Abstract Submitted
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Use of biglobal stability and resolvent analyses for controlling cavity flows[1] YIYANG SUN, QIONG LIU, LOUIS CATTAFESTA, Florida State University, LAWRENCE UKEILEY, University of Florida, KUNIHIKO TAIRA, Florida State University — Biglobal stability and resolvent analyses are used to numerically examine the three-dimensional characteristics of subsonic and supersonic flows over a rectangular cavity of aspect ratio 6 at a depth-based Reynolds number of 502. Direct numerical simulations are performed to characterize the unsteady flow features and to determine the base states (steady state and mean flows) for the stability and resolvent analyses. The present study finds preferential frequencies and wavenumbers for the intrinsic instabilities and flow response to continuously harmonic forcing, respectively. These insights from global stability and resolvent analyses are utilized to design active flow control strategies for suppressing adverse two-dimensional modes (Rossiter modes) that cause intense aerodynamic fluctuations. Flow control efforts are focused on triggering three-dimensional instability and resolvent modes that are sufficiently strong to induce spanwise mixing, modify the base state, and remove energy from the Rossiter modes. We assess the effectiveness of the proposed flow control designs in full direct numerical simulations.

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Yiyang Sun
Florida State University

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