Numerical Analysis of Multiplicity and Transition Phenomena in Natural Convection

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Abstract : Heat transfer by natural convection in two-dimensional and three-dimensional axisymmetric enclosure fitted with partially heated vertical walls is investigated numerically. The range of Rayleigh number is varied from 10³ until convective flow becomes unstable. This research focuses on multiplicity and transition phenomena in natural convection and is based on a parametric analysis to study the onset of bifurcations. It is found that, even at low Rayleigh numbers, the flow undergoes a series of turning-point bifurcations which increase the rate of natural convention. On the other hand, by partially heating or cooling the walls, more effective results can be achieved for both heating and cooling applications, such as cooling of electronic devices and heating processes in solidification and crystal growth.

Keywords : natural convection, partial heated, onset of bifurcation, Rayleigh number

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