Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Capillarity and capillary waves in immiscible two-fluid channel flows PHILIP YECKO, Dept. of Mathematical Sciences, Montclair State University — The configuration of two immiscible fluids undergoing sheared Couette-Poiseuille flow in a straight channel is analyzed as a linearized stability problem, both from the point of view of eigenvalues and energy growth resulting from the non-normality of the stability operator. Only mild density contrasts ($0.75 < r < 1$) are considered and attention is placed on the dual role of capillarity, namely: the role of capillary modes in the energy growth of disturbances and the role of capillarity in the generic stability problem. It is found that when the capillary wavevector is normal to the flow plane, capillarity facilitates the exchange of energy between the mean and perturbed flows and can significantly affect the nature of growing disturbances. This is in stark contrast to the more subtle role of capillarity in general, where its primary effect is dissipative and appears as eigenvalue damping. In addition, calculations in the eigenvalue subcritical regime indicate the possibile existence of steady deformed interface solutions which may persist, in the nonlinear regime, as steady finite amplitude states.

Philip Yecko
Montclair State University

Date submitted: 07 Oct 2005

Electronic form version 1.4