



Technical Java: Applications for Science and Engineering

By Grant Palmer

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Advanced Java for Engineers and Scientists gives the reader all the information needed to use Java to create powerful, versatile, and flexible scientific and engineering applications. The book is full of practical example problems and valuable tips. Grant Palmer, a research scientist himself, goes in-depth into advanced technical programming concepts applicable to scientific-oriented applications, such as solving differential equations, data modeling, integration of functions, and creating generic class libraries. The last section of the book shows readers how Java can be used to develop GUI or Web-based front-ends to scientific or engineering programs.

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Technical Java: Applications for Science and Engineering By Grant Palmer Bibliography

- Rank: #3907135 in Books
- Published on: 2003-04-21
- Original language: English
- Number of items: 1
- Dimensions: 9.30" h x 1.40" w x 7.00" l,
- Binding: Paperback
- 496 pages

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Editorial Review

From the Back Cover

TechnicalJava™

Developing Scientific and Engineering Applications

Grant Palmer

The practical, example-rich guide to Java technical programming

If you want to use Java to develop scientific or engineering programs, Technical Java is the Java guide you've been searching for. Using real-life examples, expert scientific programmer Grant Palmer shows how to build powerful, versatile, and flexible software for virtually any technical application. Whether you're moving from FORTRAN, C, or C++, or learning Java as your first language, Palmer covers all you need to know—

- Java, FORTRAN, C, and C++, similarities, differences, and migration issues
- Java 1.4 syntax, objects, classes, methods, interfaces, variables, arrays, exceptions, packages, I/O, and more
- Working with java.math and creating your own math functions—including detailed trigonometric and transcendental examples
- Data modeling, in depth: class hierarchies, generic class libraries, least-squares fit, fitting to non-polynomial equations, and more
- Solving differential equations and systems of equations, including Gauss-Jordan and Gaussian elimination, lower-upper decomposition, and matrix inversion
- Solving integral equations with both proper and improper integrals
- Working with Fourier transforms (DFT and FFT)
- Building Web and GUI-based technical applications with Swing/AWT and servlets

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Upper Saddle River, NJ 07458

www.phptr.com

ISBN: 0-13-101815-9

UPC: 076092022398

About the Author

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GRANT PALMER, a scientific programmer at NASA Ames Research Center in Moffett Field, CA, specializes in computational fluid dynamics programming to predict friction-related heat in reentering space vehicles. He has written or contributed to five Java books, including *Java Event Handling* (Prentice Hall PTR). Palmer resides in Chandler, Arizona.

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Preface

This book was inspired by the following premise—Java is a great language for developing scientific and engineering applications. It's more powerful and versatile than Fortran or C. It's easier to learn, less redundant, and less prone to error than C++. I have been a scientific programmer at a NASA research center for 18 years. You would think such a place would be on the cutting edge of programming technology, but that is not the case. Most of the technical programmers there still program in Fortran or C. The reason is largely one of inertia. Those languages are what they have always used and they are comfortable with them. Some people have moved over to C++, and slowly but surely people are moving to Java as their technical programming language of choice.

The book is designed to break through the inertia and misconceptions that may have kept you from using Java for your scientific and engineering programming work. It will give you a good foundation in the basics of Java and demonstrate how Java can be applied to solve a number of mathematical analysis problems. The book will discuss migration issues from other languages to Java and provide an introduction to developing GUI- or web-based technical applications.

Why Is Java a Good Technical Programming Language?

There are many features of Java that make it a good choice for your technical programming work. For one thing, Java is an object-oriented language. Because of this, it provides a structured framework for developing your programs. When a code is written in an object-oriented manner, it becomes easier to read and more modular. You can write programs that extend the capabilities of existing programs. When an analysis procedure is written as an object it can be easily incorporated into any number of different applications.

One of the design goals of the developers of Java was that the language be easy to learn and use. It borrows much of its basic syntax from C and C++, but the developers of Java simplified the language by removing redundancies that exist in C and C++, as well as removing potentially dangerous elements—such as multiple inheritance—that were of marginal value. It is much easier to learn and apply Java, for example, than it is to learn and apply C or C++.

Another powerful feature is Java's portability. Java programs are designed so that you can “compile once, run anywhere.” You can develop a scientific application on a UNIX workstation, transfer it to an Apple or Windows-based laptop, and the application will run without having to recompile it. Java's portability opens up the power of the Internet to your technical programming work. You can easily develop your scientific or engineering applications as web-based programs.

There is a global support network for Java. You can get online support and documentation from the Sun Microsystems website and many other sources as well. There are Java User Groups (JUGs) pretty much

anywhere you live in just about every country. These groups are very useful for solving problems and discussing programming techniques and issues.

It also is easy to develop code in Java. You can leverage existing classes and methods to develop new ones. In this book, we will demonstrate how simple it is to create user-defined mathematical functions. The object-oriented structure of a Java makes the code easy to read. A program that is easy to read is easier to maintain or modify.

The Structure of This Book

Think of this book in four parts. The first includes a general introduction to Java and its development history. Following this are chapters that discuss migration issues from Fortran, C, or C++ to Java. You will find that much of the basic syntax is the same between C, C++, and Java. There are some important differences, though, that these chapters will bring to light.

The second part goes over the basic elements of the Java language with an emphasis on topics pertinent to technical programming. Following a discussion of basic object-oriented programming concepts, there are chapters that discuss classes, methods, and variables. Interfaces, packages, and JAR files are also covered. There are chapters that discuss how Java treats arrays and strings. Finally, there are chapters on the math capability of Java—both the intrinsic functionality that comes with the Java API and a discussion of how to create user-defined math libraries.

Once we have a good understanding of the key elements of the Java language, we are ready to do some serious technical programming. The third part of this book discusses how Java can be applied to such tasks as solving systems of equations, differential equations, integral functions, and Fourier transforms. These chapters not only provide Java source code and real-life model problems, but also delve into the theory behind the solution techniques. This section of the book also includes chapters on developing data curve fits and generic class libraries.

The final part consists of three chapters covering important features you will probably make use of in your technical programming. Chapter 25 discusses the input/output capability of Java. The Java API provides a powerful and versatile I/O functionality for reading and writing both byte and character data. Java also gives you the ability to write GUI front ends to your technical programs. An introduction to how this is done is provided in Chapter 26. Another great feature of Java is that it gives you access to the power of the Internet. The final chapter of this book provides an introduction to how you can turn a program into a web-based application using Java servlets.

What This Book Is Not

This book will teach you the basic tools you will need to start writing technical programs in Java, but it will not cover every possible aspect of scientific or engineering programming. The book is not an exhaustive treatise on solving differential equations, integral functions, or Fourier transforms. Each of those topics is a book unto itself. This book will present the most commonly used techniques to solve those mathematical problems, but won't go into many specialized or super-advanced techniques.

The book also does not give a comprehensive description of all of the classes, methods, interfaces, and fields from the Java API. The Java libraries are enormous and a detailed look at even the Standard Edition libraries would take many hundreds of pages. This book does cover some Java API elements that are particularly relevant to technical programming. For a detailed look at the rest of the Java API, the reader is referred to the Sun Java doc pages.

Users Review

From reader reviews:

Shannon Grant:

Information is provisions for anyone to get better life, information today can get by anyone from everywhere. The information can be a knowledge or any news even a concern. What people must be consider while those information which is in the former life are challenging to be find than now could be taking seriously which one is appropriate to believe or which one typically the resource are convinced. If you have the unstable resource then you obtain it as your main information it will have huge disadvantage for you. All those possibilities will not happen inside you if you take Technical Java: Applications for Science and Engineering as your daily resource information.

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