

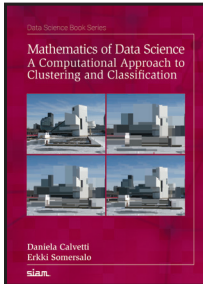
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New SIAM Titles



Mathematics of Data Science A Computational Approach to Clustering and Classification

Daniela Calvetti and Erkki Somersalo



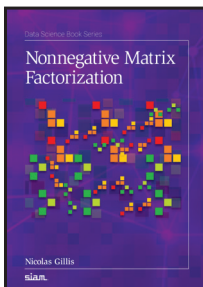
This self-contained textbook provides a solid mathematical basis for understanding popular data science algorithms for clustering and classification and shows that an in-depth understanding of the mathematics powering these algorithms gives insight into the underlying data. It presents a step-by-step derivation of these algorithms, outlining their implementation from scratch in a computationally sound

way. The book proposes different ways of visualizing high-dimensional data to unveil hidden internal structures and includes graphical explanations and computed examples using publicly available data sets.

2020 • x + 189 pages • Softcover • 978-1-611976-36-6
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Nonnegative Matrix Factorization

Nicolas Gillis



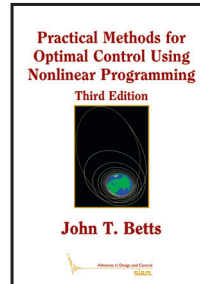
Nonnegative matrix factorization (NMF) in its modern form has become a standard tool in the analysis of high-dimensional data sets. This book provides a comprehensive and up-to-date account of the most important aspects of the NMF problem and is the first book to cover in detail the theoretical aspects of NMF, including geometric interpretation, nonnegative rank, complexity, and

uniqueness. It explains why understanding these theoretical insights is key to using this computational tool effectively and meaningfully. *Nonnegative Matrix Factorization* is accessible to a wide audience and is ideal for anyone interested in the workings of NMF. It discusses new results on identifiability and complexity and the separable NMF and contains MATLAB codes for readers to run numerical examples.

December 2020 • xxvi + 354 pages • Softcover • 978-1-611976-40-3
See bookstore.siam.org for pricing • DI02

Practical Methods for Optimal Control Using Nonlinear Programming Third Edition

John T. Betts

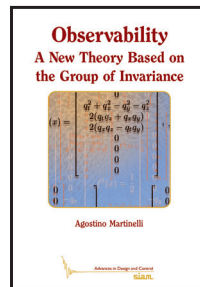


This book presents practical methods for solving real optimal control problems and focuses on the direct transcription method for optimal control. The third edition has been thoroughly updated and includes new material on implicit Runge–Kutta discretization techniques, new chapters on partial differential equations and delay equations, and more than 70 test problems and open source FORTRAN code for all the problems.

2020 • xiv + 733 pages • Hardcover • 978-1-611976-18-2
List \$119.00 • SIAM Member \$83.30 • CDC Attendee \$95.20 • DC36

Observability A New Theory Based on the Group of Invariance

Agostino Martinelli



This book provides a complete and modern theory of observability based on a new paradigm borrowed from theoretical physics and the mathematical foundation of that paradigm. It includes the analytical solution of some complex open problems in control theory, most notably the nonlinear unknown input observability (nonlinear UIO), and provides many examples, some with

important applications for neuroscience and others in the framework of vision-aided inertial navigation for aerial vehicles. It also provides many applications, mostly in robotics and autonomous navigation and, for these applications, it includes all the derivations needed to separate the observable part of the system from the unobservable.

2020 • xiv + 262 pages • Softcover • 978-1-611976-24-3
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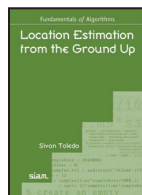
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Location Estimation from the Ground Up

Sivan Toledo

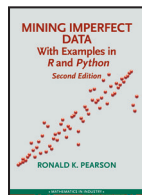


The location of an object can often be determined from indirect measurements using a process called estimation. This book explains the mathematical formulation of location-estimation problems and the statistical properties of these mathematical models and presents algorithms that are used to resolve these models to obtain location estimates. It clearly introduces analytic and algorithmic topics not covered in other books and takes a unified approach to estimation while highlighting the differences between classes of estimation problems.

