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Convective Phenomena in Rotating Annuli Heated on Periphery

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Results of time-accurate numerical simulation of 2D and 3D unsteady buoyancy-induced convection in rotating annular air-filled cavities heated on the periphery and cooled at the inner radius are presented. The cavity radial aspect ratio is equal to 0.35, the centrifugal Rayleigh number is ranged from 5E04 to 5E07. It has been established that at the Rayleigh numbers ranged from 2E05 to 2E06 stable flow regimes with two, four or six vortices can be obtained with the 2D formulation for an unlimited annulus. In a 3D configuration with two bounding adiabatic discs (axial ratio is equal 0.34), the two-vortex regime is inhibited, and possible regimes with four-vortex or six-vortex large-scale structures manifest a pronounced chaotic behavior at Ra>1E06. For the 3D configuration, the Nusselt numbers are by 3 to 5% lower that for correspondent 2D solutions. The Nusselt numbers computed are in a good agreement with the experimental correlation.

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