Contribution ID: **860** Type: **Oral Presentation**

Development of a thermodynamically-based pore-scale network model to simulate fluid intermittency during two-phase flow.

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We developed a thermodynamically-based pore network model to simulate fluid intermittency during two-phase flow through porous media. Relationship between pressure gradient and flow rate during multiphase flow in porous media have been observed to transition from linear to non-linear at intermediate flow rates in recent studies. With the aid of high resolution X-ray tomography, intermittent filling of the pore spaces by the phases has been observed resulting in a nonlinear relationship between the pressure gradient and flow rate. Existing pore network models have not been able to reproduce this phenomenon. We first develop a quasi-static pore-network model to simulate the drainage and imbibition processes where capillary forces dominate. We then modify this quasi-static model by introducing a probability distribution of filling inspired by the thermodynamic formulation of multiphase flow proposed by Hansen and colleagues. The probability distribution is formulated by drawing an analogy between thermodynamics and fluid flow in porous media. We have shown that a simple thermodynamically-based pore network model can simulate the nonlinear intermittent fluid behaviours during two-phase flow through porous media.

Participation

In-Person

References

Hansen, A., Flekkoy, E.G., Sinha, S. and Slotte, P.A. (2022). A Statistical Mechanics for Immiscible and Incompressible two-phase Flow in Porous Media.

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