

Python For Computational Science And Engineering

An Active Learning Approach to Teaching the Main Ideas in Computing Explorations in Computing: An Introduction to Computer Science and Python Programming teaches computer science students how to use programming skills to explore fundamental concepts and computational approaches to solving problems. The book gives beginning students an introduction to Introduction to Modeling and Simulation with MATLAB and Python is intended for students and professionals in science, social science, and engineering that wish to learn the principles of computer modeling, as well as basic programming skills. The book content focuses on meeting a set of basic modeling and simulation competencies that were developed as part of several National Science Foundation grants. Even though computer science students are much more expert programmers, they are not often given the opportunity to see how those skills are being applied to solve complex science and engineering problems and may also not be aware of the libraries used by scientists to create those models. The book interleaves chapters on modeling concepts and related exercises with programming concepts and exercises. The authors start with an introduction to modeling and its importance to current practices in the sciences and engineering. They introduce each of the programming environments and the syntax used to represent variables and compute mathematical equations and functions. As students gain more programming expertise, the authors return to modeling concepts, providing starting code for a variety of exercises where students add additional code to solve the problem and provide an analysis of the outcomes. In this way, the book builds both modeling and programming expertise with a "just-in-time" approach so that by the end of the book, students can take on relatively simple modeling example on their own. Each chapter is supplemented with references to additional reading, tutorials, and exercises that guide students to additional help and allows them to practice both their programming and analytical modeling skills. In addition, each of the programming related chapters is divided into two parts – one for MATLAB and one for Python. In these chapters, the authors also refer to additional online tutorials that students can use if they are having difficulty with any of the topics. The book culminates with a set of final project exercise suggestions that incorporate both the modeling and programming skills provided in the rest of the volume. Those projects could be undertaken by individuals or small groups of students. The companion website at <http://www.intromodeling.com> provides updates to instructions when there are substantial changes in software versions, as well as electronic copies of exercises and the related code. The website also offers a space where people can suggest additional projects they are willing to share as well as comments on the existing projects and exercises throughout the book. Solutions and lecture notes will also be available for qualifying instructors.

The book provides an introduction to common programming tools and methods in numerical mathematics and scientific computing. Unlike widely used standard approaches, it does not focus on any particular language but aims to explain the key underlying concepts. In general, new concepts are first introduced in the particularly user-friendly Python language and then transferred and expanded in various scientific programming environments from C / C ++, Julia and MATLAB to Maple. This includes different approaches to distributed computing. The fact that different languages are studied and compared also makes the book useful for mathematicians and practitioners trying to decide which programming language to use for which purposes.

An introduction to Python programming for linguists. Examples of code specifically designed for language analysis are featured throughout.

A fully updated tutorial on the basics of the Python programming language for science students Python is a computer programming language that has gained popularity throughout the sciences. This fully updated second edition of A Student's Guide to Python for Physical Modeling aims to help you, the student, teach yourself enough of the Python programming language to get started with physical modeling. You will learn how to install an open-source Python programming environment and use it to accomplish many common scientific computing tasks: importing, exporting, and visualizing data; numerical analysis; and simulation. No prior programming experience is assumed. This guide introduces a wide range of useful tools, including: Basic Python programming and scripting Numerical arrays Two- and three-dimensional graphics Animation Monte Carlo simulations Numerical methods, including solving ordinary differential equations Image processing Numerous code samples and exercises—with solutions—illustrate new ideas as they are introduced. This guide also includes supplemental online resources: code samples, data sets, tutorials, and more. This edition includes new material on symbolic calculations with SymPy, an introduction to Python libraries for data science and machine learning (pandas and sklearn), and a primer on Python classes and object-oriented programming. A new appendix also introduces command line tools and version control with Git.

Computing is revolutionizing the practice of biology. This book, which assumes no prior computing experience, provides students with the tools to write their own Python programs and to understand fundamental concepts in computational biology and bioinformatics. Each major part of the book begins with a compelling biological question, followed by the algorithmic ideas and programming tools necessary to explore it: the origins of pathogenicity are examined using gene finding, the evolutionary history of sex determination systems is studied using sequence alignment, and the origin of modern humans is addressed using phylogenetic methods. In addition to providing general programming skills, this book explores the design of efficient algorithms, simulation, NP-hardness, and the maximum likelihood method, among other key concepts and methods. Easy-to-read and designed to equip students with the skills to write programs for solving a range of biological problems, the book is accompanied by numerous programming exercises, available at www.cs.hmc.edu/CFB.

