

```
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

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A Primer On Scientific Programming With Python:

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A Primer on Scientific Programming with Python Hans Petter Langtangen, 2014-08-01 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

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

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 *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 [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

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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 *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 practical applications introduces the main concepts

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A Student's Guide to Python for Physical Modeling Jesse M. Kinder, Philip Nelson, 2021-08-03 Python is a computer programming language that is rapidly gaining popularity throughout the sciences 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

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Table of Contents A Primer On Scientific Programming With Python

1. Understanding the eBook A Primer On Scientific Programming With Python
 - The Rise of Digital Reading A Primer On Scientific Programming With Python
 - Advantages of eBooks Over Traditional Books
2. Identifying A Primer On Scientific Programming With Python
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an A Primer On Scientific Programming With Python
 - User-Friendly Interface
4. Exploring eBook Recommendations from A Primer On Scientific Programming With Python
 - Personalized Recommendations

- A Primer On Scientific Programming With Python User Reviews and Ratings
- A Primer On Scientific Programming With Python and Bestseller Lists
- 5. Accessing A Primer On Scientific Programming With Python Free and Paid eBooks
 - A Primer On Scientific Programming With Python Public Domain eBooks
 - A Primer On Scientific Programming With Python eBook Subscription Services
 - A Primer On Scientific Programming With Python Budget-Friendly Options
- 6. Navigating A Primer On Scientific Programming With Python eBook Formats
 - ePub, PDF, MOBI, and More
 - A Primer On Scientific Programming With Python Compatibility with Devices
 - A Primer On Scientific Programming With Python Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of A Primer On Scientific Programming With Python
 - Highlighting and Note-Taking A Primer On Scientific Programming With Python
 - Interactive Elements A Primer On Scientific Programming With Python
- 8. Staying Engaged with A Primer On Scientific Programming With Python
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers A Primer On Scientific Programming With Python
- 9. Balancing eBooks and Physical Books A Primer On Scientific Programming With Python
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection A Primer On Scientific Programming With Python
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine A Primer On Scientific Programming With Python
 - Setting Reading Goals A Primer On Scientific Programming With Python
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of A Primer On Scientific Programming With Python
 - Fact-Checking eBook Content of A Primer On Scientific Programming With Python

- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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