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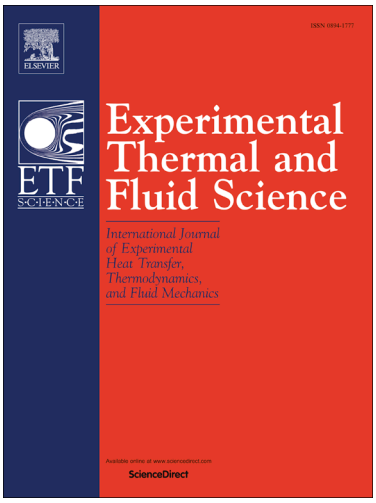

Three-dimensional natural convection and radiation in a rectangular cavity with one active vertical wall

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Three-dimensional natural convection and radiation in a rectangular cavity with one active vertical wall

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Abstract

Three-dimensional study of natural convection in a closed rectangular cavity has been carried out. The rectangular cavity is 340 mm high, 163 mm long and 210 mm deep. The aspect ratio of the rectangular cavity is 2.09. The cavity is filled with air. The cavity has one active vertical wall. The opposing vertical wall is inactive and insulated from the back. The other four walls are adiabatic. Combined radiation and natural convection in the cavity is studied experimentally. Thermocouples are used to measure the temperature. The temperature distribution between the vertical walls of the cavity is obtained at 35 positions in the length direction, five positions in the height direction and five positions in the depth direction. In the central region of the cavity, the temperature gradient is low and the temperature profile shows a linear variation. In the near wall regions, the temperature gradient is high and the temperature sharply increases. The isotherms in the cavity are obtained for five cavity depths. The variation of the Nusselt number with the cavity height and depth is presented. The average Nusselt number is obtained by taking the weighted average of the results. The Rayleigh number is 3.78×10^6.

Keywords: Cavity; Rectangular; Wall; Temperature; Distribution; Heat Transfer.

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