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Generalized Saffman-Taylor formula for multi-layer Hele-Shaw flows PRABIR DARIPA, Texas A&M University — Stability theory plays a major role from fundamental science to applied sciences. It is useful in the design of many processes and engineering instruments as well as in explaining many phenomena. In this paper we review some of the author's and his collaborator's recent works on the extension of Saffman-Taylor instability which occurs at an interface between two immiscible fluids in porous media and Hele-Shaw cells when displacing fluid is less viscous than the displaced one. The growth rate of interfacial disturbances is given by a formula called Saffman-Taylor formula which plays a very important role in many areas including flows in porous media and oil recovery among many others. In this talk, we will present our results on the generalization of this formula to multi-layer flows involving many interfaces. As an application of the generalized Saffman-Taylor formula, we will derive necessary conditions for suppressing instability of two-layer flows by introducing arbitrary number of constant viscosity fluid layers in between. The important role that these conditions play in stabilization of hydrodynamic instabilities in Hele-Shaw flows will be discussed.

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