# Dynamic Mode Decomposition: Data-Driven Modeling of Complex Systems

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Data-driven dynamical systems is a burgeoning field-it connects how measurements of nonlinear dynamical systems and/or complex systems can be used with well-established methods in dynamical systems theory. This is a critically important new direction because the governing equations of many problems under consideration by practitioners in various scientific fields are not typically known. Thus, using data alone to help derive, in an optimal sense, the best dynamical system representation of a given application allows for important new insights. The recently developed dynamic mode decomposition (DMD) is an innovative tool for integrating data with dynamical systems theory. The DMD has deep connections with traditional dynamical systems theory and many recent innovations in compressed sensing and machine learning.

*Dynamic Mode Decomposition: Data-Driven Modeling of Complex Systems*, the first book to address the DMD algorithm, presents a pedagogical and comprehensive approach to all aspects of DMD currently developed or under development; blends theoretical development, example codes, and applications to showcase the theory and its many innovations and uses; highlights the numerous innovations around the DMD algorithm and demonstrates its efficacy using example problems from engineering and the physical and biological sciences; and provides extensive MATLAB code, data for intuitive examples of key methods, and graphical presentations.

**Audience:** The core audience for this book is engineers and applied mathematicians working in the physical and biological sciences. It can be used in courses that integrate data analysis with dynamical systems.

**Contents:** Contents; Preface; Notations; Acronyms; Chapter 1: Dynamic Mode Decomposition: An Introduction; Chapter 2: Fluid Dynamics; Chapter 3: Koopman Analysis; Chapter 4: Video Processing; Chapter 5: Multiresolution DMD; Chapter 6: DMD with Control; Chapter 7: Delay Coordinates, ERA, and Hidden Markov Models; Chapter 8: Noise and Power; Chapter 9: Sparsity and DMD; Chapter 10: DMD on Nonlinear Observables; Chapter 11: Epidemiology; Chapter 12: Neuroscience; Chapter 13: Financial Trading; Glossary; Bibliography; Index.

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