

Software Lab project or Hiwi position

Porous network modelling using OpenPNM

Within the SFB-Elaine at the chair of Microfluidics, we are aiming at characterizing hydrogels for tissue engineering as poro-elastic materials. Hydrogels are anisotropic visco-poro-elastic biopolymers with a multiscale porosity. The transport phenomena occurring on the micro-scale throughout the pores are affected by the macro-scale mechanical properties and by the materials intrinsic features mainly porosity and permeability.

OpenPNM is an open-source Python package for performing a wide range of pore network simulations (doi:10.1109/MCSE.2016.49).

The tasks encompass understanding hydrogels as biopolymers, exploring the extent of practicality of openPNM to investigate models that account for certain properties such as porosity and anisotropy.

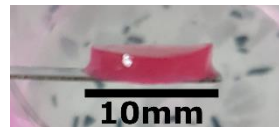


Fig. 1: an ADA-Gel scaffold

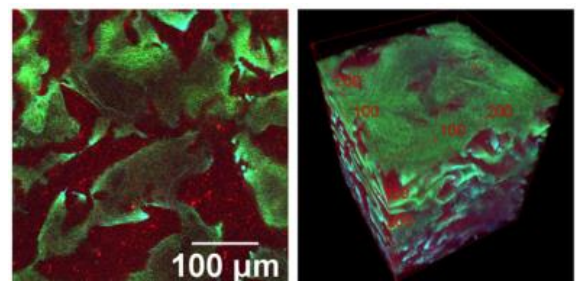


Fig. 2: Multiphoton microscopy images of a commercial hydrogel (DOI: 10.1016/j.actbio.2020.10.025)

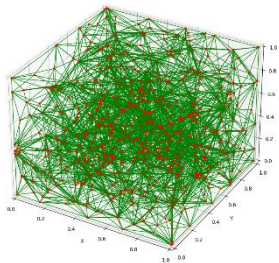


Fig. 3: A generated model with a random pores-throats distribution.

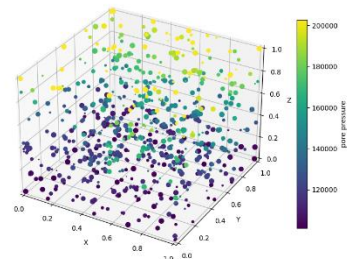


Fig. 4: Pore-pressure distribution of the generated model using a randomly assigned BC.

Tasks:

- Generating models with random pores-throats configurations within predefined porosity ranges.
- Pre-processing, running simulations and post-processing.
- Determining model parameters such as permeability, diffusivity, pores pressure, and pores and throats dimensions' distribution.
- Results examination, analysis and documentation.

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