

Abstract

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Numerical simulations of the effect of an isotropic heat field on the entropy generation due to natural convection in a square cavity

Entropy generation associated with laminar natural convection in an infinite square cavity, subjected to an isotropic heat field with different intensities was numerically investigated for different values of Rayleigh number. The numerical work was carried out using, an in-house CFD code written in FORTRAN, which discretizes non-dimensional forms of the governing equations using the finite volume method & solves the resulting system of equations using Gauss-Seidal method utilizing a TDMA algorithm. Proper code validation was undertaken in order to establish the entropy generation calculations. It was found that the increase in the isotropic heat field intensity resulted in a corresponding exponential increase of the entropy augmentation number, & promoted high values of Bejan number within the flow. The entropy generation due to heat transfer was approximately one order of magnitude higher than the entropy generation due to fluid friction. The spatial uniformity of the Bejan number was more sensitive to the change in Rayleigh number than to the heat field intensity. The thermodynamic penalty of the isotropic heat field is shown by means of global integrals of the entropy source terms over the entire flow domain.