Stability of Poiseuille Flow Over a Porous Layer (CSP-5)

Scientific Achievement:

We found that the following key factors stabilize a system that has Poiseuille flow over a porous layer:
- **Decrease in Darcy number**
- **Increase in depth ratio**
- **Increase in anisotropy parameter**
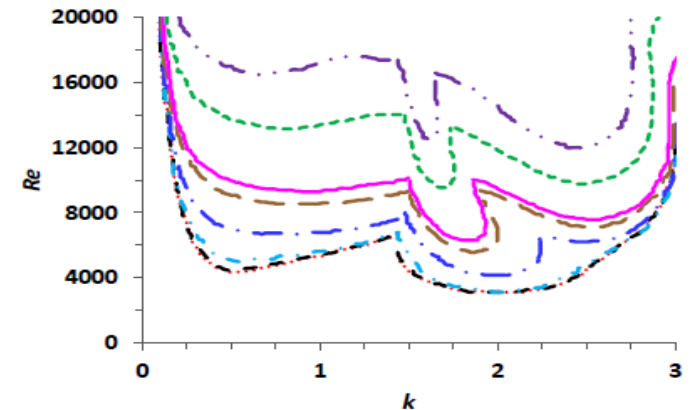- **Decrease in inhomogeneity factor.**

Significance and Impact:

In the range of parameters considered, both directional and spatial variations in permeability are found to have an immense effect on the stability characteristics for all depth ratios and Darcy numbers.

Research Details:

- We present the linear stability analysis of horizontal Poiseuille flow in a fluid overlying a porous medium with anisotropic and inhomogeneous permeability.
- The generalized Darcy model is used to describe the flow in the porous medium with the Beavers-Joseph condition at the interface of the two layers, and the eigenvalue problem is solved numerically.
- We show that the anisotropic and inhomogeneous modulation of the permeability of the underlying porous layer provides an effective means for passive control of the flow stability.

Curves of Reynold's number vs k for different values of anisotropy parameter
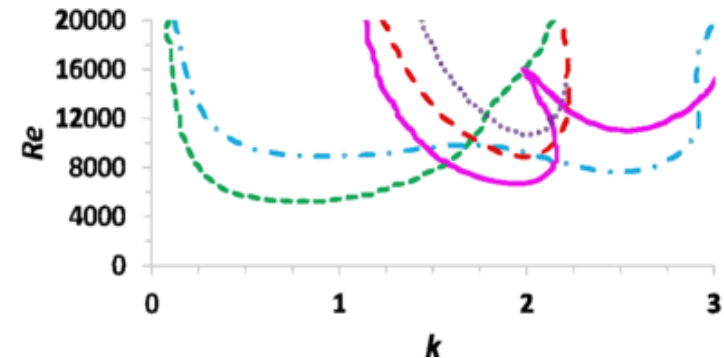
Curves of Reynolds number vs k for different values of inhomogeneity factor

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