The use of computation and simulation has become an essential part of the scientific process. Being able to transform a theory into an algorithm requires significant theoretical insight, detailed physical and mathematical understanding, and a working level of competency in programming. This upper-division text provides an unusually broad survey of the topics of modern computational physics from a multidisciplinary, computational science point of view. Its philosophy is rooted in learning by doing (assisted by many model programs), with new scientific materials as well as with the Python programming language. Python has become very popular, particularly for physics education and large scientific projects. It is probably the easiest programming language to learn for beginners, yet is also used for mainstream scientific computing, and has packages for excellent graphics and even symbolic manipulations. The text is designed for an upper-level undergraduate or beginning graduate course and provides the reader with the essential knowledge to understand computational tools and mathematical methods well enough to be successful. As part of the teaching of using computers to solve scientific problems, the reader is encouraged to work through a sample problem stated at the beginning of each chapter or unit, which involves studying the text, writing, debugging and running programs, visualizing the results, and the expressing in words what has been done and what can be concluded. Then there are exercises and problems at

the end of each chapter for the reader to work on their own (with model programs given for that purpose). The text could be used for a one-semester course on scientific computing. The relevant topics for that are covered in the first third of the book. The latter two-thirds of the text includes more physics and can be used for a two-semester course in computational physics, covering nonlinear ODEs, Chaotic Scattering, Fourier Analysis, Wavelet Analysis, Nonlinear Maps, Chaotic systems, Fractals and Parallel Computing. The e-book extends the paper version by including many codes, visualizations and applets, as well as links to video lectures. * A table at the beginning of each chapter indicates video lectures, slides, applets and animations. * Applets illustrate the results to be expected for projects in the book, and to help understand some abstract concepts (e.g. Chaotic Scattering) * The eBook's figures, equations, sections, chapters, index, table of contents, code listings, glossary, animations and executable codes (both Applets and Python programs) are linked, much like in a Web document. * Some equations are linked to their xml forms (which can be imported into Maple or Mathematica for manipulation). * The e-book will link to video-based lecture modules, held by principal author Professor Rubin Landau, that cover most every topic in the book.

This book is published open access under a CC BY 4.0 license. This book presents computer programming as a key method for solving mathematical problems. This second edition of the well-received book has been extensively revised: All code is now written in Python version 3.6 (no longer version 2.7). In addition, the two first chapters of the previous edition have been extended and split up into five new chapters, thus expanding the introduction to programming from 50 to 150 pages. Throughout the book, the explanations provided are now more detailed, previous examples have been modified, and new sections, examples and exercises have been added. Also, a number of small errors have been corrected. The book was inspired by the Springer book TCSE 6: A Primer on Scientific Programming with Python (by Langtangen), but the style employed is more accessible and concise, in keeping with the needs of engineering students. The book outlines the shortest possible path from no previous experience with programming to a set of skills that allows students to write simple programs for solving common mathematical problems with numerical methods in the context of engineering and science courses. The emphasis is on generic algorithms, clean program design, the use of functions, and automatic tests for verification.

"For intermediate Python programmers"--Back cover.

The goal of this book is to teach you to think like a computer scientist. This way of thinking combines some of the best features of mathematics, engineering, and natural science. Like mathematicians, computer scientists use formal languages to denote ideas (specifically computations). Like engineers, they design things, assembling components into systems and evaluating tradeoffs among alternatives. Like scientists, they observe the behavior of complex systems, form hypotheses, and test predictions. The single most important skill for a computer scientist is problem solving. Problem solving means the ability to formulate problems, think creatively about solutions, and express a solution clearly and accurately. As it turns out, the process of learning to program is an excellent opportunity to practice problem-solving skills. That's why this chapter is called, The way of the program. On one level, you will be learning to program, a useful skill by itself. On another level, you will use programming as a means to an end. As we go along, that end will become clearer.

