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Modal and non-modal stability of plane Couette-Poiseuille flow of a viscoplastic fluid overlying a porous layer SOURAV SENGUPTA, SIRSHENDU DE, Indian Institute of Technology Kharagpur — Hydrodynamic stability of Couette-Poiseuille flow of a viscoplastic fluid overlying a porous layer is attempted in the current study. Modal analysis reveal non-existence of any unstable eigenvalue, analogous to what is observed for viscoplastic fluid flow in a non-porous configuration. Therefore, we resort to non-modal analysis to identify possible transient amplifications of the flow system. The principal objective is to understand the intricate interaction between the Couette component and the porous layer parameters in shaping the characteristics of flow transition. The results obtained in the present work are quite different as compared to the corresponding ones reported in the literature pertaining to Newtonian flow. The primary cause for this is the contribution of yield stress, represented by the Bingham number, and its intricate interplay with the upper plate motion and the parameters of the porous layer (depth, permeability, anisotropy, inhomogeneity, etc.). We have also attempted to explore the possible physical mechanism that dictates the non-modal, short-lived amplifications owing to the interplay between the disturbance waves and the mean shear flow.

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