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Title: Flow and transport coefficients in porous media: from direct simulation to automated prediction

Abstract: Permeability, diffusion coefficients or electrical resistivity of porous media containing multiple fluids phases are important in hydrology, enhanced oil recovery, energy storage or micro-vascular networks. Direct simulation combined with images (e.g. X-ray or scanning electron microscopy) provides a way to compute them in a specific porous media case regardless of its complexity. Direct simulation can be costly, but in recent years have made a significant progress in creating and training predictive deep learning algorithms using direct simulation data. For instance we have cut down permeability estimation from 8+ hours down to seconds [1]. We further present the latest work on estimating electrical properties [2] as well as diffusion coefficients in reactive flow [3] in geologic porous media using similar approaches. I will present the results in context of the literature and discuss future directions. One of the key aspects of machine and learning framework is that it works best with shared (open) data (e.g. Digital Rocks Portal [4]) and open source code (e.g. [5]). We thus need environments that directly link data, high performance computing simulation, deep learning prediction as well as automated collection of the data into a searchable library.

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Biography

Maša Prodanović is a Frank W. Jessen Professor in Hildebrand Department of Petroleum and Geosystems Engineering (PGE), The University of Texas at Austin. She is an applied mathematician-turned-engineer and has expertise in direct simulation of flow and particulate transport in porous and fractured media, porous media characterization especially based on 2D and 3D images of rock microstructure, unconventional resources and data curation. She is a recipient of multiple awards such as InterPore Medal for Porous Media Research in 2022, SPE Distinguished Member Award in 2021, EAGE Alfred Wegener Award in 2021, SPE Formation Evaluation regional award for development of Digital Rocks Portal in 2019, Texas 10 (top faculty) and Stony Brook 40 Under Forty awards in 2017, SPE Faculty Innovative Teaching Award in 2014 and Interpore Procter & Gamble Research Award for Porous Media Research in 2014. She was elected Interpore Society Council member, SIAM Geosciences Program Director 2021-22 and SIAM Geosciences Chair 2023-24.

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Digital Rocks Portal: https://www.digitalrocksportal.org/ Twitter @RocksPortal