This book provides a theoretical background in computation to scientists who use computational methods. It explains how computing is used in the natural sciences, and provides a high-level overview of those aspects of computer science and software engineering that are most relevant for computational science. The focus is on concepts, results, and applications, rather than on proofs and derivations. The unique feature of this book is that it "connects the dots between computational science, the theory of computation and information, and software engineering. The book should help scientists to better understand how they use computers in their work, and to better understand how computers work. It is meant to compensate a bit for the general lack of any formal training in computer science and information theory. Readers will learn something they can use throughout their careers. Sharpen your coding skills by exploring established computer science problems! Classic Computer Science Problems in Java challenges you with time-tested scenarios and algorithms. Summary Sharpen your coding skills by exploring established computer science problems! Classic Computer Science Problems in Java challenges you with time-tested scenarios and algorithms. You'll work through a series of exercises based in computer science fundamentals that are designed to improve your software development abilities, improve your understanding of artificial intelligence, and even prepare you to ace an interview. As you work through examples in search, clustering, graphs, and more, you'll remember important things you've forgotten and discover classic solutions to your "new" problems! Purchase of the print book includes a free eBook in PDF, Kindle, and ePub formats from Manning Publications. About the technology Whatever software development problem you're facing, odds are someone has already uncovered a solution. This book collects the most useful solutions devised, guiding you through a variety of challenges and tried-and-true problem-solving techniques. The principles and algorithms presented here are guaranteed to save you countless hours in project after project. About the book Classic Computer Science Problems in Java is a master class in computer programming designed around 55 exercises that have been used in computer science classrooms for years. You'll work through hands-on examples as you explore core algorithms, constraint problems, AI applications, and much more. What's inside Recursion, memoization, and bit manipulation Search, graph, and genetic algorithms Constraint-satisfaction problems K-means clustering, neural networks, and adversarial search About the reader For intermediate Java programmers. About the author David Kopec is an assistant professor of Computer Science and Innovation at Champlain College in Burlington, Vermont. Table of Contents 1 Small problems 2 Search problems 3 Constraint-satisfaction problems 4 Graph problems 5 Genetic algorithms 6 K-means clustering 7 Fairly simple neural networks 8 Adversarial search 9 Miscellaneous problems 10 Interview with Brian Goetz This fast-paced introduction to Python moves from the basics to advanced concepts, enabling readers to gain proficiency quickly. This book is suitable for use in a university-level first course in computing (CS1), as well as the increasingly popular course known as CS0. It is difficult for many students to master basic concepts in computer science and programming. A large portion of the confusion can be blamed on the complexity of the tools and materials that are traditionally used to teach CS1 and CS2. This textbook was written with a single overarching goal: to present the core concepts of computer science as simply as possible without being simplistic.

Leverage this example-packed, comprehensive guide for all your Python computational needs Key Features: Learn the first steps within Python to highly specialized concepts Explore examples and code snippets taken from typical programming situations within scientific computing. Delve into essential computer science concepts like iterating, object-oriented programming, testing, and MPI presented in strong connection to applications within scientific computing. Book Description: Python has tremendous potential within the scientific computing domain. This updated edition of Scientific Computing with Python features new chapters on

graphical user interfaces, efficient data processing, and parallel computing to help you perform mathematical and scientific computing efficiently using Python. This book will help you to explore new Python syntax features and create different models using scientific computing principles. The book presents Python alongside mathematical applications and demonstrates how to apply Python concepts in computing with the help of examples involving Python 3.8. You'll use pandas for basic data analysis to understand the modern needs of scientific computing, and cover data module improvements and built-in features. You'll also explore numerical computation modules such as NumPy and SciPy, which enable fast access to highly efficient numerical algorithms. By learning to use the plotting module Matplotlib, you will be able to represent your computational results in talks and publications. A special chapter is devoted to SymPy, a tool for bridging symbolic and numerical computations. By the end of this Python book, you'll have gained a solid understanding of task automation and how to implement and test mathematical algorithms within the realm of scientific computing. What You Will Learn: Understand the building blocks of computational mathematics, linear algebra, and related Python objects Use Matplotlib to create high-quality figures and graphics to draw and visualize results Apply object-oriented programming (OOP) to scientific computing in Python Discover how to use pandas to enter the world of data processing Handle exceptions for writing reliable and usable code Cover manual and automatic aspects of testing for scientific programming Get to grips with parallel computing to increase computation speed Who this book is for: This book is for students with a mathematical background, university teachers designing modern courses in programming, data scientists, researchers, developers, and anyone who wants to perform scientific computation in Python.

Thorsten and Isaac have written this book based on a programming course we teach for Master's Students at the School of Computer Science of the University of Nottingham. The book is intended for students with little or no background in programming coming from different backgrounds educationally as well as culturally. It is not mainly a Python course but we use Python as a vehicle to teach basic programming concepts. Hence, the words conceptual programming in the title. We cover basic concepts about data structures, imperative programming, recursion and backtracking, object-oriented programming, functional programming, game development and some basics of data science.

