

Abstract Submitted
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Experimental study of natural convection inside a differentially heated enclosure with internal heat generation COLIN BUTLER, MARCO GERON, DAVID NEWPORT, University of Limerick — This study is motivated by the use of natural convection correlations in the early stages of thermal design. While correlations are widely available for benchmark geometries, in practice compartments may have many heated surfaces and several heat generating objects. An experimental investigation is undertaken to examine the influence of cavity differential heating on the natural convection flow from an isothermal circular horizontal cylinder. The square compartment, of length (L), contains the centrally positioned cylinder of diameter $0.1L$. The vertical walls are differentially heated, while the remainders are assumed adiabatic. Steady-state temperature measurements were taken in 15 different locations inside the cavity. The air flow fields and velocities were measured using a 2D PIV system. Results are presented in the form of Nusselt number correlations, velocity vector maps and boundary layer profiles for different values of the Rayleigh number and temperature difference ratio (T^*). A circular airflow was observed inside the compartment. The plume rising from the cylinder interferes with this stream with varying results depending on Ra and T^* . The flow structures become increasingly dominated by the presence of the cylinder with increasing Ra and T^* despite the Grashof number for the cylinder being several orders of magnitude lower than that for the cavity.

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