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Convective and absolute instabilities in stratified flow of Newtonian and Bingham-like layers. PRASHANT VALLURI, HANG DING, KIRTI SAHU, PETER SPELT, OMAR MATAR, Department of Chemical Engineering, Imperial College London — The stability of an interface separating either two Newtonian fluids or a Newtonian and a Bingham-like fluid in pressure-driven channel flow at moderate Reynolds numbers is analysed both theoretically and numerically. Inertia, interfacial tension and gravity are also accounted for in the study. In the linear regime, our theoretical analysis reveals that the interface is absolutely unstable over an intermediate range of Reynolds numbers and interfacial depths; convectively unstable regimes are present in the complimentary ranges of these parameters. Increasing the viscosity ratio and/or the yield stress of the Bingham layer promotes the absolute nature of the interfacial instability. Results obtained from numerical simulations elucidate the nonlinear evolution of the interface which is accompanied by ligament formation leading to pinchoff. The transition point from a convective to an absolute regime predicted by simulations also agrees well with the theoretical analysis. Simulations with Bingham layers (although initiated from a fully-yielded base state) show that unyielded regions appear in the wave troughs during late stages of wave evolution.

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