

Special Program in Applied Mathematics and Applied Mechanics

A diffuse-interface approach on radial Hele-Shaw flows

2013 - 11 - 06 (Wed.)

15:00 - 18:00

308, Mathematics Research Center Building (ori. New Math. Bldg.)

A diffuse-interface model by the classical Cahn-Hilliard approach is applied to simulate various kinds of radial flows in a Hele-Shaw cell. By considering different types of the free surface energy within the diffuse interface, the approach is capable to catch the interfacial phenomena for both a miscible system in which the interface diffuses continuously, and an immiscible system whose surface is confined within an extremely thin region. Based on the so-called Boussinesq Hele-Shaw-Cahn-Hilliard Model, a highly accurate diffuse-interface method is developed to effectively simulate fingering patterns on immiscible/miscible interfaces. The well-studied rotating Hele-Shaw flows are chosen as the bench mark flow fields to validate the numerical method. Thorough comparisons in an immiscible condition, including the qualitative fingering patterns with the experiments, as well as the quantitative correlation between numbers of fingers and the rotating Bond number by theoretical analysis, are made in numerous cases. All the simulations show excellent agreements with the existing results, and thus verify the robustness and accuracy of the presently developed numerical method. Consequently, various flow conditions, including immiscible/miscible interfaces with injection/suction, are simulated to further demonstrate the capability of the present numerical scheme and their interracial fingering



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