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# A dynamic pore network model for imbibition simulation considering corner flow

*Tuesday, 1 June 2021 20:00 (1 hour)*

Wetting films can develop in the corners of pores in porous media under strong wetting conditions where the contact angle allows the wetting phase to invade the corner. Such corner flow has a significant influence on the two-phase flow dynamics. Compared with the main meniscus rising within a pore, the wetting corner film is much thinner and can lie significantly ahead. Modeling the dynamics of corner film remains elusive using direct numerical simulation method because of the significant scale difference between main meniscus flow and corner film flow. In this presentation, we propose a dynamic pore network model for imbibition simulation which can accurately account for corner flow. First, a modified interacting capillary bundle model is presented to describe the liquid imbibition dynamics in a single angular tube with corner films. In this model, a square tube is decomposed into several interacting sub-capillaries with the first sub-capillary representing the main meniscus and the other ones representing the corner films. The conductance of each sub-capillary is calculated based on single-phase lattice Boltzmann simulation. The modified interacting capillary bundle model is validated by comparing its results with the two-phase lattice Boltzmann simulation results for the same geometry. Then this modified interacting capillary bundle model is incorporated into a dynamic pore network model with single-pressure algorithm. Thus the pore network is decomposed into several layers of interacting sub-pore-networks where the first layer of sub-pore-network simulates the main meniscus flow in the porous media while the other sub layers simulate the corner film flow. The snap off mechanism is also introduced into the model, which plays an important role under low flow rate condition. Finally, both the proposed dynamic pore network model and a two-phase lattice Boltzmann model are used to simulate wetting fluid redistribution in a porous medium induced by capillary force and corner film flow. The good agreement between the simulation results of both methods demonstrates the accuracy of the proposed dynamic pore network model in considering corner flow.

## Time Block Preference

Time Block B (14:00-17:00 CET)

## References

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