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Proper orthogonal decomposition of turbulent thermal convection[1] JORGE BAILON-CUBA, JOERG SCHUMACHER, Technical University of Ilmenau — The determination of the empirical eigenfunctions, which result from the Proper Orthogonal Decomposition (POD) procedure, is considered for Rayleigh-Bénard convection in rectangular boxes. Periodic boundary conditions correspond to continuous symmetries and eigenmodes in the lateral translation-invariant directions, which are Fourier modes. These symmetries reduce the dimensionality of the eigenvalue problem. Free-slip boundary conditions in the vertical direction y, correspond to so-called discrete symmetries which can be handled by group theoretical considerations, with a significant increase in the available database. Several data sets at different Rayleigh number, are analyzed. We study how much kinetic energy is contained in the first POD modes, and how it changes with Rayleigh number. The most energetic POD modes give us also a hint on the dynamic dominance of coherent flow patterns, and how well the original inhomogeneous flow can be modeled with a reduced number of modes.

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Jorge Bailon-Cuba
Technical University of Ilmenau

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