More physicists today are taking on the role of software developer as part of their research, but software development isn't always easy or obvious, even for physicists. This practical book teaches essential software development skills to help you automate and accomplish nearly any aspect of research in a physics-based field. Written by two PhDs in nuclear engineering, this book includes practical examples drawn from a working knowledge of physics concepts. You'll learn how to use the Python programming language to perform everything from collecting and analyzing data to building software and publishing your results. In four parts, this book includes: Getting Started: Jump into Python, the command line, data containers, functions, flow control and logic, and classes and objects Getting It Done: Learn about regular expressions, analysis and visualization, NumPy, storing data in files and HDF5, important data structures in physics, computing in parallel, and deploying software Getting It Right: Build pipelines and software, learn to use local and remote version control, and debug and test your code Getting It Out There: Document your code, process and publish your findings, and collaborate efficiently; dive into software licenses, ownership, and copyright procedures The new edition of an introductory text that teaches students the art of computational problem solving, covering topics ranging from simple algorithms to information visualization. This book introduces students with little or no prior programming experience to the art of computational problem solving using Python and various Python libraries, including PyLab. It provides students with skills that will enable them to make productive use of computational techniques, including some of the tools and techniques of data science for using computation to model and interpret data. The book is based on an MIT course (which became the most popular course offered through MIT's OpenCourseWare) and was developed for use not only in a conventional classroom but in in a massive open online course (MOOC). This new edition has been updated for Python 3, reorganized to make it easier to use for courses that cover only a subset of the material, and offers additional material including five new chapters. Students are introduced to Python and the basics of programming in the context of such computational concepts and techniques as exhaustive enumeration, bisection search, and efficient approximation algorithms. Although it covers such traditional topics as computational complexity and simple algorithms, the book focuses on a wide range of topics not found in most introductory texts, including information visualization, simulations to model randomness, computational techniques to understand data, and statistical techniques that inform (and misinform) as well as two related but relatively advanced topics: optimization problems and dynamic programming. This edition offers expanded material on statistics and machine learning and new chapters on Frequentist and Bayesian statistics.

Leverage the numerical and mathematical modules in Python and its standard library as well as popular open source numerical Python packages like NumPy, SciPy, FiPy, matplotlib and more. This fully revised edition, updated with the latest details of each package and changes to Jupyter projects, demonstrates how to numerically compute solutions and mathematically model applications in big data, cloud computing, financial engineering, business management and more. Numerical Python, Second Edition, presents many brand-new case study examples of applications in data science and statistics using Python, along with extensions to many previous examples. Each of these demonstrates the power of Python for rapid development and exploratory computing due to its simple and high-level syntax and multiple options for data analysis. After reading this book, readers will be familiar with many computing techniques including array-based and symbolic computing, visualization and numerical file I/O, equation solving, optimization, interpolation and integration, and domain-specific computational problems, such as differential equation solving, data analysis, statistical modeling and machine learning. What You'll Learn Work with vectors and matrices using NumPy Plot and visualize data with Matplotlib Perform data analysis tasks with Pandas and SciPy Review statistical modeling and machine learning with statsmodels and scikit-learn Optimize Python code using Numba and Cython Who This Book Is For Developers who want to understand how to use Python and its related ecosystem for numerical computing.

The book serves as a first introduction to computer programming of scientific applications, using the high-level Python language. The exposition is example and problem-oriented, where the applications are taken from mathematics, numerical calculus, statistics, physics, biology and finance. The book teaches "Matlab-style" and procedural programming as well as object-oriented programming. High school mathematics is a required background and it is advantageous to study classical and numerical one-variable calculus in parallel with reading this book. Besides learning how to program computers, the reader will also learn how to solve mathematical problems, arising in various branches of science and engineering, with the aid of numerical methods and programming. By blending programming, mathematics and scientific applications, the book lays a solid foundation for practicing computational science. From the reviews: Langtangen ... does an excellent job of introducing programming as a set of skills in

problem solving. He guides the reader into thinking properly about producing program logic and data structures for modeling real-world problems using objects and functions and embracing the object-oriented paradigm. ... Summing Up: Highly recommended. F. H. Wild III, Choice, Vol. 47 (8), April 2010 Those of us who have learned scientific programming in Python 'on the streets' could be a little jealous of students who have the opportunity to take a course out of Langtangen's Primer." John D. Cook, The Mathematical Association of America, September 2011 This book goes through Python in particular, and programming in general, via tasks that scientists will likely perform. It contains valuable information for students new to scientific computing and would be the perfect bridge between an introduction to programming and an advanced course on numerical methods or computational science. Alex Small, IEEE, CiSE Vol. 14 (2), March /April 2012 "This fourth edition is a wonderful, inclusive textbook that covers pretty much everything one needs to know to go from zero to fairly sophisticated scientific programming in Python..." Joan Horvath, Computing Reviews, March 2015

