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Koopman operator theory: Past, present, and future STEVEN BRUNTON, EURIKA KAISER, NATHAN KUTZ, University of Washington — Koopman operator theory has emerged as a dominant method to represent nonlinear dynamics in terms of an infinite-dimensional linear operator. The Koopman operator acts on the space of all possible measurement functions of the system state, advancing these measurements with the flow of the dynamics. A linear representation of nonlinear dynamics has tremendous potential to enable the prediction, estimation, and control of nonlinear systems with standard textbook methods developed for linear systems. Dynamic mode decomposition has become the leading data-driven method to approximate the Koopman operator, although there are still open questions and challenges around how to obtain accurate approximations for strongly nonlinear systems. This talk will provide an introductory overview of modern Koopman operator theory, reviewing the basics and describing recent theoretical and algorithmic developments. Particular emphasis will be placed on the use of data-driven Koopman theory to characterize and control high-dimensional fluid dynamic systems. This talk will also address key advances in the rapidly growing fields of machine learning and data science that are likely to drive future developments.

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