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Role of anisotropy and inhomogeneity on the instability due to viscosity stratification of Poiseuille flow in a porous channel R USHA, Indian Institute of Technology Madras, GEETANJALI CHATTOPADHYAY, Indian Inst of Tech-Madras, SEVERINE MILLET, Claude Bernard University Lyon 1 — Understanding of stability characteristics of two-fluids system in confined complex geometries is crucial in industrial applications and natural phenomena. This study is motivated by the necessity to understand possible drag reduction using superhydrophobic surfaces or liquid-infused surfaces or surfaces with complex features which can be modeled as porous substrates with appropriate properties. A linear stability analysis of Poiseuille flow of viscosity-stratified two-layer immiscible fluids system in a porous channel with anisotropic and inhomogeneous permeability is analyzed. The flow in the porous medium is governed by the generalized Darcy model with Beavers-Joseph condition at the interface of the liquid-porous layers. The resulting generalized eigenvalue problem is solved numerically and the temporal linear stability analysis shows the existence of three distinct modes of instability; a porous mode, an interface mode and a shear mode. The influence of the variations in anisotropic and inhomogeneous properties of the porous medium on the interface and shear mode instabilities is assessed.The study reveals a possibility of controlling instabilities in two-layer flows in a rigid channel by designing a wall of the channel as a porous surface with appropriate properties.

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