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## An improved network extraction algorithm by tracking size variation of throats

Thursday, 2 June 2022 09:55 (15 minutes)

Pore-network model is a pore-scale modeling method, in which the complex pore space is represented by idealized geometries [1]. With the advantage of high computation efficiency and easy up-scaling, pore-network model has been widely used to simulate immiscible fluid displacement, reactive transport, phase change and heat transfer, and gas-water transport in proton exchange membrane. Pore-network model has become a powerful tool for simulation of millions of pores which is computationally unacceptable for direct numerical simulation.

Network construction, local transport rules, and calculation of transport properties constitute the main parts of pore-network models. In network construction, the void space is simplified into pore bodies and pore throats that are endowed with different local transport rules. This step is the foundation to simulate the physical and chemical behaviors of fluid in porous media. With the explosion in imaging capacity, researchers are highly motivated to extract pore-networks from the voxel-based representation of porous medium. Based on three-dimensional (3D) images, there are several types of algorithms for network construction, such as medial axis algorithm, maximal ball algorithm [2], grain-based algorithm, and watershed algorithm. Despite decades of efforts by many scholars, the lack of a specific definition for what constitutes pores and throats in void space remains a challenge. The ambiguous definition of pores and throats causes the inappropriate pore space segmentation, and further leads to inaccurate geometrical information. Some of this information impacts the simulation results significantly. For example, incorrect throat length causes great errors in permeability calculation in pore-network models.

In this study, we modify the SNOW algorithm [3] to distinguish pores and throats accurately. The throat voxels are determined by tracking size variation from the interface of two neighboring 'regions' to both sides. It obtains accurate descriptions of throats including throat length, shape variation, and throat volume. Compared with the experimental data or results of direct numerical simulations, the improved pore-networks predict more accurate permeability than that reported by other scholars.

Keywords: pore-network model; extraction method; watershed algorithm; pore-throat segmentation.

Reference

- [1] Fatt, I. (1956). The network model of porous media. Transactions of the AIME, 207(01), 144-181.
- [2] Dong, H., & Blunt, M. J. (2009). Pore-network extraction from micro-computerized-tomography images. Physical review E, 80(3), 036307.
- [3] Gostick, J. T. (2017). Versatile and efficient pore network extraction method using marker-based watershed segmentation. Physical Review E, 96(2), 023307.

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## **References**

## **Time Block Preference**

Time Block A (09:00-12:00 CET)

## **Participation**

Online

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**Presenter:** Dr LIU, Yang

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