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Modelling the suppression of radial fingering in elastic Hele-Shaw cells DRAGA PIHLER-PUZOVIC, University of Manchester, RAPHAEL PERILLAT, University of Manchester, Ecole Centrale de Lyon, MATTHIAS HEIL, ANNE JUEL, University of Manchester — We find a surprisingly effective means of suppressing the fingering instabilities at the interface of air and a viscous fluid in the narrow gap between two parallel plates, by replacing one of the plates with an elastic membrane. Experiments show that the resulting fluid-structure interaction considerably delays the onset of fingering and fundamentally alters the large-amplitude interfacial patterns that develop subsequently. We present the results of a linear stability analysis which assesses how the stability of the axisymmetrically expanding air bubble to non-axisymmetric perturbations is affected by the presence of the elastic membrane, and perform direct numerical simulations to follow the evolution of the instabilities into the large-amplitude regime. The theoretical/computational predictions are then compared against the experimental results.

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