

1. Record Nr.	UNINA9910637724303321
Autore	Nazareth J. L (John Lawrence)
Titolo	Concise Guide to Numerical Algorithmics : The Foundations and Spirit of Scientific Computing // John Lawrence Nazareth
Pubbl/distr/stampa	Cham, Switzerland : , : Springer Nature Switzerland AG, , [2023] ©2023
ISBN	3-031-21762-4
Edizione	[First edition.]
Descrizione fisica	1 online resource (XIV, 69 p. 9 illus., 7 illus. in color.)
Collana	SpringerBriefs in Computer Science Series
Disciplina	518.1
Soggetti	Algorithms Numerical analysis
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	PART I: RATIONALE AND FOUNDATIONS -- The discussion here is premised on the paper that accompanies this proposal. -- Chapter 1: Algorithmics---The Spirit of Computing -- Chapter 2: Number ---The Language of Science -- Chapter 3: Bringing Number Under the Rubric of Algorithm -- PART II: NUMERICAL ALGORITHMIC SCIENCE -- Chapter 4: Algorithms on Graphs and Networks -- Chapter 5: Uni-Dimensional Equation-Solving and Optimization -- Chapter 6: Matrix-Based and Tensor-Based Computations -- Chapter 7: Linear Programming before the 1984 Revolution -- Chapter 8: Unconstrained Nonlinear Optimization -- Chapter 9: Nonlinear Equation-Solving -- Chapter 10: Constrained Nonlinear Optimization -- Chapter 11: Linear Programming after the 1984 Revolution -- Chapter 12: The Many Other Facets of Numerical Algorithmics -- PART III: CONVERGENCE, COMPLEXITY, AND NUMERICAL ERROR -- Chapter 13: Global Convergence and Asymptotic Rate-of-Convergence -- Chapter 14: Complexity Classes and Analysis -- Chapter 15: Roundoff-Error Analysis -- PART IV: NUMERICAL ALGORITHMIC ENGINEERING -- Chapter 16: Languages and Systems -- Chapter 17: Implementation Techniques and Software Development.
Sommario/riassunto	Numerical Algorithmic Science and Engineering (NAS&E), or more compactly, Numerical Algorithmics, is the theoretical and empirical

study and the practical implementation and application of algorithms for solving finite-dimensional problems of a numeric nature. The variables of such problems are either discrete-valued, or continuous over the reals, or, and as is often the case, a combination of the two, and they may or may not have an underlying network/graph structure. This re-emerging discipline of numerical algorithmics within computer science is the counterpart of the now well-established discipline of numerical analysis within mathematics, where the latter's emphasis is on infinite-dimensional, continuous numerical problems and their finite-dimensional, continuous approximates. A discussion of the underlying rationale for numerical algorithmics, its foundational models of computation, its organizational details, and its role, in conjunction with numerical analysis, in support of the modern *modus operandi* of scientific computing, or computational science & engineering, is the primary focus of this short monograph. It comprises six chapters, each with its own bibliography. Chapters 2, 3 and 6 present the book's primary content. Chapters 1, 4, and 5 are briefer, and they provide contextual material for the three primary chapters and smooth the transition between them. Mathematical formalism has been kept to a minimum, and, whenever possible, visual and verbal forms of presentation are employed and the discussion enlivened through the use of motivating quotations and illustrative examples. The reader is expected to have a working knowledge of the basics of computer science, an exposure to basic linear algebra and calculus (and perhaps some real analysis), and an understanding of elementary mathematical concepts such as convexity of sets and functions, networks and graphs, and so on. Although this book is not suitable for use as the principal textbook for a course on numerical algorithmics (NAS&E), it will be of value as a supplementary reference for a variety of courses. It can also serve as the primary text for a research seminar. And it can be recommended for self-study of the foundations and organization of NAS&E to graduate and advanced undergraduate students with sufficient mathematical maturity and a background in computing. When departments of computer science were first created within universities worldwide during the middle of the twentieth century, numerical analysis was an important part of the curriculum. Its role within the discipline of computer science has greatly diminished over time, if not vanished altogether, and specialists in that area are now to be found mainly within other fields, in particular, mathematics and the physical sciences. A central concern of this monograph is the regrettable, downward trajectory of numerical analysis within computer science and how it can be arrested and suitably reconstituted. Resorting to a biblical metaphor, numerical algorithmics (NAS&E) as envisioned herein is neither old wine in new bottles, nor new wine in old bottles, but rather this re-emerging discipline is a decantation of an age-old vintage that can hopefully find its proper place within the larger arena of computer science, and at what appears now to be an opportune time.

---