Familiarize yourself with the basics of Python for engineering and scientific computations using this concise, practical tutorial that is focused on writing code to learn concepts. Introduction to Python is useful for industry engineers, researchers, and students who are looking for open-source solutions for numerical computation. In this book you will learn by doing, avoiding technical jargon, which makes the concepts easy to learn. First you'll see how to run basic calculations, absorbing technical complexities incrementally as you progress toward advanced topics. Throughout, the language is kept simple to ensure that readers at all levels can grasp the concepts. What You'll Learn Understand the fundamentals of the Python programming language Apply Python to numerical computational programming projects in engineering and science Discover the Pythonic way of life Apply data types, operators, and arrays Carry out plotting for visualization Work with functions and loops Who This Book Is For Engineers, scientists, researchers, and students who are new to Python. Some prior programming experience would be helpful but not required. Series in Computational Physics Steven A. Gottlieb and Rubin H. Landau, Series Editors Introduction to Python for Science and Engineering This guide offers a quick and incisive introduction to Python programming for anyone. The author has carefully developed a concise approach to using Python in any discipline of science and engineering, with plenty of examples, practical hints, and insider tips. Readers will see why Python is such a widely appealing program, and learn the basics of syntax, data structures, input and output, plotting, conditionals and loops, user-defined functions, curve fitting, numerical routines, animation, and visualization. The author teaches by example and assumes no programming background for the reader. David J. Pine is the Silver Professor and Professor of Physics at New York University, and Chair of the Department of Chemical and Biomolecular Engineering at the NYU Tandon School of Engineering. He is an elected fellow of the American Physical Society and American Association for the Advancement of Science (AAAS), and is a Guggenheim Fellow.

This easy-to-understand textbook presents a modern approach to learning numerical methods (or scientific computing), with a unique focus on the modeling and applications of the mathematical content. Emphasis is placed on the need for, and methods of, scientific computing for a range of different types of problems, supplying the evidence and justification to motivate the reader. Practical guidance on coding the methods is also provided, through simple-to-follow examples using Python. Topics and features: provides an accessible and applications-oriented approach, supported by working Python code for many of the methods; encourages both problem- and project-based learning through extensive examples, exercises, and projects drawn from practical applications; introduces the main concepts in modeling, python programming, number representation, and errors; explains the essential details of numerical calculus, linear, and nonlinear equations, including the multivariable Newton method; discusses interpolation and the numerical solution of differential equations, covering polynomial interpolation, splines, and the Euler, Runge–Kutta, and shooting methods; presents largely self-contained chapters, arranged in a logical order suitable for an introductory course on scientific computing. Undergraduate students embarking on a first course on numerical methods or scientific computing will find this textbook to be an invaluable guide to the field, and to the application of these methods across such varied disciplines as computer science, engineering, mathematics, economics, the physical sciences, and social science. Computational Nuclear Engineering and Radiological Science Using Python provides the necessary knowledge users need to embed more modern computing techniques into current practices, while also helping practitioners replace Fortran-based implementations with higher level languages. The book is especially unique in the market with its implementation of Python into nuclear engineering methods, seeking to do so by first teaching the basics of Python, then going through different techniques to solve systems of equations, and finally applying that knowledge to solve problems specific to nuclear engineering. Along with examples of code and end-of-chapter problems, the book is an asset to novice programmers in nuclear engineering and radiological sciences, teaching them how to analyze complex systems using modern computational techniques. For decades, the paradigm in engineering education, in particular, nuclear engineering, has been to teach Fortran along with numerical methods for solving engineering problems. This has been slowly changing as new codes have been written utilizing modern languages, such as Python, thus resulting in a greater need for the development of more modern computational skills and techniques in nuclear engineering. Offers numerical methods as a tool to solve specific problems in nuclear engineering Provides examples on how to simulate different problems and produce graphs using Python Supplies accompanying codes and data on a companion website, along with solutions to end-of-chapter problems

This resource is written to follow the updated IGCSE® Computer Science syllabus 0478 with examination from June and November 2016. Cambridge IGCSE® and O Level Computer Science Programming Book for Python accompanies the Cambridge IGCSE and O Level Computer Science coursebook, and is suitable for students and teachers wishing to use Python in their studies. It introduces and develops practical skills to guide students in developing coding solutions to the tasks presented in the book. Starting from simple skills and progressing to more complex challenges, this book shows how to approach a coding problem using Structure Diagrams and Flow Charts, explains programming logic using pseudocode, develops Python programming skills and gives full solutions to the tasks set.

