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Linear stability analysis and direct numerical simulation of two layer channel flow KIRTI SAHU, Indian Institute of Technology Hyderabad, India, RAMA GOVINDARAJAN, Tata Institute of Fundamental Research Narsingi, Hyderabad, India, MANOJ TRIPATHI, Indian Institute of Technology Hyderabad, India — We study the stability of two-fluid flow through a plane channel at Reynolds numbers of a hundred to a thousand. The two fluids have the same density but different viscosities. The fluids, when miscible, are separated from each other by a mixed layer of small but finite thickness, across which viscosity changes from that of one fluid to that of the other. When immiscible, the interface is sharp. Our study spans a range of Schmidt numbers, viscosity ratios and location and thickness of the mixed layer. Our two-dimensional linear stability results predict well the behaviour displayed by our three-dimensional direct numerical simulations at early times. In both linear and non-linear regimes, the miscible flow is more unstable than the corresponding immiscible one, and the miscible flow breaks spanwise symmetry more readily to go into three-dimensionality. We show that the miscible flow over our range of parameters is always significantly more unstable than the corresponding immiscible case.

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