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ADVANCE MODELING AND SIMULATION IN COMPLEX POROUS MEDIA

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MINISYMPOSIUM

Advanced numerical methods enable us to delve into intricate flow phenomena within complex geometries, all while navigating through various temporal and spatial scales. One prime illustration of such flows resides in pore-scale porous media (PSPM). Within this realm, the intricate interplay of geometry and physics compels us to tackle nonlinear equations, like the Navier-Stokes (NS) equations, while incorporating pertinent boundary conditions. Directly observing multiphase flow in complex pore structures within experimental setups is the ideal approach for studying physical phenomena in porous media. However, the complexity of pore space geometry and connectivity can make this impractical. In such cases, one can explore the microscopic flow behavior in porous media through pore-scale modeling, which employs particle-based techniques, grid-based computational fluid dynamics (CFD) models, and process methods.

In certain scenarios, where boundary conditions are mutable, as in cases involving variable ambient temperatures or multiphase/multicomponent flows within PSPM, the complexity of the problem escalates significantly. Moreover, when dealing with complex geometries or elaborate case studies, the sheer volume of data generated presents distinctive challenges. The post-processing and analysis of such data necessitate the application of innovative data processing techniques, all while being cognizant of the constraints imposed by computational resources.

In recent years, the fusion of data science and numerical simulations has opened up fresh perspectives for addressing the challenges posed by big data. Researchers have amalgamated machine learning, deep learning, and artificial intelligence with CFD simulations and experimental data to forecast, post-process, and scrutinize the behaviors of intricate systems. As such the goal of this mini-symposium is to gather experts in the field of PSPM to discuss the following subject:

- Innovative CFD methods for porous media simulation
- Advance experimental measurements in porous media
- Use of machine learning in porous media
- Validation and tuning of the porous media data set
- Fluid flow, and heat and mass transfer in porous media
- Meshless numerical approach for simulating packed beds of particles
- Nanofluid and Nanoparticles transport phenomena in porous media

Diverse application of porous media (heat exchangers, geothermal heat source, fuel cells, carbon capturing, energy storage systems, biofuels, particulate filters, biomedical, biomaterials, etc.)