Abstract Submitted
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Nonlinear reduced order models for fluids systems using extended dynamic mode decomposition[1] SCOTT DAWSON, CLARENCE ROWLEY, Princeton University — The development of techniques that can extract simple, accurate, and computationally tractable models from fluids data is of importance for enhanced prediction, control, and fundamental understanding of such systems. Modeling approaches can take the form of identifying modes upon which to project the governing equations (e.g., Galerkin projection onto a set of POD modes), or in determining (or calibrating) the temporal dynamics from data, such as in dynamic mode decomposition (DMD), or various modifications to Galerkin projection. Here, we demonstrate that choosing appropriate observables (such as linear and quadratic monomials of POD coefficients) can allow for nonlinear behavior to be accurately captured using the recently proposed extended DMD algorithm. For cylinder wake data spanning the transient and vortex shedding limit cycle regimes, the identified nonlinear models show significant improvement in accuracy and robustness over standard DMD and Galerkin projection. Compared to traditional DMD, this approach should also allow for a better global approximation of the Koopman operator for the dynamical system. We make connections with other related model identification algorithms, and additionally investigate the performance of the method upon spatially sparse and noisy data.

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