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Three-dimensional linear instability in pressure-driven two-layer channel flow of a Newtonian and a Herschel-Bulkley fluid KIRTI SAHU, Department of Chemical Engineering, Indian Institute of Technology Hyderabad, India, OMAR MATAR, Department of Chemical Engineering, Imperial College London, UK — We investigate the three-dimensional linear characteristics of pressure-driven two-layer channel flow, focussing on the range of parameters for which Squire's theorem does not exist, wherein a Newtonian fluid layer overlies a layer of a Herschel-Bulkley fluid. The modified Orr-Sommerfeld and Squire equations in each layers are derived and solved using an efficient spectral collocation method. Our results demonstrate the presence of three-dimensional instabilities for situations where the square root of the viscosity ratio is larger than the thickness ratio of the two layers; these "interfacial" mode instabilities are also present when density stratification is destabilising. These results may be of particular interest to researchers studying the transient growth and nonlinear stability of two-fluid flows. We also show that the "shear" modes, which are present at sufficiently large Reynolds numbers, are most unstable to two-dimensional disturbances.

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