Workshop

Challenges and Perspectives in Data-driven Modeling

May 03-04, 2018

Final Program

Leuphana University of Lüneburg

Helmholtz-Zentrum Geesthacht

GAMM ACTIVITY GROUP DATA-DRIVEN MODELING AND NUMERICAL SIMULATION OF MICROSTRUCTURED MATERIALS…

The GAMM AG Data aims at coordinating the activities of the members of the International Association of Applied Mathematics and Mechanics (GAMM) in the field of data-based modeling, simulation and analysis in the context of microstructured materials.

In recent years, the field of imaging based experimental methods has experienced significant technological improvements. For instance, the quality and the speed of computed tomography based imaging techniques have advanced considerably, while at the same time, X-ray computed tomography devices are now available in many research facilities. By virtue of the obtained three-dimensional voxel images, microstructures of modern natural and artificial materials can be analyzed and used directly in numerical simulations. Incorporating three-dimensional microstructure data is, however, highly non-trivial from a numerical point of view. Special data processing techniques that are able to operate on billions of unknowns, are required. Developing algorithms and data processing techniques for processing three-dimensional data sets constitute major topics of the GAMM AG Data. Innovative image processing techniques for automatic phase segmentation and microstructure reconstructions are of equal importance.

Objectives of the Workshop

— To discuss the state of the art and recent trends in computational and experimental research

— To plan the AG Data activities

— Explore possible collaborations with DGM

— Lab tours with focus on modern experimental techniques for microstructure characterization at the Helmholtz-Zentrum Geesthacht

Program

Thursday, 03.05.2018 (Central building Leuphana University Lüneburg, C40.704)

10:00-11:30 city tour Lüneburg (meeting point Tourist Information (Rathaus/ Am Markt))

12:00 **Lunch**

12:50-13:00 Opening

13:00-13:45 N. Vajragupta, D. Reimann, H. ul Hassan, A. Hartmaier (keynote lecture)
Micromechanical modeling of plasticity and damage in realistic microstructures
Interdisciplinary Centre for Advanced Materials Simulation (ICAMS), Ruhr-Universität Bochum

13:45-14:10 B. Prifling, D. Westhoff, V. Schmidt
Quantitative analysis and stochastic 3D modeling of tomographic image data for electrodes in lithium-ion batteries
Institute of Stochastics, Ulm University

14:10-14:35 E. Lilleodden, K. Hu, M. Ziehmer
Correlating 3D structural characteristics to micro-mechanical behavior of nanoporous gold
Institute of Materials Research, Materials Mechanics, Helmholtz-Zentrum Geesthacht

14:35-15:00 C. Richert, N. Huber
Skeletonization, Geometrical Analysis and Finite Element Modeling of Nanoporous Gold Based on 3D Tomography Data
Institute of Materials Research, Materials Mechanics, Helmholtz-Zentrum Geesthacht

15:00-15:30 **Coffee break**

15:30-15:55 D. Uribe, H. Steeb
Experimental analysis of multiphase ow and solute transport in porous media using SXRCT
Institute of Mechanics (CE), University of Stuttgart

15:55-16:20 C. Motz and J. R. Velayarce
Influence of grain boundaries on fatigue damage evolution studied by micro fatigue tests
Department of Material Sciene and Engineering, Saarland University

16:20-16:45 F. Scherff, S. Scholl, K. Srivastava, S. Diebels
Simulation of dual-phase steel based on real and virtual 3D microstructuress
Lehrstuhl für Technische Mechanik, Saarland University

16:45-17:10 M. Schneider, D. Wicht
On polarization-based schemes for FFT-based computational homogenization of inelastic materials
Chair for Continuum Mechanics, Institute of Engineering Mechanics, Karlsruhe Institute of Technology

17:10-17:25 S. Sandfeld
Presentation DGM Arbeitskreis "3D Data Science" (Fachausschuss Materialographie)

17:25-18:15 Discussion Collaboration DGM / Further Steps GAMM Activity Group

19:00 **Workshop-Dinner (Mälzer Brau- und Tafelhaus, Lüneburg)**

Friday, 04.05.2018 (HZG Hörsaal, building 27)

08:30 Transfer to Helmholtz-Zentrum Geesthacht (pick-up point Best Western Plus Residenzhotel Lüneburg, Munstermannskamp 10, 21335 Lüneburg)

09:15-10:00 Lab tour **Solid State Joining Processes (Materials Mechanics)**

10:15-11:00 M. Ortiz (keynote lecture)
Data-Driven Computing
California Institute of Technology, USA & Hausdorff Center for Mathematics, University of Bonn

11:00-11:25 K. Nguyen, M. Rambausek, M.-A. Keip
A variational framework for data-driven computational mechanics applied to elasticity
Chair of Material Theory, University of Stuttgart

