

```
import numpy
from ODESolver import RungeKutta4

def rhs(u, t):
    R = 1
    return alpha*u*(1 - u/R)
```

```
du/dt = alpha*u*(1 - u/R)
u(0) = 0.1
R = 1
alpha = 0.2
```

TEXTS IN COMPUTATIONAL SCIENCE
AND ENGINEERING

6

Hans Petter Langtangen

A Primer on Scientific Programming with Python

Second Edition

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A Primer On Scientific Programming With Python

Hans Petter Langtangen



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Elements of Scientific Computing Aslak Tveito,Hans Petter Langtangen,Bjørn Frederik Nielsen,Xing Cai,2010-09-27 Science used to be experiments and theory now it is experiments theory and computations The computational approach to understanding nature and technology is currently flowering in many fields such as physics geophysics astrophysics chemistry biology and most engineering disciplines This book is a gentle introduction to such

computational methods where the techniques are explained through examples It is our goal to teach principles and ideas that carry over from field to field You will learn basic methods and how to implement them In order to gain the most from this text you will need prior knowledge of calculus basic linear algebra and elementary programming

Introduction to Scientific Computing and Data Analysis Mark H. Holmes, 2016-05-30 This textbook provides an introduction to numerical computing and its applications in science and engineering The topics covered include those usually found in an introductory course as well as those that arise in data analysis This includes optimization and regression based methods using a singular value decomposition The emphasis is on problem solving and there are numerous exercises throughout the text concerning applications in engineering and science The essential role of the mathematical theory underlying the methods is also considered both for understanding how the method works as well as how the error in the computation depends on the method being used The MATLAB codes used to produce most of the figures and data tables in the text are available on the author's website and SpringerLink

Scientific Computing John A. Trangenstein, 2018-05-14 This is the second of three volumes providing a comprehensive presentation of the fundamentals of scientific computing This volume discusses more advanced topics than volume one and is largely not a prerequisite for volume three This book and its companions show how to determine the quality of computational results and how to measure the relative efficiency of competing methods Readers learn how to determine the maximum attainable accuracy of algorithms and how to select the best method for computing problems This book also discusses programming in several languages including C Fortran and MATLAB There are 49 examples 110 exercises 66 algorithms 24 interactive JavaScript programs 77 references to software programs and 1 case study Topics are introduced with goals literature references and links to public software There are descriptions of the current algorithms in LAPACK GSLIB and MATLAB This book could be used for a second course in numerical methods for either upper level undergraduates or first year graduate students Parts of the text could be used for specialized courses such as nonlinear optimization or iterative linear algebra

Scientific Computing Bertil Gustafsson, 2018-10-03 This book explores the most significant computational methods and the history of their development It begins with the earliest mathematical numerical achievements made by the Babylonians and the Greeks followed by the period beginning in the 16th century For several centuries the main scientific challenge concerned the mechanics of planetary dynamics and the book describes the basic numerical methods of that time In turn at the end of the Second World War scientific computing took a giant step forward with the advent of electronic computers which greatly accelerated the development of numerical methods As a result scientific computing became established as a third scientific method in addition to the two traditional branches theory and experimentation The book traces numerical methods journey back to their origins and to the people who invented them while also briefly examining the development of electronic computers over the years Featuring 163 references and more than 100 figures many of them portraits or photos of key historical figures the book provides a unique historical

perspective on the general field of scientific computing making it a valuable resource for all students and professionals interested in the history of numerical analysis and computing and for a broader readership alike

Numerical Geometry, Grid Generation and Scientific Computing Vladimir A. Garanzha, Lennard Kamenski, Hang Si, 2021-09-25 The focus of these conference proceedings is on research development and applications in the fields of numerical geometry scientific computing and numerical simulation particularly in mesh generation and related problems In addition this year's special focus is on Delaunay triangulations and their applications celebrating the 130th birthday of Boris Delaunay In terms of content the book strikes a balance between engineering algorithms and mathematical foundations It presents an overview of recent advances in numerical geometry grid generation and adaptation in terms of mathematical foundations algorithm and software development and applications The specific topics covered include quasi conformal and quasi isometric mappings hyperelastic deformations multidimensional generalisations of the equidistribution principle discrete differential geometry spatial and metric encodings Voronoi Delaunay theory for tilings and partitions duality in mathematical programming and numerical geometry mesh based optimisation and optimal control methods Further aspects examined include iterative solvers for variational problems and algorithm and software development The applications of the methods discussed are multidisciplinary and include problems from mathematics physics biology chemistry material science and engineering

