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Role of slip on the Yih-Marangoni instability in an interface dominated channel flow GEETANJALI CHATTOPADHYAY, R USHA, IIT Madras, India — A linear stability analysis of Poiseuille flow of two immiscible fluids of different viscosities and densities in a slippery channel, in the presence of an insoluble surfactant at the interface is examined, within the framework of Orr-Sommerfeld system. The equations governing the flow system are solved numerically by a Chebyshev collocation method for a wide range of dimensionless parameters describing the flow system. The effects of slip on the neutral stability boundaries for the interface modes in the presence/absence of an insoluble surfactant at the interface are examined for different thickness ratios of the two layers. Slip conditions at the wall show a promise for control of the Yih-Marangoni instability of the corresponding flow system in a rigid channel. The influence of the parameters on the critical Reynolds number for the shear mode is assessed. The interaction between the two modes under the influence of different parameters displays interesting scenarios such as coalescence of modes. The study reveals that it is possible to control instabilities in interface dominated rigid channel flows by designing the walls of the channel as hydrophobic/rough/porous or undulated surfaces as these can be modeled as one with slip at the substrates.

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