2020 • xvi + 200 pages • Softcover • ISBN 978-1-611976-28-1
List \$67.00 • SIAM Member \$46.90 • CDC Attendee \$53.60 • FA17

Mining Imperfect Data With Examples in R and Python Second Edition

Ronald K. Pearson



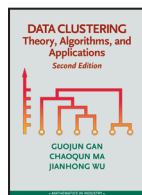
It has been estimated that as much as 80% of the total effort in a typical data analysis project is taken up with data preparation, including reconciling and merging data from different sources, identifying and interpreting various data anomalies, and selecting and implementing appropriate treatment strategies for the anomalies that are found. This book focuses on the identification and treatment of data anomalies, including examples that highlight different types of anomalies, their potential consequences if left undetected and untreated, and

options for dealing with them. The book also emphasizes the range of open-source tools available for identifying and treating data anomalies, mostly in R but also with several examples in Python.

2020 • x + 481 pages • Softcover • 978-1-611976-26-7
List \$94.00 • SIAM Member \$65.80 • CDC Attendee \$75.20 • MN04

Data Clustering Theory, Algorithms, and Applications Second Edition

Guojun Gan, Chaoqun Ma, and Jianhong Wu

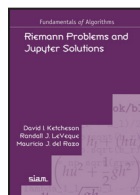


Data clustering, also known as cluster analysis, is an unsupervised process that divides a set of objects into homogeneous groups. Development in the area has exploded, especially in clustering algorithms for big data and open-source software for cluster analysis. This second edition reflects these new developments, covers the basics of data clustering, includes a list of popular clustering algorithms, and provides program code that helps users implement clustering algorithms.

2020 • xxiv + 406 pages • Softcover • 978-1-611976-32-8
List \$94.00 • SIAM Member \$64.80 • CDC Attendee \$75.20 • MN05

Riemann Problems and Jupyter Solutions

David I. Ketcheson, Randall J. LeVeque, and
Mauricio J. del Razo

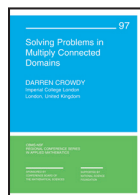


This book addresses an important class of mathematical problems (the Riemann problem) for first-order hyperbolic partial differential equations, which arise when modeling wave propagation in applications such as fluid dynamics, traffic flow, acoustics, and elasticity. It covers the fundamental ideas related to classical Riemann solutions, including their special structure and the types of waves that arise, as well as the ideas behind fast approximate solvers for the Riemann problem. The emphasis is on the general ideas, but each chapter delves into a particular application. The book is available in electronic form as a collection of Jupyter notebooks that contain executable computer code and interactive figures and animations.

2020 • xii + 166 pages • Softcover • 978-1-611976-20-5
List \$59.00 • SIAM Member \$41.30 • CDC Attendee \$47.20 • FA16

Solving Problems in Multiply Connected Domains

Darren Crowdy

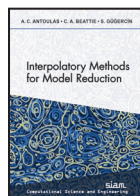


This one-of-a-kind book describes a novel mathematical framework for solving problems in two-dimensional, multiply connected regions. The framework is built on a central theoretical concept: the prime function, whose significance for the applied sciences, especially for solving problems in multiply connected domains, has been missed until recent work by the author. It is the first monograph to focus on solving applied problems in multiply connected domains.

2020 • xxii + 434 pages • Softcover • 978-1-611976-14-4
List \$89.00 • SIAM Member \$62.30 • CDC Attendee \$71.20 • CB97

Interpolatory Methods for Model Reduction

Athanasios C. Antoulas, Christopher Beattie, and
Serkan Güğercin



Interpolatory methods are among the most widely used model reduction techniques, used to replace large systems of coupled differential and algebraic equations that constitute high fidelity system models with substantially fewer equations that are crafted to control the loss of fidelity that order reduction may induce in the system response. This textbook is the first comprehensive analysis of this approach available in a single, extensive resource. It introduces state-of-the-art methods and covers both classical projection frameworks for model reduction and data-driven, nonintrusive frameworks.

2020 • xii + 232 pages • Softcover • 978-1-611976-07-6
List \$79.00 • SIAM Member \$55.30 • CDC Attendee \$63.20 • CS21

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