

# About This Book

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This book, *Inside Macintosh: PowerPC Numerics*, is the reference for the PowerPC Numerics environment. PowerPC Numerics is an environment in which floating-point operations are performed quickly and as accurately as possible. The PowerPC Numerics environment applies to Macintosh computers that use the PowerPC processor. The core features of PowerPC Numerics are not exclusive to Apple Computer; rather they are taken from IEEE Standard 754 for binary floating-point arithmetic and the standard proposed by the Floating-Point C Extensions (FPCE) branch of the Numerical C Extensions Group (ANSI X3J11.1).

In one sense, PowerPC Numerics is an abstraction: a definition of an environment for computer numerics, independent of a specific computer. To have an instance of this environment, you need a language in which to describe operations and an implementation unit to carry them out. The first part of this book describes the PowerPC Numerics definition, and the remaining parts describe how numerics is implemented in the PowerPC hardware and software.

You should read this book if

- you want to create PowerPC applications that use floating-point operations
- you have created a 680x0 application that uses floating-point operations and you plan to port it to PowerPC processor-based Macintosh computers (in this case, you might want to read Appendix A, “SANE Versus PowerPC Numerics,” first)
- you have not yet created a floating-point application, but you want to learn more about IEEE Standard 754 for binary floating-point arithmetic

This book is *not* for you if you don't plan to port your 680x0 applications to the PowerPC environment. Applications that are 680x0 based will run on PowerPC processor-based Macintosh computers without rebuilding, but they use the Standard Apple Numerics Environment (SANE) in emulation instead of PowerPC Numerics. You should refer to the *Apple Numerics Manual*, second edition, which describes SANE.

Before reading this book, you should already be familiar with the PowerPC run-time architecture as described in *Inside Macintosh: PowerPC System Software*.

## What's in This Book

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Part 1 describes the features shared by all PowerPC Numerics implementations and includes examples that show how to use PowerPC Numerics effectively. These examples are written in C, although other high-level languages might provide support for PowerPC Numerics. Read Part 1 to find out how PowerPC Numerics implements IEEE Standard 754 in general or to learn more about this standard.

Part 2 explains the numeric implementation in compilers and in the PowerPC Numerics library MathLib. This library is provided in ROM to implement both IEEE Standard 754 and the recommendations in the FPCE technical report. Part 2 is for use exclusively by C language programmers.

Part 3 explains the implementation in PowerPC hardware and the available assembly-language tools that perform numeric operations. Part 3 is for use by assembly-language programmers and by those who wish to look at compiler output.

The appendixes provide supplementary reference material. They give the differences between PowerPC Numerics and SANE, show how to port numerical programs to PowerPC processor-based Macintosh computers, provide listings of the header files in MathLib, and describe the FPCE recommendations for compilers. There are also summaries of the MathLib functions and PowerPC assembly-language floating-point instructions for your reference.

The bibliography at the end of this book lists some of the major sources on numerics. Refer to this bibliography for more extensive information on IEEE Standard 754, the FPCE technical report, or numerical programming in general. Also at the end of this book are a glossary of terms and an index.

## Conventions Used in This Book

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*Inside Macintosh* uses various conventions to present information. Words that require special treatment appear in specific fonts or font styles. Certain information appears in special formats so that you can scan it quickly.

## Special Fonts

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All code listings, reserved words, and the names of actual data structures, constants, fields, parameters, and routines are shown in Courier (`this is Courier`).

Words that appear in **boldface** are key terms or concepts and are defined in the glossary at the end of this book.

When a word or character appears in italics, it represents a variable that is replaced with a literal value in an actual computation. For example,

`sqrt(x)`

means take the square root of any floating-point value *x*, such as 1.45 or 2.789.

When a character appears in italics in one of the tables for special cases in Chapters 6, 9, or 10, it represents a nonzero, finite floating-point number.

## Types of Notes

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There are several types of notes used in *Inside Macintosh*.

### Note

A note like this contains information that is interesting but possibly not essential to an understanding of the main text. ◆

### IMPORTANT

A note like this contains information that is essential for an understanding of the main text. ▲

### ▲ WARNING

Warnings like this indicate potential problems that you should be aware of as you design your application. Failure to heed these warnings could result in system crashes or loss of data. ▲

## For More Information

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Macintosh Developer Technical Support  
Apple Computer, Inc.  
20525 Mariani Avenue, M/S 303-2T  
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