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Stability of multi-layer Hele-Shaw flows with and without diffusion PRABIR DARIPA, Texas A&M University — In this talk, we will provide some results in the context of multi-layer Hele-Shaw flows. We will address issues related to collective effects of individually unstable interfaces on the overall stability of multi-layer Hele-Shaw flows in the presence of interfacial surface tensions. We will also discuss complications in the analysis resulting from making, in the above set-up, individual layers also unstable. We obtain some sufficient conditions for suppressing instability of two-layer flows by introducing arbitrary number of constant viscosity fluid layers in between. For stabilization purposes, this condition allows selection of fluids in internal layers based on interfacial surface tensions and viscosities of fluids. Time permitting, we also examine the effects of species diffusion on the stability of the three-layer Hele-Shaw flows. This has relevance to enhanced oil recovery by polymer flooding. Analytically, we will prove the diffusive slow-down of unstable waves. It will be shown that a strong enough diffusion can almost stabilize the flow, though the magnitude of this diffusion coefficient required to completely stabilize the flow will depend on the magnitude of interfacial viscosity jumps and the viscosity gradient of the basic viscous profile of the internal layer. This work has been done in collaboration with Gelu Pasa.

Prabir Daripa
Texas A&M University

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