Contribution ID: **978** Type: **Poster Presentation**

Multiscale Direct Numerical Simulation of Pore Scale Fluid Flow Through Porous Media

Thursday, 25 May 2023 15:30 (1h 30m)

Multiphase fluid flow through porous media has many beneficial applications for various industries such as oil and gas, hydrology, geothermal, medical, and manufacturing. A substantial amount of research has been carried out at various scales (e.g., reservoir, Darcy, microscale) to further understand the fluid behavior, with many recent studies directed towards the pore scale. This work has revolutionized our understanding of the fundamental principles governing fluid flow in porous media and their impact on larger scale applications. However, pore-scale investigation tools are not directly applicable to multiscale porous media (e.g., fractured, and microporous rocks or multi-layered membranes) because it is impossible to run simulations on an image of the domain that resolves all scales. The multiscale Darcy-Brinkman-Stokes (DBS) approach is a novel technique that has been gaining popularity in recent years that enables the inclusion of unresolved porosity in micro-CT images through Darcy parameters (e.g., porosity, permeability). The DBS approach has been successfully employed to investigate single-phase flow and reactive transport in multiscale porous media. DBS models for multiphase flow exist, but their capability to represent accurately capillary effects at the interface between scales is unclear. The main objective of this study is to evaluate the applicability of a multiphase DBS approach to simulate multiphase fluid flow through a multiscale porous medium. Simplified 2D models containing solid free regions and porous matrices are considered and the results of DBS simulations are compared with the results of fully resolved simulations. The flow simulations are carried out using GeoChemFoam, our open-source pore-scale modelling solver package, in which the DBS method has been implemented. A wide range of regimes is considered and the domain of application of the DBS method is identified.

Participation

In-Person

References

MDPI Energies Student Poster Award

Yes, I would like to submit this presentation into the student poster award.

Country

United Kingdom

Acceptance of the Terms & Conditions

Click here to agree

Primary author: STEWART, Gospel Ezekiel

Co-authors: MAES, Julien (Heriot-Watt University); MENKE, Hannah (Heriot-Watt University)

Presenter: STEWART, Gospel Ezekiel

Session Classification: Poster

Track Classification: (MS09) Pore-scale modelling