom:

### ***RECENT ADVANCES IN MULTISCALE MATERIALS MODELLING***

Molimo da o ovom predavanju obavijestite i svoje kolege s obzirom da će ono biti preglednog karaktera i zanimljivo za širi krug stručnjaka.

Predsjednik Znanstvenog vijeća za  
tehnološki razvoj

Predsjednik Hrvatskog društva  
za mehaniku

Akademik Marin Hraste v.r.

Prof. dr. sc. Zdravko Virag v.r.

# RECENT ADVANCES IN MULTISCALE MATERIALS MODELLING

**Siegfried Schmauder**

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## **Abstract:**

Multiscale materials' modelling plays an increasingly prominent role in modelling the mechanical behavior of materials and structures. In many cases two scales are sufficient for representing the relevant features of the material under investigation. In the present study an overview is given over the history of multiscale materials modelling. Furthermore, classical examples are presented in which two, three or more scales are bridged and macroscopic mechanical properties are derived from numerical computer simulations. Moreover, a new application case is presented which bridges three length scales in order to mimic the macroscopic behavior of a nonhomogeneous material as well as a textured microstructure including failure aspects within the microstructure. The microstructure of dual phase steels can be compared with a composite composed of a matrix reinforced by small islands of martensite. This assumption has been applied in several attempts to model the mechanical properties of dual phase steels. However, recent measurements show that the properties of the ferrite phase change with distance from the martensite grains. These measurements showed that the grains of the ferrite phase are harder in the vicinity of martensite grains. As a consequence of these local hardening effects the ferrite phase has to be considered as the inhomogeneous matrix in modeling dual phase steels. This experiment inspires the idea that local hardening is caused by geometrically necessary dislocations. The idea is investigated experimentally and numerically in the present analysis, which for the first time leads to a good agreement with experimental observations of the mechanical stress-strain behavior of DP steels.

## **Biography:**

**Professor Siegfried Schmauder** achieved the degree Dipl.-Mathematics (information technology) in the Mathematics Department, University of Stuttgart in 1981, and in 1988 he achieved the doctor of science degree in Materials Science at University of Stuttgart. From 1994 he is Professor of Strength of Materials and Materials Sciences at University of Stuttgart. Currently he is the Acting Director of the Institute for Materials Testing, Materials Science and Strength of Materials (IMWF), and of the Institute of Thermal Turbo machinery and Machinery Laboratory (ITSM). His research interests are: Computational methods in applied sciences and engineering; Finite elements, analytical methods; Materials modelling on nano-, meso-, micro- and macromechanical scales as well as experiments to investigate microstructure/property-relationships in heterogeneous materials.

Prof. Schmauder started his career as Scientific Assistant at Max-Planck-Institute for Metals Research in Stuttgart in 1982. From 1988-89 he is representative Leader Group Electron Microscopy at Max-Planck-Institute for Metals Research in Stuttgart. From 1991 - 94 he is Leader of the Group Structural Mechanics in Max-Planck-Institute for Metals Research. During the period 2004-2008 he was a member of the Council of the Collaborative Research Center 381 "Characterization of Damage in Fiber Reinforced Composites using Non-Destructive Methods".

Prof. Schmauder was a guest professor at University of Tokyo, Japan in 1996; a DAAD guest professor at Academy of Sciences in Tomsk, Russia in 1997; a guest professor at Science University of Tokyo in 1999 and at University of Kyoto, Japan in 2004. He was awarded the JSPS-Research Fellowship, University of Tokyo, Japan, 1989 -1990. He received Medal of the University of Tokyo in 1989. He was awarded a DFG-Research Fellowship for University of California in the period 1990-1991. Professorship was offered to him from University of Bochum, Germany in 2007 and from University of Rostock, Germany in 2005.

Prof. Schmauder is Co-Editor of the International Journal of Computational Materials Science since March 2003 and Editorial Board member of the Journal of Physical Mesomechanics since 1998. He has distinguished Community and University Services as a member of numerous comities. He was Organizer and Chairmen of 18 International Workshops on Computational Mechanics of Materials and chairman, organizer or member of the organizing committee of more than 10 conferences. Prof. Schmauder supervised more than 30 dissertations and he is external examiner of Universities Oxford, Lille, Ecole Polytechnique Saclay, Université Paris 13 – Paris Nord, Karlsruhe, Dresden, Jena, Bochum, Freiberg. He gave more than 170 invited oral presentations at conferences, workshops etc. He authored or co-authored more than 400 papers, 4 book chapters and 2 books.