"Havill's problem-driven approach introduces algorithmic concepts in context and motivates students with a wide range of interests and backgrounds." -- Janet Davis, Associate Professor and Microsoft Chair of Computer Science, Whitman College "This book looks really great and takes exactly the approach I think should be used for a CS 1 course. I think it really fills a need in the textbook landscape." -- Marie desJardins, Dean of the College of Organizational, Computational, and Information Sciences, Simmons University "Discovering Computer Science is a refreshing departure from introductory programming texts, offering students a much more sincere introduction to the breadth and complexity of this ever-growing field." -- James Deverick, Senior Lecturer, The College of William and Mary "This unique introduction to the science of computing guides students through broad and universal approaches to problem solving in a variety of contexts and their ultimate implementation as computer programs." -- Daniel Kaplan, DeWitt Wallace Professor, Macalester College Discovering Computer Science: Interdisciplinary Problems, Principles, and Python Programming is a problem-oriented introduction to computational problem solving and

programming in Python, appropriate for a first course for computer science majors, a more targeted disciplinary computing course or, at a slower pace, any introductory computer science course for a general audience. Realizing that an organization around language features only resonates with a narrow audience, this textbook instead connects programming to students' prior interests using a range of authentic problems from the natural and social sciences and the digital humanities. The presentation begins with an introduction to the problem-solving process, contextualizing programming as an essential component. Then, as the book progresses, each chapter guides students through solutions to increasingly complex problems, using a spiral approach to introduce Python language features. The text also places programming in the context of fundamental computer science principles, such as abstraction, efficiency, testing, and algorithmic techniques, offering glimpses of topics that are traditionally put off until later courses. This book contains 30 well-developed independent projects that encourage students to explore questions across disciplinary boundaries, over 750 homework exercises, and 300 integrated reflection questions engage students in problem solving and active reading. The accompanying website — <https://www.discoveringcs.net> — includes more advanced content, solutions to selected exercises, sample code and data files, and pointers for further exploration.

Applied Computational Thinking with Python provides a hands-on approach to implementation and associated methodologies that will have you up-and-running, and productive in no time. Developers working with Python will be able to put their knowledge to work with this practical guide using the computational thinking method for problem-solving.

A complete guide for Python programmers to master scientific computing using Python APIs and tools About This Book The basics of scientific computing to advanced concepts involving parallel and large scale computation are all covered. Most of the Python APIs and tools used in scientific computing are discussed in detail The concepts are discussed with suitable example programs Who This Book Is For If you are a Python programmer and want to get your hands on scientific computing, this book is for you. The book expects you to have had exposure to various concepts of Python programming. What You Will Learn Fundamentals and components of scientific computing Scientific computing data management Performing numerical computing using NumPy and SciPy Concepts and programming for symbolic computing using SymPy Using the plotting library matplotlib for data visualization Data analysis and visualization using Pandas, matplotlib, and IPython Performing parallel and high performance computing Real-life case studies and best practices of scientific computing In Detail In today's world, along with theoretical and experimental work, scientific computing has become an important part of scientific disciplines. Numerical calculations, simulations and computer modeling in this day and age form the vast majority of both experimental and theoretical papers. In the scientific method, replication and reproducibility are two important contributing factors. A complete and concrete scientific result should be reproducible and replicable. Python is suitable for scientific computing. A large community of users, plenty of help and documentation, a large collection of scientific libraries and environments, great performance, and good support makes Python a great choice for scientific computing. At present Python is among the top choices for developing scientific workflow and the book targets existing Python developers to master this domain using Python. The main things to learn in the book are the concept of scientific workflow, managing scientific workflow data and performing computation on this data using Python. The book discusses NumPy, SciPy, SymPy, matplotlib, Pandas and IPython with several example programs. Style and approach This book follows a hands-on approach to explain the complex concepts related to scientific computing. It details various APIs using appropriate examples.

