



Workshop

Challenges and Perspectives in Data-driven Modeling

May 18-19, 2017

Final Program

Karlsruhe Institute of Technology (KIT)

The Research University in the Helmholtz Association

The GAMM activity group

... *Data-driven modeling and numerical simulation of microstructured materials* (GAMM AG Data, www.mechbau.uni-stuttgart.de/EMMA/ag-data) aims at coordinating the activities of the members of the International Association of Applied Mathematics and Mechanics (GAMM, www.gamm-ev.de) 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 (i.e. frame rate) 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 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, e.g., by making use of the advantageous properties of the Fast Fourier Transform (FFT). 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 that are usable for finite element discretizations 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 (research, education, networking)
- Lab tours with focus on modern experimental techniques for microstructure characterization

Program

Thursday, 18.05.2017

- 11:45 **Lunch**
Presentations and discussion
- 12:30-13:00 Matti Schneider
An FFT-based fast gradient method for elastic and inelastic unit cell homogenization problems
 Fraunhofer ITWM, Kaiserslautern
- 13:00-13:30 Felix Göküzüm, Marc-André Keip
Consistent FFT-based Homogenization of Electromechanically Coupled Materials
 University of Stuttgart
- 13:30-14:00 Niklas Miska, Daniel Balzani
Optimal bounds on the probability of failure in formed multiphase steels based on quantified microstructure uncertainties
 TU Dresden
- 14:00-14:30 Frederik Scherff, Sebastian Scholl, Stefan Diebels
Simulation of the deformation behavior of 3D microstructures in dual-phase steel
 Saarland University, Saarbrücken
- 14:30-15:00 **Coffee break**
- 15:00-15:30 Loredana Kehrer, Pascal Pinter, Kay André Weidenmann, Thomas Böhlke
A mechanical and μ CT-based microstructure characterization of SMC and prediction of material properties using mean and full field simulations
 Karlsruhe Institute of Technology (KIT)
- 15:30-16:00 Sergey Chupakhin, Sören Keller, Nikolai Kashaev, Norbert Huber, Benjamin Klusemann
Laser Shock Peeding induced residual stresses: Correction of plasticity effect in experimental measurements based on a data-driven modeling approach
 Leuphana University Lüneburg
- 16:00-16:30 Lu Trong Khiem Nguyen, Marc-Andre Keip
A data-driven approach to nonlinear elasticity
 University of Stuttgart
- 16:30-17:00 Holger Steeb, David Uribe
Bildgebende Charakterisierung und Modellierung poröser Medien
 University of Stuttgart
- 17:00-17:30 Matthias Neumann, Ole Stenzel, Omar Pecho, Lorenz Holzer, Volker Schmidt
Big data for microstructure-property relationships: a case study of predicting effective conductivities
 Ulm University
- 19:00 **Conference Dinner**

Friday, 19.05.2017

08:30	Transfer to KIT Campus North
09:00-09:45 and 09:45-10:30	Two lab tours for groups of 12 participants with a duration of 45 minutes for each tour Institute for Applied Materials - Materials and Biomechanics (Dr. Mönig) www.iam.kit.edu/wbm Tour Entrance Building 696, 9:00 and 9:45 Institute of Nanotechnology (Dr. Kübel, Dr. Wang) www.int.kit.edu Tour Entrance Building 640, 9:00 and 9:45
Approx. 10:30-11:00	Transfer to Campus South
Approx: 11:00 - 11:30	Lab tour Institute for Applied Materials – Materials Science and Engineering (Dr. Dietrich) www.iam.kit.edu/wk Meeting point: Building 10.96, Nusselt-Weg
12:30	Lunch, KIT Mensa
13:15	End of the workshop

Participants

- Dr. Heiko Andrä, Fraunhofer ITWM, Kaiserslautern
- Prof. Dr.-Ing. Thomas Böhlke, Karlsruhe Institute of Technology (KIT)
- M.Sc. Róbert Bertóti, Karlsruhe Institute of Technology (KIT)
- Dr.-Ing. Dominik Brands, University Duisburg-Essen
- Prof. Dr.-Ing. Stefan Diebels, Saarland University
- Dr.-Ing. Dipl.-Math. techn. Felix Fritzen, University of Stuttgart
- B.Sc. Orkun Furat, Ulm University
- M.Sc. Felix Göküzüm, University of Stuttgart
- M.Sc. Reza Hassani, University of Stuttgart
- Dr. Jörg Hohe, Fraunhofer-Institut für Werkstoffmechanik IWM, Freiburg
- M.Sc. Loredana Kehrer, Karlsruhe Institute of Technology (KIT)
- Prof. Dr.-Ing. Benjamin Klusemann, Leuphana University Lüneburg
- Dr. Alexander Konstandin, Robert Bosch GmbH
- M.Sc. Klaus Kuchler, Ulm University
- M.Sc. Oliver Kunc, University of Stuttgart
- Dr.-Ing. Tom-Alexander Langhoff, Karlsruhe Institute of Technology (KIT)
- Dr. André Liebscher, TU Kaiserslautern
- Dipl.-Ing. Niklas Miska, TU Dresden
- M.Sc. Matthias Neumann, Ulm University
- Dr. Khiem Nguyen, University of Stuttgart
- M.Sc. Lukas Petrich, Ulm University
- Univ. Prof. Dr.-Ing. Tim Ricken, TU Dortmund University
- Dr. rer. nat. Michael Roland, Saarland University
- M.Sc. Frederik Scherff, Saarland University, Saarbrücken
- M.Sc. Lisa Scheunemann, University Duisburg-Essen
- Dr. Matti Schneider, Fraunhofer ITWM, Kaiserslautern
- Dr.-Ing. Katrin Schulz, Karlsruhe Institute of Technology (KIT)
- M.Sc. Julian Seuffert, Karlsruhe Institute of Technology (KIT)
- Prof. Dr.-Ing. Holger Steeb, University of Stuttgart
- Kay André Weidenmann, Karlsruhe Institute of Technology (KIT)

Workshop Venue and Location

Karlsruhe Institute of Technology (KIT)
Geb. 50.41, 1.OG, Seminar Room 145/146
AVG-Gebäude
Adenauerring 20A
76131 Karlsruhe

How to reach KIT+ Campus Map: <http://www.itm.kit.edu/english/1081.php>

Hotel recommendations

- Guest House, KIT Campus South: <https://www.gdh.kit.edu/english/index.php>
- <https://www.booking.com>

Conference Dinner

18.05.2017 / 19:00

Höpfner Burghof, Haid-und-Neu-Straße 18, 76131 Karlsruhe, Tel.: 0721 622644

Organizers

- Prof. Dr.-Ing. Thomas Böhlke, Chair for Continuum Mechanics, Institute of Engineering Mechanics, Karlsruhe Institute of Technology (KIT)
- Dr. Matti Schneider, Fraunhofer Institute for Industrial Mathematics ITWM
- Dr.-Ing. Dipl.-Math.techn. Felix Fritzen, Emmy-Noether-Gruppe EMMA - Effiziente Methoden zur Mechanischen Analyse, University of Stuttgart

Contact

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KIT – Campus South