Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Overview on sparsity in fluids ZHE BAI, Lawrence Berkeley National Laboratory, STEVEN BRUNTON, University of Washington — Fluid flows are typically represented in high-dimension, although they often exhibit low-dimensional patterns. Understanding these patterns and their evolving dynamics is crucial for control. Thus, discovering these patterns from experimental and numerical data is a central challenge in fluid dynamics. The existence of these low-dimensional flow patterns also enable efficient sensing strategies, sparsity-promoting optimization, and randomized methods in fluids. In this talk, we will discuss integrated sparse sensing and modal decomposition for fluids, which involve compressed sensing, proper orthogonal decomposition, and dynamic mode decomposition, providing a foundation for pattern recognition and low-rank structure discovery of high-dimensional systems. These data-driven models save tremendous online experimental and computational resources by leveraging the existence of patterns. We will illustrate these ideas on a variety of engineering applications.

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Date submitted: 31 Jul 2019 Electronic form version 1.4