This book presents computer programming as a key method for solving mathematical problems. There are two versions of the book, one for MATLAB and one for Python. The book was inspired by the Springer book TCSE 6: A Primer on Scientific Programming with Python (by Langtangen), but the style is more accessible and concise, in keeping with the needs of engineering students. The book outlines the shortest possible path from no previous experience with programming to a set of skills that allows the students to write simple programs for solving common mathematical problems with numerical methods in engineering and science courses. The emphasis is on generic algorithms, clean design of programs, use of functions, and automatic tests for verification.

Python Scripting for Computational Science Springer Science & Business Media

Provides clear guidance on leveraging computational techniques to answer social science questions In disciplines such as political science, sociology, psychology, and media studies, the use of computational analysis is rapidly increasing. Statistical modeling, machine learning, and other computational techniques are revolutionizing the way electoral results are predicted, social sentiment is measured, consumer interest is evaluated, and much more. Computational Analysis of Communication teaches social science students and practitioners how computational methods can be used in a broad range of applications, providing discipline-relevant examples, clear explanations, and practical guidance. Assuming little or no background in data science or computer linguistics, this accessible textbook teaches readers how to use state-of-the-art computational methods to perform data-driven analyses of social science issues. A cross-disciplinary team of authors—with expertise in both the social sciences and computer science—explains how to gather and clean data, manage textual, audio-visual, and network data, conduct statistical and quantitative analysis, and interpret, summarize, and visualize the results. Offered in a unique hybrid format that integrates print, ebook, and open-access online viewing, this innovative resource: Covers the essential skills for social sciences courses on big data, data visualization, text analysis, predictive analytics, and others Integrates theory, methods, and tools to provide unified approach to the subject Includes sample code in Python and links to actual research questions and cases from social science and communication studies Discusses ethical and normative issues relevant to privacy, data ownership, and reproducible social science Developed in partnership with the International Communication Association and by the editors of Computational Communication Research Computational Analysis of Communication is an invaluable textbook and reference for students taking computational methods courses in social sciences, and for professional social scientists looking to incorporate computational methods into their work.

Introduction to Computer Science Using Python: A Computational Problem-Solving Focus, recommended by Guido van Rossum, the creator of Python (“This is not your average Python book...I think this book is a great text for anyone teaching CS1”). With a focus on computational problem solving from Chapter 1, this text provides numerous hands-on exercises and examples, each chapter ending with a significant-size program demonstrating the step-by-step process of program development, testing, and debugging. A final chapter includes the history of computing, starting with Charles Babbage, containing over 65 historical images. An end-of-book Python 3 Programmers' Reference is also included for quick lookup of Python details. Extensive instructor materials are provided for those adopting for classroom use, including an instructors' manual, over 1,000 well-developed slides covering all fundamental topics of each chapter, source code, and test bank.

This open access book offers an initial introduction to programming for scientific and computational applications using the Python programming language. The presentation style is compact and example-based, making it suitable for students and researchers with little or no prior experience in programming. The book uses relevant examples from mathematics and the natural sciences to present programming as a practical toolbox that can quickly enable readers to write their own programs for data processing and mathematical modeling. These tools include file reading, plotting, simple text analysis, and using NumPy for numerical computations, which are fundamental building blocks of all programs in data science and computational science. At the same time, readers are introduced to the fundamental concepts of programming, including variables, functions, loops, classes, and object-oriented programming. Accordingly, the book provides a sound basis for further computer science and programming studies. Scientific Python is a significant public domain alternative to expensive proprietary software packages. This book teaches from scratch everything the working scientist needs to know using copious, downloadable, useful and adaptable code snippets.

Readers will discover how easy it is to implement and test non-trivial mathematical algorithms and will be guided through the many freely available add-on modules. A range of examples, relevant to many different fields, illustrate the language's capabilities. The author also shows how to use pre-existing legacy code (usually in Fortran77) within the Python environment, thus avoiding the need to master the original code. In this new edition, several chapters have been re-written to reflect the IPython notebook style. With an extended index, an entirely new chapter discussing SymPy and a substantial increase in the number of code snippets, researchers and research students will be able to quickly acquire all the skills needed for using Python effectively.

