



# Data-Driven Modeling & Scientific Computation: Methods for Complex Systems & Big Data

By J. Nathan Kutz

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## Data-Driven Modeling & Scientific Computation: Methods for Complex Systems & Big Data By J. Nathan Kutz

The burgeoning field of data analysis is expanding at an incredible pace due to the proliferation of data collection in almost every area of science. The enormous data sets now routinely encountered in the sciences provide an incentive to develop mathematical techniques and computational algorithms that help synthesize, interpret and give meaning to the data in the context of its scientific setting. A specific aim of this book is to integrate standard scientific computing methods with data analysis. By doing so, it brings together, in a self-consistent fashion, the key ideas from:

DT statistics,

DT time-frequency analysis, and

DT low-dimensional reductions

The blend of these ideas provides meaningful insight into the data sets one is faced with in every scientific subject today, including those generated from complex dynamical systems. This is a particularly exciting field and much of the final part of the book is driven by intuitive examples from it, showing how the three areas can be used in combination to give critical insight into the fundamental workings of various problems.

*Data-Driven Modeling and Scientific Computation* is a survey of practical numerical solution techniques for ordinary and partial differential equations as well as algorithms for data manipulation and analysis. Emphasis is on the implementation of numerical schemes to practical problems in the engineering, biological and physical sciences.

An accessible introductory-to-advanced text, this book fully integrates MATLAB and its versatile and high-level programming functionality, while bringing together computational and data skills for both undergraduate and graduate students in scientific computing.

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#### **Review**

The book allows methods for dealing with large data to be explained in a logical process suitable for both undergraduate and post-graduate students ... With sport performance analysis evolving into deal with big data, the book forms a key bridge between mathematics and sport science John Francis, University of Worcester

#### **About the Author**

J. Nathan Kutz, *Professor of Applied Mathematics, University of Washington*

Professor Kutz is the Robert Bolles and Yasuko Endo Professor of Applied Mathematics at the University of Washington. Prof. Kutz was awarded the B.S. in physics and mathematics from the University of Washington (Seattle, WA) in 1990 and the PhD in Applied Mathematics from Northwestern University (Evanston, IL) in 1994. He joined the Department of Applied Mathematics, University of Washington in 1998 and became Chair in 2007.

Professor Kutz is especially interested in a unified approach to applied mathematics that includes modeling, computation and analysis. His area of current interest concerns phenomena in complex systems and data analysis (dimensionality reduction, compressive sensing, machine learning), neuroscience (neuro-sensory systems, networks of neurons), and the optical sciences (laser dynamics and modelocking, solitons, pattern formation in nonlinear optics).

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