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Editorial

HIGHLIGHTS FROM THE NEW ISSUE OF INTERPORE JOURNAL

Nima Shokri

Institute of Geo-Hydroinformatics, Hamburg University of Technology, Hamburg, Germany

Correspondence to:
Nima Shokri at nima.shokri@tuhh.de

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As we open this new issue of the InterPore Journal, I am encouraged by how rapidly our field is developing and by the role the journal plays in this progress. Each contribution in this edition reflects not only technical advancement but also the expanding relevance of porous media research to a wide range of challenges. The work presented here demonstrates a shared commitment to curiosity, rigor, and collaboration, which are necessary to sustain our community and push the boundaries of what we can achieve together.

In this new issue, Liu et al. (1) presents a numerical study combining the discrete element method with a pore network model to examine how compaction influences longitudinal dispersion in granular materials. The authors show that dispersion does not vary monotonically with compaction. This non-monotonic trend emerges because compaction affects dispersion mechanisms in multiple ways. With increasing compaction, molecular diffusion becomes less dominant, while mechanical and hold-up dispersion grows stronger. The authors also report previously unrecognized forms of hold-up dispersion that fall outside the scope of classical dispersion theory. The study further demonstrates that compaction modifies both pore size and network topology, with topological changes moderating flow disorder. These findings provide new insight into how mechanical processes shape transport behavior and could offer guidance for designing porous materials with tailored dispersion characteristics.

Zhang et al. (2) examines how geological heterogeneity affects hydraulic fracturing in the Mahu area in China. Using CT imaging, QEMSCAN analysis, and the Global Pore-Pressure Cohesive Zone model, the authors compare fracture behavior in homogeneous and heterogeneous core samples. They show that fractures tend to propagate in regions with lower critical fracture energy, and propagate slower in heterogeneous samples. These findings highlight how variations in rock properties shape fracture networks and offer guidance for optimizing hydraulic fracturing strategies in complex conglomerate reservoirs.

Hibben et al. (3) explores the feasibility of using a rhamnolipid biosurfactant as a sustainable flushing agent for PFAS-contaminated soils. Column experiments using materials from an AFFF-impacted site show that the biosurfactant solution removes PFOS more efficiently than water alone, reducing retardation. While its benefits are most pronounced for PFOS, the results provide promising initial evidence that biosurfactants could support more effective and environmentally friendly PFAS remediation strategies.

Gomes et al. (4) advances digital rock analysis by introducing an inverse modeling approach to estimate variations in elastic properties in rocks. Using a sandstone sample from the Botucatu Formation, the authors combine finite element modeling, a genetic algorithm, and artificial neural networks to iteratively match simulations with experimental data. Their studies demonstrate that this integrated framework can reliably infer mechanical properties, offering a robust new tool for pore-scale characterization.

Salek et al. (5) investigates how carbonate mineralization affects fracture aperture and permeability evolution, which are important in subsurface storage systems. Using replicable 3D-printed fracture models, the authors examine calcite precipitation and its impact on fracture aperture through flow experiments, imaging, and surface topography analyses. Their results contribute to a deeper understanding of the permeability evolution due to carbonate mineralization in caprock formations.

McKague et al. (6) revisits medial-axis-based pore network extraction and presents an updated, efficient method called Medial Axis Guided Network Extraction Tool (MAGNET). By analyzing the skeleton of the pore space and incorporating improved approaches for identifying pore bodies and throat geometry, MAGNET delivers fast, topologically accurate networks. Validation against Berea sandstone imaging shows strong agreement with watershed-based methods and lattice-Boltzmann simulations, with permeability predictions within 5% of the lattice-Boltzmann prediction on the same image. The tool offers a modern, computationally efficient alternative for digital porous media analysis.

Notably, the final two papers associated with the InterPore2024 Invited Student Paper Award—by Liu et al. (1) and Zhang et al. (2)—are published in this issue. These awards are based on outstanding presentations delivered at the InterPore2024 Annual Meeting last year. The Invited Student Paper Award recognizes exceptional student contributions to the field and invites nominees to submit their research for publication in *InterPore Journal*. The award is conferred upon successful publication, ensuring that only work of the highest quality is recognized. More details about this award can be found here.

As we conclude this issue, I am reminded of how much our community continues to expand the possibilities of porous media research. The diverse insights gathered here reflect a shared commitment to advancing both fundamental understanding and practical solutions. I look forward to seeing how the ideas presented in these pages initiate new collaborations and future discoveries.

ORCID ID

Nima Shokri https://orcid.org/0000-0001-6799-4888

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