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Influence of Periodic Fins in a 2-D Rayeigh-Bénard Cavity ADIS ZILIĆ, DARREN HITT, ANTONIO CAMPO, School of Engineering, University of Vermont — We examine the heat transfer augmentation of classic Rayleigh-Bénard convection resulting from the the addition of periodically-spaced tranverse fins attached to the heated, lower plate. The respective impacts of the fin size, the fin spacing and the thermal conductivity of the fin material are examined through numerical simulations. The present study has been primarily focused on laminar flow regimes and fin spacing-to-gap ratios of 5-to-1 and less. Weakly turbulent flow conditions have also been examined, as have instances of thermally-conducting and thermally-insulating fin materials. The results from numerical simulations have revealed that surprisingly rich fluid mechanical behavior is possible under certain parametric conditions, including flow bifurcations leading to dual-convection cells not found in the classic 2-D Rayleigh-Bénard problem. It is found that the impact of the fin is almost entirely due to its hydrodynamic role as a no-slip boundary condition, thus rendering the selection of fin material moot. For all but the shortest of fins, the heat transfer obtained for all spacing-to-gap ratios is less than that for the Rayleigh-Bénard scenario; in contrast, for very short fins, an enhancement of heat transfer is possible for the range of conditions examined. The existence of 'optimal' conditions which maximize heat transfer is discussed.

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