Guide to Scientific Computing in C++ (Undergraduate Topics in Computer Science)

By Joe Pitt-Francis, Jonathan Whiteley

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This easy-to-read textbook/reference presents an essential guide to object-oriented C++ programming for scientific computing. With a practical focus on learning by example, the theory is supported by numerous exercises.

Features: provides a specific focus on the application of C++ to scientific computing, including parallel computing using MPI; stresses the importance of a clear programming style to minimize the introduction of errors into code; presents a practical introduction to procedural programming in C++, covering variables, flow of control, input and output, pointers, functions, and reference variables; exhibits the efficacy of classes, highlighting the main features of object-orientation; examines more advanced C++ features, such as templates and exceptions; supplies useful tips and examples throughout the text, together with chapter-ending exercises, and code available to download from Springer.

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Editorial Review

Review

From the reviews:

"This book is intended for experts – mathematicians or other scientists who are familiar with the concept of programming in a high-level language and experienced in programming in languages like Fortran or MathLab. The book contains an almost full description of C++ capabilities listing the basic distinctive features of programming in it. It can serve as a fine manual for quick introduction to the subtleties of C++. … Finally a plenty of useful examples and exercises with solutions is presented." (Nail Zamov, Zentralblatt MATH, Vol. 1246, 2012)

From the Back Cover

The computational demands of modern-day simulation software needed across a range of diverse scientific disciplines lead many programmers to write their code in an object-oriented language such as C++.

This easy-to-read textbook/reference presents an essential guide to object-oriented C++ programming for scientific computing. With a practical focus on learning by example, the theory is supported by numerous exercises. Features of both the C++ language and standard libraries are highlighted via the development of classes of vectors and matrices, allowing demonstration of key concepts. The text then explains how these classes can be adapted for parallel computing, before demonstrating how a flexible, extensible library can be written for the numerical solution of differential equations.

Topics and features:

- Provides a specific focus on the application of C++ to scientific computing, including parallel computing using MPI
- Stresses the importance of a clear programming style to minimize the introduction of errors into code
- Presents a practical introduction to procedural programming in C++, covering variables, flow of control, input and output, pointers, functions, and reference variables
- Exhibits the efficacy of classes, highlighting the main features of object-orientation
- Examines more advanced C++ features, such as templates and exceptions
- Supplies useful tips and examples throughout the text, together with chapter-ending exercises, and code available to download from http://www.springer.com/978-1-4471-2735-2

This clearly written textbook is a "must-read" for programmers of all levels of expertise. Basic familiarity with concepts such as operations between vectors and matrices, and the Newton-Raphson method for finding the roots of non-linear equations, would be an advantage, but extensive knowledge of the underlying mathematics is not assumed.

About the Author

Dr Joe Pitt-Francis is a Senior Research Fellow at the Department of Computer Science and teaches

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Dr Jonathan Whiteley is a University Lecturer at the Department of Computer Science and Governing Body Fellow of Linacre College, the University of Oxford, UK.

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