Linear stability of Darcy-Brinkman convection in a multilayer system of fluid and porous layers with internal heat sources

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ABSTRACT: Linear stability of thermal natural convection in a horizontal multilayer system consisting of a homogeneous porous layer sandwiched between two fluid layers has been simulated by an accurate numerical method. The porous and fluid layers include uniform heat sources. Flow in the porous medium has been governed by Darcy-Brinkman's low and in the fluid layer by Navier-Stokes equations with the Boussinesq approximation. The lower and upper rigid surfaces are assumed to be fixed at temperatures T_L and T_U respectively, in which $T_L > T_U$. The eigenvalues and eigenfunctions of the linear stability analysis are have been solved by utilizing Compound Matrix Method (CMM). The CMM reaches accurate results in a very efficient manner. Moreover, the method removes the stiffness from the equations of stability system. The results indicate that the onset of convection and nature of convection cells depend on relative depths of layers and the strength of heat sources. It has been observed that the thickness of lower fluid layer increases the critical Rayleigh number of the upper fluid layer.