Contribution ID: 77

Type: Poster

How to (numerically) calculate tortuosity in porous media?

Tortuosity is the third parameter (after porosity and permeability) that is most often computed in investigation of transport through porous media. It characterizes the elongation of emergent paths of diffusive, hydrodynamic or electric transport.

In this poster we will present several ways of tortuosity computation. Initially, we spotlight the streamlinebased approach. To facilitate this, our docker-integrated OpenFOAM (FVM) framework —engineered to efficiently construct porous media and execute pore-scale fluid flow simulations —will be supplemented with Python script to compute multiple streamlines. We will then compare results derived from this method with those from the velocity-based procedure. The poster will shed light on the challenges posed by these methodologies, especially in conditions like the inertial regime where non-linear dynamics become prominent. Additionally, the discourse will touch upon meshless interpolation techniques suitable to both for streamlines as well as for the Lattice Boltzmann solver in the context of tortuosity. Concluding, we will explore a novel procedure utilizing a deep learning Convolutional Neural Network (CNN) approach, designed to determine tortuosity in randomized porous media. This approach proficiently calculates hydrodynamic and diffusive tortuosity.

References

Acknowledgement of financial support

Funded by National Science Centre, Poland under the OPUS call in the Weave programme 2021/43/I/ST3/00228.

Primary author: Dr MATYKA, Maciej (Faculty of Physics and Astronomy, Institute of Theoretical Physics, University of Wroclaw)

Co-authors: Dr NAQVI, Sahrish (Faculty of Physics and Astronomy, Institute of Theoretical Physics, University of Wroclaw); SNIEŻEK, Damian (Faculty of Physics and Astronomy, Institute of Theoretical Physics, University of Wroclaw); STRZELCZYK, Dawid (Faculty of Physics and Astronomy, Institute of Theoretical Physics, University of Wroclaw); GRACZYK, Krzysztof (Faculty of Physics and Astronomy, Institute of Theoretical Physics, University of Wroclaw)

Presenter: Dr MATYKA, Maciej (Faculty of Physics and Astronomy, Institute of Theoretical Physics, University of Wroclaw)

Session Classification: AI & Simulation, Big Data & Analytics