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Supercritical Quasi-conduction States and Multiple Stable Flows in Stochastic Rayleigh-Bénard Convection DANIELE VENTURI, GEORGE KARNIADAKIS, Brown University — Stochastic bifurcations and stability of natural convection within two-dimensional square enclosures are investigated by using different stochastic modeling approaches. Deterministic stability analysis is carried out first to obtain steady state solutions and primary bifurcations. It is found that multiple stable steady states coexist, in agreement with recent results, within specific ranges of Rayleigh number. Stochastic simulations are then conducted around bifurcation points and transitional regimes. The influence of random initial conditions and random perturbations in the temperature distribution at the horizontal walls is also investigated. It is found that random noise renders the bifurcation process to convection imperfect and it extends the range of stability of quasi-conduction states beyond the classical onset of convection. In particular, subcritical and nearly supercritical quasi-conduction stable states are observed within the range of Rayleigh numbers Ra=0-4000. Analysis of the stochastic bifurcation diagrams also shows the presence of a stochastic drift phenomenon in the heat transfer coefficient, especially in the transcritical region. Such stochastic drift is investigated further by means of a sensitivity analysis based on functional ANOVA decomposion.

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