Practical Numerical and Scientific Computing with MATLAB® and Python concentrates on the practical aspects of numerical analysis and linear and non-linear programming. It discusses the methods for solving different types of mathematical problems using MATLAB and Python. Although the book focuses on the approximation problem rather than on error analysis of mathematical problems, it provides practical ways to calculate errors. The book is divided into three parts, covering topics in numerical linear algebra, methods of interpolation, numerical differentiation and integration, solutions of differential equations, linear and non-linear programming problems, and optimal control problems. This book has the following advantages: It adopts the programming languages, MATLAB and Python, which are widely used among academics, scientists, and engineers, for ease of use and contain many libraries covering many scientific and engineering fields. It contains topics that are rarely found in other numerical analysis books, such as ill-conditioned linear systems and methods of regularization to stabilize their solutions, nonstandard finite differences methods for solutions of ordinary differential equations, and the computations of the optimal controls. It provides a practical explanation of how to apply these topics using MATLAB and Python. It discusses software libraries to solve mathematical problems, such as software Gekko, pulp, and pyomo. These libraries use Python for solutions to differential equations and static and dynamic optimization problems. Most programs in the book can be applied in versions prior to MATLAB 2017b and Python 3.7.4 without the need to modify these programs. This book is aimed at newcomers and middle-level students, as well as members of the scientific community who are interested in solving math problems using MATLAB or Python.

Learn data science by doing data science! Data Science Using Python and R will get you plugged into the world's two most widespread open-source platforms for data science: Python and R. Data science is hot. Bloomberg called data scientist "the hottest job in America." Python and R are the top two open-source data science tools in the world. In Data Science Using Python and R, you will learn step-by-step how to produce hands-on solutions to real-world business problems, using state-of-the-art techniques. Data Science Using Python and R is written for the general reader with no previous analytics or programming experience. An entire chapter is dedicated to learning the basics of Python and R. Then, each chapter presents step-by-step instructions and walkthroughs for solving data science problems using Python and R. Those with analytics experience will appreciate having a one-stop shop for learning how to do data science using Python and R. Topics covered include data preparation, exploratory data analysis, preparing to model the data, decision trees, model evaluation, misclassification costs, naïve Bayes classification, neural networks, clustering, regression modeling, dimension reduction, and association rules mining. Further, exciting new topics such as random forests and general linear models are also included. The book emphasizes data-driven error costs to enhance profitability, which avoids the common pitfalls that may cost a company millions of dollars. Data Science Using Python and R provides exercises at the end of every chapter, totaling over 500 exercises in the book. Readers will therefore have plenty of opportunity to test their newfound data science skills and expertise. In the Hands-on Analysis exercises, readers are challenged to solve interesting business problems using real-world data sets.

An example-rich, comprehensive guide for all of your Python computational needs
About This Book* Your ultimate resource for getting up and running with Python numerical computations* Explore numerical computing and mathematical libraries using Python 3.x code with SciPy and NumPy modules* A hands-on guide to implementing mathematics with Python, with complete coverage of all the key concepts
Who This Book Is For
This book is for anyone who wants to perform numerical and mathematical computations in Python. It is especially useful for developers, students, and anyone who wants to use Python for computation. Readers are expected to possess basic a knowledge of scientific computing and mathematics, but no prior experience with Python is needed.
What you will learn* The principal syntactical elements of Python* The most important and basic types in Python* The essential building blocks of computational mathematics, linear algebra, and related Python objects* Plot in Python using matplotlib to create high quality figures and graphics to draw and visualize your results* Define and use functions and learn to treat them as objects* How and when to correctly apply object-oriented programming for scientific computing in Python* Handle exceptions, which are an important part of writing reliable and usable code* Two aspects of testing for scientific programming: Manual and Automatic
In Detail
Python can be used for more than just general-purpose programming. It is a free, open source language and environment that has tremendous potential for use within the domain of scientific computing. This book presents Python in tight connection with mathematical applications and demonstrates how to use various concepts in Python for computing purposes, including examples with the latest version of Python 3. Python is an effective tool to use when coupling scientific computing and mathematics and this book will teach you how to use it for linear algebra, arrays, plotting, iterating, functions, polynomials, and much more.

Scripting with Python makes you productive and increases the reliability of your scientific work. Here, the author teaches you how to develop tailored, flexible, and efficient working environments built from small programs (scripts) written in Python. The focus is on examples and applications of relevance to computational science: gluing existing applications and tools, e.g. for automating simulation, data analysis, and visualization; steering simulations and computational experiments; equipping programs with graphical user interfaces; making computational Web services; creating interactive interfaces with a Maple/Matlab-like syntax to numerical applications in C/C++ or Fortran; and building flexible object-oriented programming interfaces to existing C/C++ or Fortran libraries.

Introduction to Computational Models with Python explains how to implement computational models using the flexible and easy-to-use Python programming language. The book uses the Python programming language interpreter and several packages from the huge Python Library that improve the performance of numerical computing, such as the Numpy and Scipy m

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