Symposium on “Instability and Flow Transition”

Title: - Linear and Nonlinear thermosolutal instabilities in an inclined porous layer

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Abstract:

We investigate the double-diffusive instability in an inclined porous layer with a concentration based internal heat source by conducting linear instability and nonlinear energy analyses. The effects of different dimensionless parameters, such as the thermal (Ra_T) and solutal (Ra_S) Rayleigh numbers, the angle of inclination $(\emptyset)$, the Lewis number (Le) and the concentration-based internal heat source (Q) are examined. A comparison between the linear and nonlinear thresholds for the longitudinal and transverse rolls provides the region of subcritical instability. We found that the system becomes more unstable when the thermal diffusivity is greater than the solute and the internal heat source strength increases. It is observed that the system is stabilized by increasing the angle of inclination. While the longitudinal roll remains stationary without the region of subcritical instability, as the angle of inclination increases, the transverse roll switches from stationary-oscillatory-stationary mode. Our numerical results show that for $Ra_S < 0$, for all Q values, the subcritical instability only exists for transverse rolls. For $Ra_S \geq 0$, however, the subcritical instability appears only for $Q = 0$ and $Q \geq 0$, respectively, for longitudinal and transverse rolls.