Stability of two-phase vertical flow in homogeneous porous media
AMIR RIAZ, HAMDI TCHELEPI, Stanford University — Immiscible two-phase flow in porous media, that results from the downward injection of a heavier fluid or upward injection of a lighter fluid, is characterized by two shocks, one at each end of a rarefaction wave. The specific details of the saturation profile, such as the shock speeds and the shock saturations, are determined by the fractional flow function for given values of the mobility ratio and the gravity number. We employ a normal mode, matched asymptotic expansion analysis to obtain analytical expressions governing the stability behavior of such flows. Instability occurs at both ends of the 1-D base saturation profile with unique characteristics such that, the maximum growth rate decreases both when the mobility ratio is increased at the front end and decreased at the back end. This unusual behavior is explained in terms of vorticity eigenfunctions related to non-monotonic mobility profiles.

Amir Riaz
Stanford University

Date submitted: 14 Aug 2007

Electronic form version 1.4