11:25-11:50 S. Sandfeld
Data mining in small-scale plasticity
Institute of Mechanics and Fluid Dynamics, TU Bergakademie Freiberg

11:50-12:15 F. Fritzen, O. Kunc
Data-assisted surrogate modeling of nonlinear solids
Emmy-Noether-Group EMMA – Efficient Methods for Mechanical Analysis, University of Stuttgart

12:15-12:30 Final discussions

12:30-13:15 **Lunch**

13:15-14:00 Lab tour **Magnesium Innovation Centre MagIC**

14:00-14:30 Lab tour **Joining and Assessment (Materials Mechanics)**

14:30 End of the workshop – Transfer to Hamburg-Nettelnburg and Lüneburg

List of Participants

- M.Sc. Masoud Abbaszadeh, Helmholtz-Zentrum Geesthacht
- M.Sc. Frederic E. Bock, Helmholtz-Zentrum Geesthacht
- Prof. Dr.-Ing. Christian J. Cyron, TU Hamburg & Helmholtz-Zentrum Geesthacht
- Prof. Dr.-Ing. Stefan Diebels, Saarland University
- M.Sc. Robert Eggersmann, RWTH Aachen University
- Dr.-Ing. Rainer Falkenberg, Bundesanstalt für Materialforschung und- prüfung (BAM)
- Dr.-Ing. Dipl.-Math. techn. Felix Fritzen, University of Stuttgart
- M.Sc. Christian Gebhardt, RWTH Aachen University
- Prof. Dr. Alexander Hartmaier, Ruhr Universität Bochum
- M.Sc. Reza Hassani, University of Stuttgart
- M.Sc. Jan Herrnring, Helmholtz-Zentrum Geesthacht
- Prof. Dr.-Ing. Norbert Huber, Helmholtz-Zentrum Geesthacht

- M.Sc. Sören Keller, Helmholtz-Zentrum Geesthacht
- Prof. Dr.-Ing. Benjamin Klusemann, Leuphana University Lüneburg & Helmholtz-Zentrum Geesthacht
- M.Sc. Tim Fabian Korzeniowski, University of Siegen
- M.Sc. Stephan Kreis, Karlsruher Institute of technology
- M.Sc. Oliver Kunc, University of Stuttgart
- Prof. Dr. Erica Lilleoden, Helmholtz-Zentrum Geesthacht
- Prof. Dr. Rolf Mahnken, Paderborn University
- Prof. Dr. mont. Christian Motz, Saarland University
- Dr.-Ing. Lu Trong Khiem Nguyen, University of Stuttgart
- Prof. Michael Ortiz, PhD, California Institute of Technology
- Dr.-Ing. Aruna Prakash, TU Bergakademie Freiberg
- M.Sc. Benedikt Prifling, Ulm University
- M.Sc. Dennis Rapp, University of Stuttgart
- M.Sc. Syed Hasan Raza, Leuphana University of Lüneburg
- M.Sc. Claudia Richert, Helmholtz-Zentrum Geesthacht
- Prof. Dr. Stefan Sandfeld, TU Bergakademie Freiberg
- Dr.-Ing. Ingo Scheider, Helmholtz-Zentrum Geesthacht
- M.Sc. Frederik Scherff, Saarland University
- M.Sc. David Uribe, University of Stuttgart
- M.Sc. Daniel Wicht, Karlsruher Institute of technology

Workshop Venues and Locations

Leuphana University of Lüneburg
Universitätsallee 1, C 40.704 (Central Building)
21335 Lüneburg
How to reach Leuphana University of Lüneburg
www.leuphana.de/en/services/travel-directions

Helmholtz-Zentrum Geesthacht

Max-Planck-Straße 1 (HZG Hörsaal, building 27) – start will be at building 31

21502 Geesthacht

How to reach Helmholtz-Zentrum Geesthacht

https://www.hzg.de/about_us/visit_us/lageplan/geesthacht/index.php.en

Organizers

- Prof. Dr.-Ing. Benjamin Klusemann
  Institute of Product and Process Innovation, Leuphana University of Lüneburg
  Institute of Materials Research, Materials Mechanics Helmholtz-Zentrum Geesthacht
  https://www.leuphana.de/institute/ppi.html
  https://www.hzg.de/institutes_platforms/materials_research/materials_mechanics/joining_and_assessment/index.php.de

- Dr.-Ing. Dipl.-Math.techn. Felix Fritzen
  Emmy-Noether-Gruppe EMMA - Effiziente Methoden zur Mechanischen Analyse, University of Stuttgart
  http://www.mechbau.uni-stuttgart.de/EMMA/index.html

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Campus Map Leuphana University of Lüneburg