Analyze and validate structures with PoroDict and MatDict

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PoroDict

Characterize the pore space of a structure

Validate geometry models via comparison with CT-images

Validate geometry models via comparison with experiments

Compare the pore space of different structures (materials)

- Geometric Pore Size Distribution (PSD)
- Pore Size Distribution by Porosimetry
- Percolation Path
- Estimate Surface Area
- Three-Phase Contact Line
- Open and Closed Porosity
- Chord Length Distribution
- Bubble Point
- Euclidean Distance Transform
- Identify Pores (Watershed)
Geometric Pore Size Distribution

simple geometry:

Pore sizes well defined and easy to measure

usually:

How to define a pore size?
What is measured?
Defining Pore Sizes

Pore space: $X$

Opening of radius $r$:
$$O_r(X) = \bigcup_{B_{r,x} \subset X} B_{r,x}$$

Volume of pores with radius $r_1 \leq r \leq r_2$:
$$O_{r_1}(X) - O_{r_2}(X)$$

dark grey: $r \geq 20$
light grey: $16 \leq r < 20$
Analyze the PSD of a Sponge

Validate the model of a sponge via comparison of the PSD for model and CT-image
Identify Pores (Watershed)

Use the watershed algorithm to:

- Separate pores
- Get a pore size analyzes
MatDict

Characterize the material phases of a structure

Validate geometry models via comparison with CT-images

Validate geometry models via comparison with experiments

Compare the material phases of different structures

- Connected Components
- 1D Statistics
- 2D Statistics
- Analyze Objects
2D Statistics

Calculate the SVF along rays in x-, y- or z-direction

Example:
Use the 2D statistics to study the heterogeneity of a paper sheet
Heterogeneity of a Paper Sheet 1
Heterogeneity of a Paper Sheet 2

Raster Length 2μm

Raster Length 10μm

Raster Length 100μm

Raster Length 1000μm
Analyze Gad-Objects:

- Volumes
- Contacts
- Overlaps
Conclusions

PoroDict and MatDict are powerful tools to **analyze** and **validate** the geometry of material models and CT-images.

**Examples:**
- validation of a sponge model via comparison of the PSD
- Study the heterogeneity of paper with the 2D statistics

Outlook

Planed new features:
- Skeletonization algorithm
- Fiber property estimation (diameters,..)
- 3D Statistics