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Transition to unsteady flows in a differentially heated air-filled cavity with a fin

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The transition from a steady to an unsteady flow induced by a fin on the sidewall of a differentially heated air-filled cavity is investigated using numerical simulations. The numerical results show that the fin plays a critical role in the transition and triggers the unstable flow if the Rayleigh number is larger than the critical value. Based on the present results, the temporal development and spatial structures of the flow following sudden heating and cooling are described, and distinct features in the transition to an unsteady flow are characterized. Additionally, the dependence on the Rayleigh number of heat transfer rate through the cavity under the steady and unstable flow regimes is quantified.

Keywords: steady flow, unsteady flow, fin, air-filled cavity