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Dynamic mode decomposition for compressive system identification ZHE BAI, EURIKA KAISER, Department of Mechanical Engineering, University of Washington, Seattle, WA, JOSHUA L. PROCTOR, Institute of Disease Modeling, Bellevue, WA, J. NATHAN KUTZ, Department of Applied Mathematics, University of Washington, Seattle, WA, STEVEN L. BRUNTON, Department of Mechanical Engineering, University of Washington, Seattle, WA — Dynamic mode decomposition has emerged as a leading technique to identify spatiotemporal coherent structures from high-dimensional data. In this work, we integrate and unify two recent innovations that extend DMD to systems with actuation and systems with heavily subsampled measurements. When combined, these methods yield a novel framework for compressive system identification, where it is possible to identify a low-order model from limited input–output data and reconstruct the associated full-state dynamic modes with compressed sensing, providing interpretability of the state of the reduced-order model. When full-state data is available, it is possible to dramatically accelerate downstream computations by first compressing the data. We demonstrate this unified framework on simulated data of fluid flow past a pitching airfoil, investigating the effects of sensor noise, different types of measurements (e.g., point sensors, Gaussian random projections, etc.), compression ratios, and different choices of actuation (e.g., localized, broadband, etc.). This example provides a challenging and realistic test-case for the proposed method, and results indicate that the dominant coherent structures and dynamics are well characterized even with heavily subsampled data.

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