

Abstract Submitted
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Synchronization of natural convection in thermostatically-controlled adjacent cavities¹ RAFAEL CHAVEZ-MARTINEZ, MARIO SANCHEZ-LOPEZ, FRANCISCO JAVIER SOLORIO-ORDAZ, Department of Thermofluids, Faculty of Engineering, Universidad Nacional Autonoma de Mexico, MIHIR SEN, Department of Aerospace and Mechanical Engineering, University of Notre Dame, IN 46556, USA — Synchronization is a phenomenon observed in complex dynamical systems. It was first noticed by Huygens in the 17th century, and since then has been observed in systems of different types such as mechanical, biological and social. In thermal systems, numerical and analytical studies have found that two or more similar heat sources, with independent thermostatic temperature control and communicating with each other through a common interface, can have temperature oscillations. In the present study, laboratory experiments were carried out to study the thermal synchronization in two cuboid rooms separated by a common wall. Computer-based thermostats independently control the temperature of each cavity. The experiments show the effect of the ambient temperature and the initial condition in the cavities on the phase difference $\Delta\phi$. The results demonstrate in-phase and out-of-phase synchronization. An increase of the temperature difference between the cavity and the ambient, ΔT , increases $\Delta\phi$. When $\Delta T < 2^\circ\text{C}$, $\Delta\phi$ oscillates around zero. $\Delta\phi$ is negative independently of the initial condition. The results of these experiments will be useful in the desing of heating in full-scale buildings.

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