Contribution ID: **351**

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Physics-driven interface modeling of multiphase flow in different scale of subsurface fractures

Thursday, 2 June 2022 14:30 (15 minutes)

Multiphase flow and transport phenomena within fractures are important because fractures often represent primary flow conduits in otherwise low-permeability rock. Flows within the fracture, between the fracture and the adjacent matrix, and through the pore space within the matrix typically happen on different length and time scales. Capturing these scales experimentally is difficult. It is, therefore, useful to have a computational tool that establishes the exact position and shape of fluid/fluid interfaces in realistic fracture geometries. We here propose a progressive quasi-static level set-lattice Boltzmann coupling algorithm to study multiphase flow behavior in different scales of fracture (hydraulic fracture and natural fracture). The proposed model finds detailed, pore-level fluid configurations satisfying the Young-Laplace equation at a series of prescribed capillary pressures. The fluid volumes, contact areas, and interface curvatures are readily extracted from the configurations. The method automatically handles topological changes of the fluid volumes as capillary pressure varies. It also accommodates arbitrarily complicated shapes of confining solid surfaces. The influence of fracture cementation and stress dependence on relative permeability and capillary pressure in different scales of fractures are discussed in detail. The simulated results establish a new, mechanistic basis for evaluating transfer functions in dual-porosity flow models.

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References

[1]Song, W., Yin, Y., Landry, C. J., Prodanovic, M., Qu, Z., & Yao, J. (2021). A local-effective-viscosity multirelaxation-time lattice Boltzmann pore-network coupling model for gas transport in complex nanoporous media. SPE Journal, 26(01), 461-481.
[2]Tokan-Lawal, A., Prodanović, M., Landry, C. J., & Eichhubl, P. (2017). Influence of numerical cementation on multiphase displacement in rough fractures. Transport in Porous Media, 116(1), 275-293.
[3]Prodanovic, M., Bryant, S. L., & Karpyn, Z. T. (2010). Investigating matrix/fracture transfer via a level set method for drainage and imbibition. Spe Journal, 15(01), 125-136.

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

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