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Three-Dimensional Unsteady Natural Convection and Entropy Generation in an Inclined Cubical Trapezoidal Cavity Subjected to Uniformly Heated Bottom Wall

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Abstract : Numerical computation of unsteady laminar three-dimensional natural convection and entropy generation in an inclined cubical trapezoidal air-filled cavity is performed for the first time in this work. The vertical right and left sidewalls of the cavity are maintained at constant cold temperatures. The lower wall is subjected to a constant hot temperature, while the upper one is considered insulated. Computations are performed for Rayleigh numbers varied as $103 \leq Ra \leq 105$, while the trapezoidal cavity inclination angle is varied as $0° \leq \phi \leq 180°$. Prandtl number is considered constant at $Pr = 0.71$. The second law of thermodynamics is applied to obtain thermodynamic losses inside the cavity due to both heat transfer and fluid friction irreversibilities. The variation of local and average Nusselt numbers are presented and discussed.While, streamlines, isotherms and entropy contours are presented in both two and three-dimensional pattern. The results show that when the Rayleigh number increases, the flow patterns are changed especially in three-dimensional results and the flow circulation increases. Also, the inclination angle effect on the total entropy generation becomes insignificant when the Rayleigh number is low.Moreover, when the Rayleigh number increases the average Nusselt number increases.

Keywords : transient natural convection, trapezoidal cavity, three-dimensional flow, entropy generation, second law
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