Abstract Submitted
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An improved algorithm for balanced proper orthogonal decomposition using analytic tails[1] JONATHAN TU, CLARENCE ROWLEY, Princeton University — Balanced proper orthogonal decomposition (BPOD) can be used in flow control applications to identify coherent structures of interest and to form reduced-order models. Doing so involves simulating impulse responses of the direct and adjoint systems, in order to compute factorizations of the empirical Gramians. We present a new variant of the BPOD algorithm that simultaneously reduces its computational cost and increases its accuracy. Dynamic mode decomposition (DMD) is used to identify the slow eigenvectors that dominate the long-time behavior of the impulse responses, and the contribution of these eigenvectors to the empirical Gramians is then accounted for analytically. This procedure greatly reduces the error inherent in truncating the impulse responses after a finite time. We demonstrate the effectiveness of this algorithm by applying it to the flow past a two-dimensional cylinder, at a Reynolds number of 100. Reduced-order models are computed for the restriction of the wake dynamics to the stable subspace. Models generated using the analytic tail method yield the same accuracy as those computed using traditional BPOD, with a 70% reduction in computation time.

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