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Inhibition of viscous fluid fingering: A variational scheme for optimal flow rates[1] JOSE MIRANDA, EDUARDO DIAS, Depto. de Fisica - UFPE, BRAZIL, ENRIQUE ALVAREZ-LACALLE, Dept. Fisica Aplicada, UPC, SPAIN, MARCIO CARVALHO, Depto. Eng. Mec., PUC-Rio, BRAZIL — Conventional viscous fingering flow in radial Hele-Shaw cells employs a constant injection rate, resulting in the emergence of branched interfacial shapes. The search for mechanisms to prevent the development of these bifurcated morphologies is relevant to a number of areas in science and technology. A challenging problem is how best to choose the pumping rate in order to restrain growth of interfacial amplitudes. We use an analytical variational scheme to look for the precise functional form of such an optimal flow rate. We find it increases linearly with time in a specific manner so that interface disturbances are minimized. Experiments and nonlinear numerical simulations support the effectiveness of this particularly simple, but not at all obvious, pattern controlling process.

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