A First Course in
Computational
Physics

Second Edition

Paul L. DeVries • Javier E. Hasbun

A First Course In Computational Physics

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A First Course In Computational Physics:

    A First Course in Computational Physics Paul L. DeVries,Javier E. Hasbun,2010-03-12 Computers and computation are extremely important components of physics and should be integral parts of a physicist s education Furthermore computational physics is reshaping the way calculations are made in all areas of physics Intended for the physics and engineering students who have completed the introductory physics course A First Course in Computational Physics Second Edition covers the different types of computational problems using MATLAB with exercises developed around problems of physical interest Topics such as root finding Newton Cotes integration and ordinary differential equations are included and presented in the context of physics problems A few topics rarely seen at this level such as computerized tomography are also included Within each chapter the student is led from relatively elementary problems and simple numerical approaches through derivations of more complex and sophisticated methods often culminating in the solution to problems of significant difficulty The goal is to demonstrate how numerical methods are used to solve the problems that physicists face Read the review published in Computing in Science Engineering magazine March April 2011 Vol 13 No 2 2011 IEEE Published by the IEEE Computer Society   **A First Course in Computational Physics** Paul L. DeVries,1993   A First Course in Computational Physics and Object-Oriented Programming with C++ Hardback with CD-ROM David Yevick,2005-03-17 Textbook and reference work on the application of C in science and engineering   *Computational Physics* Rubin H. Landau,Manuel J. Páez,Cristian C. Bordeianu,2015-07-10 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   **A First Course in Scientific Computing** Rubin Landau,2011-10-30 This book offers a new approach to introductory

scientific computing It aims to make students comfortable using computers to do science to provide them with the computational tools and knowledge they need throughout their college careers and into their professional careers and to show how all the pieces can work together Rubin Landau introduces the requisite mathematics and computer science in the course of realistic problems from energy use to the building of skyscrapers to projectile motion with drag He is attentive to how each discipline uses its own language to describe the same concepts and how computations are concrete instances of the abstract Landau covers the basics of computation numerical analysis and programming from a computational science perspective The first part of the printed book uses the problem solving environment Maple as its context with the same material covered on the accompanying CD as both Maple and Mathematica programs the second part uses the compiled language Java with equivalent materials in Fortran90 on the CD and the final part presents an introduction to LaTeX replete with sample files Providing the essentials of computing with practical examples A First Course in Scientific Computing adheres to the principle that science and engineering students learn computation best while sitting in front of a computer book in hand in trial and error mode Not only is it an invaluable learning text and an essential reference for students of mathematics engineering physics and other sciences but it is also a consummate model for future textbooks in computational science and engineering courses A broad spectrum of computing tools and examples that can be used throughout an academic career Practical computing aimed at solving realistic problems Both symbolic and numerical computations A multidisciplinary approach science math computer science Maple and Java in the book itself Mathematica Fortran90 Maple and Java on the accompanying CD in an interactive workbook format   *A First Course in Mathematical Physics* Colm T. Whelan,2016-06-27 The book assumes next to no prior knowledge of the topic The first part introduces the core mathematics always in conjunction with the physical context In the second part of the book a series of examples showcases some of the more conceptually advanced areas of physics the presentation of which draws on the developments in the first part A large number of problems helps students to hone their skills in using the presented mathematical methods Solutions to the problems are available to instructors on an associated password protected website for lecturers   *A Physicist's Guide to Mathematica* Patrick T. Tam,2011-08-09 For the engineering and scientific professional A Physicist s Guide to Mathematica Second Edition provides an updated reference guide based on the 2007 new 6 0 release providing an organized and integrated desk reference with step by step instructions for the most commonly used features of the software as it applies to research in physics For professors teaching physics and other science courses using the Mathematica software A Physicist s Guide to Mathematica Second Edition is the only fully compatible new software release Mathematica text that engages students by providing complete topic coverage new applications exercises and examples that enable the user to solve a wide range of physics problems Does not require prior knowledge of Mathematica or computer programming Can be used as either a primary or supplemental text for upper division physics majors Provides over 450 end of section exercises and end of

