

Statistical Characterisation of Porous Media at the Pore Scale

Progress Report 2

Student:

Lukas Mosser

Supervisors:

Professor Olivier Dubrule

Professor Martin Blunt

Report Outline

- **Current Status**
- **Next Steps**
- **Meeting Summaries**

Current Status

- Parametric Models
 - Allows better understanding of behavior of Minkowski Tensors
 - » Planar Surfaces
 - » Bundle of Tubes
 - » Regular Spaced Spheres
 - » Regular Spaced Ellipsoids
 - » Gaussian model of porous medium (Random noise + Gaussian Filter + Otsu's method)
 - Included in final thesis as introduction to Minkowski Tensors
 - General rewrite of code:
 - Uses VTK instead of scikit-image
 - Allows much faster computation of meshes
 - No problems with non-manifold vertices
 - Better quality meshes in general
 - Code put under code versioning system
 - Lower memory requirements
 - Allows larger volumes to be sampled (250^3 Ketton possible with < 8 GB RAM)
- Evaluation of possible links to permeability
 - Working through papers by Kozeny and later Carman papers
 - Possible link to hydraulic tortuosity as indicated in previous research

Next Steps

- Computation of Minkowski tensor on larger subvolumes
- Compute Minkowski tensors on beadpack image
- Computation of Minkowski tensor for more complex parametric models
 - Gaussian Model
 - Boolean Model
- Compute Minkowski tensor for one image (beadpack/ketton) as function of:
 - Window Size
 - Smoothing / Threshold
- Investigate removing smaller disconnected domains on overall result
- Difference between pre-segmented images and application of smoothing
- Investigate links to permeability, two-phase flow
- Writing up Minkowski tensor introduction, literature review and parametric models.
- Next Meeting:
 - 24/06/16: Attending: Prof. Martin Blunt, Prof. Olivier Dubrule, LM

Meeting 5:

- Date: 08/06/2016
- Attendants: Prof. Martin Blunt, Dr. Branko Bijeljic, Lukas Mosser
- Discussed Topics:
 - Introduction to recent progress
 - Discussion of Minkowski tensor computation and equations
 - Discussion of initial results from 100^3 subvolume computations
 - Found need to compute larger subvolumes
 - » Ketton shows anisotropy at 100^3 whereas should be isotropic
 - Proposed parametric models to compute Minkowski Tensor on simple geometries
 - » Will allow for better understanding of results on more complex geometries
 - Additional Beadpack image as example of isotropic medium

Meeting 6:

- Date: 14/06/2016
- Attendants: Prof. Olivier Dubrule, Lukas Mosser
- Discussed Topics:
 - Discussion of Minkowski Tensor equations
 - Interpretation of resulting values
 - Discussion of results based on parametric models:
 - » Bundle of tubes, regular spaced spheres, regular spaced ellipsoids
 - Discussed a possible link of tensors with covariance function
 - Need for more complex parametric models such as Boolean model