Programming for Computations - Python Svein Linge, Hans Petter Langtangen, 2016-07-25 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

Programming for Computations - Python Svein Linge, Hans Petter Langtangen, 2019-10-30 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 [The British National Bibliography](#) Arthur James Wells,2009 **Numerical Methods for Scientific Computing** Kyle Novak,2022-03-13 A comprehensive guide to the theory intuition and application of numerical methods in linear algebra analysis and differential equations With extensive commentary and code for three essential scientific computing languages Julia Python and Matlab *Introduction to Scientific Programming with Python* Joakim Sundnes,2020-07-01 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

Learning Scientific Programming with Python Christian Hill,2015 Learn to master basic programming tasks from scratch with real life scientific examples in this complete introduction to Python *Finite Difference Computing with Exponential Decay Models* Hans Petter Langtangen,2016-06-10 This text provides a very simple initial introduction to the complete scientific computing pipeline models discretization algorithms programming verification and visualization The pedagogical strategy is to use one case study an ordinary differential equation describing exponential decay processes to illustrate fundamental concepts in mathematics and computer science The book is easy to read and only requires a command of one variable calculus and some very basic knowledge about computer programming Contrary to similar texts on numerical methods and programming this text has a much stronger focus on implementation and teaches testing and software engineering in particular

Scientific Database and Programming Examples Using PHP,MySQL,XML,MATLAB,PYTHON,PERL K.Y. Cheung,2011-09-27 This book deals with but is not limited to the following 1 A collection of typical computer programs written in Python and Matlab for scientific computations and their comparisons 2 Interfaces of Php Python Perl with Matlab and vice versa 3 Use of MySQL tables and XML for storing and transmitting scientific and economic data in scientific programming with Matlab Python and Perl 4 Converting from XML to MySQL tables and vice versa using Php 5 Creating XML and MySQL tables and retrieving data from them for inputting to Matlab and to Python using Php It is assumed that the reader has had some knowledge of Php Matlab Python Perl MySQL

and XML As this book is written with Matlab programmers in mind the following books are highly recommended for understanding the details of computer programs in this book 1 Julie C Meloni PHP MySQL and Apache All in One 4th ed 2 Hans Petter Langtangen A Primer on Scientific Programming with Python 3 Robin Nixon PHP MySQL JavaScript K Y CHEUNG

Programming for Computations - MATLAB/Octave Svein Linge,Hans Petter Langtangen,2016-08-01 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

Introduction to Scientific Programming with Python Pankaj Jayaraman,2025-02-20 Introduction to Scientific Programming with Python offers an immersive exploration into the dynamic field of scientific programming using Python We cater to a diverse audience serving as an entry point for novices and a valuable resource for seasoned practitioners in scientific computing Python s popularity in scientific circles stems from its readability versatility and extensive libraries for numerical computing data analysis and visualization We cover fundamental programming concepts and gradually introduce advanced techniques specific to scientific applications From mastering Python basics to exploring advanced topics like machine learning and symbolic mathematics each chapter provides a structured and hands on learning experience Real world case studies practical examples and exercises ensure readers grasp theoretical concepts and gain practical skills Throughout the book Python becomes a tool of empowerment enabling readers to unravel complex scientific data model intricate phenomena and contribute meaningfully to their fields Introduction to Scientific Programming with Python is an invaluable companion for harnessing Python s potential in scientific inquiry and discovery By the end readers will have a robust foundation in Python and the confidence to apply scientific programming methodologies to real world problems This book unlocks the door to a world where Python drives exploration discovery and innovation in science

Applied Scientific Computing Peter R. Turner,Thomas Arildsen,Kathleen Kavanagh,2018-07-18 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

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Scientific Computing with Python Claus Fuhrer, Jan Erik Solem, Olivier Verdier, 2021-07-30 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

Whitaker's Books in Print, 1998

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