chapter problems Serves as a reference suitable for chemists physical scientists and engineers Compatible with Mathematica Version 6 a recent major release   *What Mathematics from Africa?* Giandomenico Sica,2005   *Applied Numerical Methods for Partial Differential Equations* Carl L. Gardner,2024-10-21 The aim of this book is to quickly elevate students to a proficiency level where they can solve linear and nonlinear partial differential equations using state of the art numerical methods It covers numerous topics typically absent in introductory texts on ODEs and PDEs including Computing solutions to chaotic dynamical systems with TRBDF2 Simulating the nonlinear diffusion equation with TRBDF2 Applying Newton s method and GMRES to the nonlinear Laplace equation Analyzing gas dynamics with WENO3 1D Riemann problems and 2D supersonic jets Modeling the drift diffusion equations with TRBDF2 and PCG Solving the classical hydrodynamic model electro gas dynamics with WENO3 and TRBDF2 The book features 34 original MATLAB programs illustrating each numerical method and includes 93 problems that confirm results discussed in the text and explore new directions Additionally it suggests eight semester long projects This comprehensive text can serve as the basis for a one semester graduate course on the numerical solution of partial differential equations or with some advanced material omitted for a one semester junior senior or graduate course on the numerical solution of ordinary and partial differential equations The topics and programs will be of interest to applied mathematicians engineers physicists biologists chemists and more   Computational Physics Philipp O. J. Scherer,2010-11-30 This book encapsulates the coverage for a two semester course in computational physics The first part introduces the basic numerical methods while omitting mathematical proofs but demonstrating the algorithms by way of numerous computer experiments The second part specializes in simulation of classical and quantum systems with instructive examples spanning many fields in physics from a classical rotor to a quantum bit All program examples are realized as Java applets ready to run in your browser and do not require any programming skills   **American Journal of Physics** ,2005   **A Survey of Computational Physics** Rubin H. Landau,José Páez,Manuel José Páez Mejía,Cristian C. Bordeianu,2008-07-21 This book presents a broad survey of many of the topics that constitute modern computational science Its view is as a multidisciplinary subject combining aspects of physics applied mathematics and computer science

Computational Methods for Fluid Dynamics Joel H. Ferziger,Milovan Perić,Robert L. Street,2019-08-16 This book is a guide to numerical methods for solving fluid dynamics problems The most widely used discretization and solution methods which are also found in most commercial CFD programs are described in detail Some advanced topics like moving grids simulation of turbulence computation of free surface flows multigrid methods and parallel computing are also covered Since CFD is a very broad field we provide fundamental methods and ideas with some illustrative examples upon which more advanced techniques are built Numerical accuracy and estimation of errors are important aspects and are discussed in many examples Computer codes that include many of the methods described in the book can be obtained online This 4th edition includes major revision of all chapters some new methods are described and references to more recent publications with new

approaches are included Former Chapter 7 on solution of the Navier Stokes equations has been split into two Chapters to allow for a more detailed description of several variants of the Fractional Step Method and a comparison with SIMPLE like approaches In Chapters 7 to 13 most examples have been replaced or recomputed and hints regarding practical applications are made Several new sections have been added to cover e g immersed boundary methods overset grids methods fluid structure interaction and conjugate heat transfer   *Book Review Index* ,2006 Every 3rd issue is a quarterly cumulation

   Choice ,2008   <u>Math Refresher for Scientists and Engineers</u> John R. Fanchi,2000-05-25 All of the basic math that scientists and engineers need now expanded and revised Whether you need to understand advances in modern technology prepare for professional exams or simply brush up on skills acquired long ago John Fanchi s quick reference guide to applied math is for you He has updated his 1997 book to include probability and statistics in new chapters with exercises and solutions Fanchi explains all topics clearly and methodically from the ground up He begins with straightforward concepts in college math and gradually progresses to more advanced topics using practical applications throughout to demonstrate relationships between different areas The wealth of numerical methods and illustrative examples further enhances the utility of this truly indispensable book Math Refresher for Scientists and Engineers Second Edition reviews Algebra Geometry analytic geometry trigonometry and hyperbolic functions Vectors matrices and linear algebra Differential calculus integral calculus and special integrals Partial derivatives Ordinary differential equations and ODE solution techniques Partial differential equations Probability and statistics   <u>A First Course in Monte Carlo</u> George S. Fishman,2006 A FIRST COURSE IN MONTE CARLO shows you how to design perform and analyze the results of MC experiments based on independent replications Markov chain MC and MC optimization The text emphasizes the variance reducing techniques of importance sampling stratified sampling Rao Blackwellization control variates antithetic variates and quasi random numbers For solving optimization problems it describes several MC techniques including simulated annealing simulated tempering swapping stochastic tunneling and genetic algorithms Examples from many areas show how these techniques perform in practice Hands on exercises allow you to experience challenges encountered when solving real problems An answer key to selected problems is included   **Proceedings of the IEEE Workshop on Mathematical Methods in Biomedical Image Analysis** ,2000   <u>Proceedings : IEEE Workshop on Mathematical Methods in Biomedical Image Analysis</u> ,2000 Twenty nine contributions are organized into segments addressing segmentation deformable models registration flow and motion and shape Topics addressed include watersheds on the cortical surface for automated sulcal segmentation needle placement under X ray fluoroscopy using perspective invari   **Computational Methods for Multi-Domain Geophysical Flows** Kuo-Cheng Kao,2006

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