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Linear stability analysis of a plane Poiseuille flow in a multi-layer porous channel SUPRIYA KARMAKAR, R USHA, PRIYANKA SHUKLA, Indian Inst of Tech-Madras — We examine a pressure-driven, incompressible, fully developed flow through a multi-layer channel containing an anisotropic porous layer placed parallel to the channel walls. The channel is confined by impermeable walls and governed by the Darcy-Brinkman-Forchheimer equation in a porous layer along with the Navier-Stokes equation in liquid layers. The continuity of stress and velocity are used at the interface and no-slip condition at the impermeable walls. The effect of anisotropic permeability and orientation angle on the flow and on the skin friction are discussed. Furthermore, the linear stability analysis of aforementioned configuration by considering the nonlinear inertial term in the Darcy-Brinkman-Forchheimer equation is performed numerically. The results are validated with the linear stability results of a flow where the channel consists of a fluid layer sandwiched between two isotropic porous layers. The present results are consistent when we neglect the inertial effect of the porous medium. It is found that the major system parameters affect significantly the stability characteristics of the flow, and therefore the inertial effect provides a useful means to control the flow instability of a multi-layer porous system having anisotropic permeability.

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