Contribution ID: **1040**

Type: **Poster Presentation**

Development of multiphase flow simulation method in DEM under a movable-grain condition

Tuesday, 14 May 2024 09:25 (1h 30m)

Understanding how hydrodynamics of multiphase flow couple porous media deformation is essential to ensure successful engineering practices such as geological carbon sequestration. However, existing hydro-mechanical coupled models face significant challenges in reliably and efficiently capturing fluid-grain displacement patterns. In response, we present a novel two-way coupled hydro-mechanical discrete-element method model that manages fast fluid transport and considers the synchronising pore deformation. This model, which employs the implicit finite volume approach to solve pore pressure under a remarkable timestep, predicts fluid-fluid and fluid-grain interactions unconditionally stable. We design a pressure-volume iteration scheme to balance injection-induced pressure changes with pore structure rearrangements dynamically. Additionally, we incorporate adaptive flow front advancement criteria to enhance the capture of interface motion, particularly in complex flow scenarios where fluid migration surpasses the frontline pores or is impeded by capillary effects. The robustness and reliability of our model, validated against Darcy flow theory and experimental observations from Hele-Shaw tests, demonstrate its capability in accurately analysing multiphase fluid migration and dynamic fluid-grain interactions in porous media. We are confident in considering this model a powerful tool to illustrate the micro-mechanisms of multiphase flow in deformable porous media.

Acceptance of the Terms & Conditions

Click here to agree

Student Awards

I would like to submit this presentation into both awards

Country

Hong Kong SAR

Porous Media & Biology Focused Abstracts

References

Conference Proceedings

I am not interested in having my paper published in the proceedings

Primary author: Mr DAI, Quanwei (PhD Candidate)

Co-authors: Dr KWOK, Fiona CY (Assistant Professor); Dr DUAN, Kang (Professor)

Presenter: Mr DAI, Quanwei (PhD Candidate)

Session Classification: Poster

Track Classification: (MS09) Pore-scale modelling