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Linear stability analysis of plane Poiseuille-Couette flow over a permeable surface[1] SAMAN HOOSHYAR, PARISA MIRBOD, University of Illinois at Chicago — The instability of plane Poiseuille-Couette flow (PCF) over a porous medium has been studied extensively due to their wide range of applications in environmental engineering, oil and pharmaceutical industries, and geophysical problems. This study investigates the effect of imposing Couette to the instability of plane Poiseuille flow over a porous surface. We performed linear stability analysis to analyze the impact of upper moving wall on the porous media with different geometrical parameters and to obtain the most unstable perturbation modes. The Navier-Stokes and Brinkman equations are coupled to characterize the behavior of the fluid and porous layers, respectively. It was found that the presence of Couette flow always destabilizes the Poiseuille flow when the velocity of the upper moving wall is smaller than the cutoff velocity, defined as the velocity at which the flow stabilizes and it is a function of the depth ratio and porous resistivity. The flow becomes more stable as the wall velocity exceeds the cutoff velocity. Also, increasing the wall velocity results in an instability mode shift from the fluid layer mode to the porous layer mode.

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