Abstract of our keynote speaker, Dr. Katja Schladitz:

Quantitative 3D analysis of microstructures

In this talk, we demonstrate how to use integral-geometric methods and the concept of a macroscopically homogeneous random closed set in order to analyze quantitatively the complex microstructure of modern materials, based on 3D image data obtained e.g. by micro computed tomography or FIB tomography.

A basic set of characteristics for objects are the intrinsic volumes – in 2D area, perimeter length and Euler number, in 3D volume, surface area, the integral of mean curvature and the Euler number. If there is no natural particle, cell or pore structure, whole materials components can be described using the densities of the intrinsic volumes instead.

Combining integral and digital geometry yields an efficient algorithm for simultaneous calculation of the intrinsic volumes based on local image information only. The densities of the intrinsic volumes calculated in sub-volumes yield valuable information e.g. about the homogeneity.

The methods are applied to CT images of open and closed rigid foams, combined with a morphological processing pipeline for cell reconstruction (see Figure on the cover); simulation, processing, segmentation of FIB tomography images of highly porous structures; and stochastic geometric models, their use in structure optimization, and how to fit them based on image data.

Dr. Katja Schladitz is Senior scientist, coordinator of the group "Analysis and modeling of micro- and nanostructures", at the Image Processing Department of Fraunhofer Institut für Techno- und Wirtschaftsmathematik (ITWM), in Kaiserslautern, Germany. She completed her PhD in Mathematics from Freidrich-Schiller-Universität in 1996. She joined the Department of Mathematics of the University of Western Australia, as research associate and then moved to Aalborg as research assistant in the European Union's research network "Statistical and Computational Methods for the Analysis of Spatial Data". Since 1999, she is with ITWM. She is the co-author of "3D Images of Materials Structures – Processing and Analysis", published at Wiley VCH, Weinheim, in 2009.

GENERAL INFORMATION

Location Empa, Dübendorf
Überlandstrasse 129
AKADEMIE

Costs The event is sponsored by Empa and free of charge.

Registration www.empa.ch/imaging

Deadline April 17, 2013

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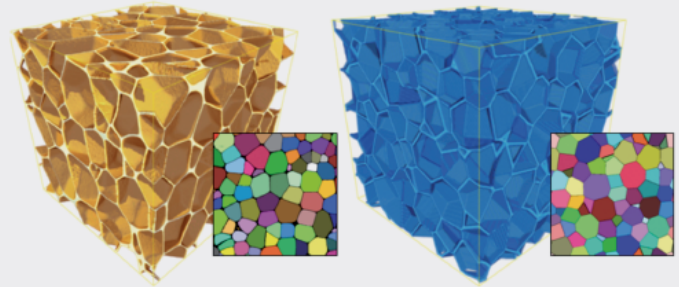
EMPA AKADEMIE
Zentrum für Wissenstransfer

TOPICAL DAY

Imaging and image analysis III



Empa, Dübendorf, Überlandstrasse 129
Wednesday, April 24, 2013, 8.30am – 5pm

Online registration: *www.empa.ch/imaging*

TOPIC

Images, from scanning electron microscopy to X-ray, neutron radiography, tomography and more, as well as the different methods and techniques used in performing image analyses

TARGET AUDIENCE

Scientists, PhDs and postdocs working with different imaging techniques and analysis procedures

OBJECTIVES

This is the third Topical Day on imaging where Empa experts in imaging, data visualization and analysis can share and exchange their activities.

The day will start with a presentation of Dr. Katja Schladitz (Fraunhofer Institut für Techno- und Wirtschaftsmathematik), on quantitative 3D analysis of microstructures with several application cases. Then, several Empa scientists will present examples of their imaging work. Two short commercial software demonstrations are also included.

In the previous two Topical Days, we have started discussions on the need to group the labs in choosing and purchasing the different software required for this work. A core group was chosen to propose a solution in terms of image analysis infrastructure support at Empa. The group will present its conclusions for discussion at the end of the day.

PROGRAM

08.30 **Welcome Coffee, Registration**

09.00 **Opening remarks**
Dominique Derome

09.10 **Quantitative 3D analysis of microstructures**
Katja Schladitz, Fraunhofer Institut für Techno- und Wirtschaftsmathematik, Germany

10.20 **Coffee break**

10.40 **X-ray tomography at Empa**
Jerjen Iwan, Electronics/Metrology/Reliability: *X-ray computed tomography for material science at Empa*
Jürgen Hofmann, Electronics/Metrology/Reliability: *How to accelerate 3D tomogram reconstruction (FDK) using GPUs*

11.30 **Examples and current work from colleagues at Empa**
Michele Griffa and Beat Münch, Concrete and Construction Chemistry: *Segmentation algorithms for porous (building) materials*
Salomé Dossantos, Road Engineering/Sealing Components: *Characterization of bituminous surfaces*

12.15 **Lunch**

13.30 **Examples and current work from colleagues at Empa (continued)**
Sébastien Vaucher, Advanced Materials Processing: *Dynamic of materials under electromagnetic field explored by 4D-tomography*
Tobias Keplinger, Applied Wood Materials: *Scanning near field optical microscopy for wood characterization*
Matthias Scheller Lichtenauer, Media Technology: *Machine learning for image analysis*
Dennis Küpper; Media Technology: *High dynamic range imaging from capture to display*
Magda Obarzanek-Fojt and Arie Bruinink, Materials-Biology Interactions: *CLSM activities on cells: from simple to more advanced approaches*
Deborah Alberts and James Whitby, Mechanics of Materials and Nanostructures: *Visualization of multichannel 3D datasets: challenges and solutions for TOFSIMS data*
Simone Pokrant, Solid State Chemistry and Catalysis: *Challenges in imaging battery materials*

15.15 **Coffee break**

15.35 **Short presentations of commercial software on segmentation**
Peter Westenberger, AvizoFire
Daniela Handl, VG Studio

16.05 **Roundtable – Presentation of the proposal for imaging support at Empa**

17.00 **Closing**

REGISTRATION

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You will receive a confirmation by e-mail.