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Compressed sensing DMD with control ZHE BAI, EURIKA KAISER, University of Washington, JOSHUA PROCTOR, Institute of Disease Modeling, J. NATHAN KUTZ, STEVEN BRUNTON, University of Washington — The dynamic mode decomposition (DMD) has been widely adopted in the fluid dynamics community, in part due to its ease of implementation, its connection to nonlinear dynamical systems, and its highly extensible formulation as a linear regression. This work combines the recent innovations of compressed sensing DMD and DMD with control, resulting in a new computational framework to extract spatiotemporal coherent structures using subsampled data from a complex system with inputs or control. The resulting compressed DMD with control (cDMDc), has two major uses in high-dimensional systems, such as a fluid flow: 1) if only subsampled or compressive measurements are available, it is possible to used compressed sensing to reconstruct full-dimensional DMD modes, and 2) if full data is available, it is possible to accelerate computations by first pre-compressing data and then reconstructing full modes from compressed DMD computations. In both cases, the addition of DMD with inputs and control makes it possible to disambiguate the natural unforced dynamics from the effect of actuation. We demonstrate this architecture on a number of relevant examples from fluid dynamics.

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