



## 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](http://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](http://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   Holger Steeb, David Uribe  
*Bildgebende Charakterisierung und Modellierung poröser Medien*  
 University of Stuttgart
- 13:00-13:30   Matti Schneider  
*An FFT-based fast gradient method for elastic and inelastic unit cell homogenization problems*  
 Fraunhofer ITWM, Kaiserslautern
- 13:30-14:00   Felix Göküzüm, Marc-André Keip  
*Consistent FFT-based Homogenization of Electromechanically Coupled Materials*  
 University of Stuttgart
- 14:00-14:30   Niklas Miska, Daniel Balzani  
*Optimal bounds on the probability of failure in formed multiphase steels based on quantified microstructure uncertainties*  
 TU Dresden
- 14:30-15:00   Frederik Scherff, Sebastian Scholl, Stefan Diebels  
*Simulation of the deformation behavior of 3D microstructures in dual-phase steel*  
 Saarland University, Saarbrücken
- 15:00-15:30   **Coffee break**
- 15:30-16:00   Loredana Kehrler, Pascal Pinter, Kay André Weidenmann, Thomas Böhlke  
*A mechanical and  $\mu$ CT-based microstructure characterization of SMC and prediction of material properties using mean and full field simulations*  
 Karlsruhe Institute of Technology (KIT)
- 16:00-16:30   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
- 16:30-17:00   Lu Trong Khiem Nguyen, Marc-Andre Keip  
*A data-driven approach to nonlinear elasticity*  
 University of Stuttgart
- 17:00-17:30   Rakulan Sivanesapillai, Ehsan Ghobadi, Holger Steeb  
*Thermodynamische Modellierung und Charakterisierung von Formgedächtnispolymeren*  
 University of Stuttgart
- 17:30-18:00   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
- 19:30           **Workshop-Dinner**

**Friday, 19.05.2017**

- 08:30            Transfer to KIT Campus North
- 09:00            Lab tour **Institute of Nanotechnology**  
[www.int.kit.edu](http://www.int.kit.edu)
- 10:00            Lab tour **Institute for Applied Materials – Materials and Biomechanics**  
[www.iam.kit.edu/wbm](http://www.iam.kit.edu/wbm)
- 11:00            Transfer to KIT Campus South
- 11:30            Lab tour **Institute for Applied Materials – Materials Science and Engineering**  
[www.iam.kit.edu/wk](http://www.iam.kit.edu/wk)
- 12:30            Lunch
- 13:30            Final discussion
- 14:00            End of the workshop

**Participants**

- Dr. Heiko Andrä, Fraunhofer ITWM, Kaiserslautern
- Prof. Dr.-Ing. Thomas Böhlke, Karlsruher Institut für Technologie (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
- Prof. Dr. Jörg Hohe, Fraunhofer-Institut für Werkstoffmechanik IWM, Freiburg
- Prof. Dr.-Ing. Holger Steeb, University of Stuttgart
- M.Sc. Loredana Kehrer, Karlsruher Institut für Technologie (KIT)
- Prof. Dr.-Ing. Benjamin Klusemann, Leuphana University Lüneburg
- M.Sc. Klaus Kuchler, Ulm University
- M.Sc. Oliver Kunc, University of Stuttgart
- Dr.-Ing. Tom-Alexander Langhoff, Karlsruher Institut für Technologie (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

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- 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, Karlsruher Institut für Technologie (KIT)

### Workshop Venue and Location

Karlsruher Institut für Technologie (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>

### 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

### Contact

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