Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Stability analysis of two phase stratified flow in a rectangular channel[1] DINESH BHAGAVATULA[2], PUSHPAVANAM S[3], Indian Inst of Tech-Madras — Two phase stratified flows arise in extraction operations in microfluidic systems. It is well established that stratified flows in between two infinite plates is always unstable. However such flows are experimentally observed in micro channels. To understand this paradox we perform a linear stability analysis of stratified two phase Poiseuille flow in a rectangular duct. A two-dimensional fully developed flow through the rectangular channel is considered. The linearized equations along with the boundary conditions in primitive variable formulation are numerically solved using Chebyshev collocation method. All the primitive variables, which are the velocity and pressure fields, are retained in the linearised governing equations. Since boundary conditions for disturbance pressure do not exist, the corresponding compatibility conditions derived from the Navier-Stokes equations are collocated both at the walls and the interface. The resulting eigen-value problem is solved using a shift and invert Arnoldi algorithm. The role of different parameters such as Aspect ratio, density ratio, viscosity ratio on the stability characteristics is analyzed. The stability results are validated in the limit of large Aspect Ratios. The flow fields are sought as a combination of Chebyshev polynomials in both y and z directions.

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Date submitted: 30 Jul 2015 Electronic form version 1.4