Effect of internal heat source on the onset of double-diffusive convection in a rotating nanofluid layer with feedback control strategy

ABSTRACT

A linear stability analysis has been carried out to examine the effect of internal heat source on the onset of Rayleigh–Bénard convection in a rotating nanofluid layer with double diffusive coefficients, namely, Soret and Dufour, in the presence of feedback control. The system is heated from below and the model used for the nanofluid layer incorporates the effects of thermophoresis and Brownian motion. Three types of bounding systems of the model have been considered which are as follows: both the lower and upper bounding surfaces are free, the lower is rigid and the upper is free, and both of them are rigid. The eigenvalue equations of the perturbed state were obtained from a normal mode analysis and solved using the Galerkin method. It is found that the effect of internal heat source and Soret parameter destabilizes the nanofluid layer system while increasing the Coriolis force, feedback control, and Dufour parameter helps to postpone the onset of convection. Elevating the modified density ratio hastens the instability in the system and there is no significant effect of modified particle density in a nanofluid system.

K**eyword**: Internal feat source; Double-diffusive convection; Rotating nanofluid layer