Preface

This small volume is intended to be both a companion to my graphics textbook—*Interactive Computer Graphics: A Top-Down Approach with OpenGL* 2d ed., Addison-Wesley, 2000—and a stand-alone beginner's guide to OpenGL for programmers who already know some computer graphics and wish to get started with OpenGL. Both of these objectives require some justification.

Interactive Computer Graphics takes a top-down approach to teaching computer graphics for seniors in computer science and engineering. The book is based on the premise that students learn modern computer graphics best if they can start programming significant applications as soon as possible. The OpenGL application programmer's interface (API) is used both for the programming examples and as an illustration of the graphics concepts in the book. This approach has been extremely successful, as evidenced by the large number of adoptions in universities and colleges around the world. Although it makes heavy use of OpenGL, *Interactive Computer Graphics* does not claim to be an OpenGL programming guide or a user's manual. Consequently, the information on OpenGL in the text is incomplete. Not all OpenGL functions are covered, and no detailed listing of the functions and their parameters is provided. For students, the former usually does not present problems; the latter, however, does. The missing information is found in the *OpenGL Programming Guide*—Addison-Wesley 2000—and the *OpenGL Reference Manual*—Addison-Wesley 2000—known as the Red Book and the Blue Book, respectively. Although the information in the reference manual can be obtained online, it is usually necessary to have physical access to the Red Book. For instructors and students, this situation poses a dilemma, since the cost of buying two or three books for a single course is significant, and these reference texts go beyond the scope of what is needed for someone to understand the basics of OpenGL.

Thus, my first motivation is to provide a low-cost supplement that will fill in the gaps in OpenGL in my textbook. This primer covers the OpenGL necessary to

do the exercises and projects that come from the textbook and also includes additional OpenGL functions that are not in the text The primer's layout makes it easy for the student to find functions, their most important options, and their descriptions. It also includes supplemental examples and covers some programming topics that I could not fit into the textbook.

However, many people already know some computer graphics and want to learn something about OpenGL. At my SIGGRAPH tutorials over the past few years, I have worked with hundreds of such people, and they leave wanting some references to pursue OpenGL further. Often, even though they may know something about graphics, they do not want to pursue the more mathematical issues; rather, they are interested only in the programming aspects of the API. Such people are the ones who purchase professional books rather than textbooks. The obvious references are the Red Book and the Blue Book. However, again, these books can represent a large investment for someone who just wants to get started. The other books in the Addison-Wesley OpenGL series are aimed at specific areas, as are books targeted specifically for the Windows market. I believe that a small, self-contained volume, such as this primer, will appeal to many of these people.

Consequently, this primer is not intended to replace either the *Programming Guide to OpenGL* or the *OpenGL Reference Guide* but instead lies somewhere between a beginner's guide and these comprehensive resources. This primer has complete coverage of a subset of the OpenGL API and should allow you to get started without reference to these other worthy volumes.

The coverage is done almost entirely without the mathematics used in my textbook. So, for example, the chapter on curves and surfaces deals with the details of how to program applications using Bézier curves and surfaces but never derives them. The chapter on transformations shows how to use rotation, translation, and scaling but does not derive the underlying matrices. The order of topics roughly follows that of the textbook but also is a natural progression in learning OpenGL. We start with two-dimensional problems in Chapter 2, move on to interactivity in Chapter 3 and to basic three-dimensional programs in Chapters 4 and 5. Chapter 6 covers lights and materials. Chapters 7 and 8 cover using OpenGL to display discrete entities, first through pixels and bitmaps and then through texture mapping. Chapter 9 introduces curves and surfaces. Chapter 10 presents a longer example than in previous chapters; the example includes most of the topics covered in previous chapters and touches on some advanced OpenGL features.

This primer includes both complete programs and partial code. As you will discover, once you write your first few OpenGL applications, much of the code is repeated in subsequent programs. Consequently, after the first few examples, I have left out much of the repeated code. Readers can find the complete examples either through my Web site, www.cs.unm.edu/~angel, or at the FTP site ftp.cs.unm.edu under pub/angel.

Obviously, this primer cannot cover all OpenGL topics. Nor did I want to. Decisions on what to leave out were based on which topics would require more mathematics, such as NURBS curves and surfaces, and such topics as tessellation, which would require a lot of detailed OpenGL functions whose applicability is not very general.

Many people provided significant help in various aspects of this primer. In particular, I want to thank a group of people who are or were at Silicon Graphics for helping me learn and appreciate OpenGL. In particular, Mark Kilgard and Mason Woo helped me when I first started using OpenGL with my classes at the University of New Mexico. Mason, Kathleen Danielson, Dave Shreiner, and Vicki Shreiner invited me to teach OpenGL tutorials with them at SIGGRAPH over the past five years, an enterprise that forced me to learn much more about the API and formed many of my ideas about how to teach with OpenGL. Mark, Nate Robins, and Brian Paul have made great contributions to all of us who use and teach OpenGL, through the creation of the GLUT library, the Mesa implementation, and many OpenGL example programs. Tom Abbott was a great help in checking the examples in the text. William Shoaff of the Florida Institute of Technology and Parris Egbert of Brigham Young University provided early encouraging reviews that were helpful in developing this project.

Having done four books with Addison-Wesley, I still marvel at the competence and professionalism of the entire production crew there. My editors at Addison-Wesley, Maite Suarez-Rivas and Peter Gordon, are as good friends and dinner companions as they are editors. Rose May Molnar, my wife and partner in all things, has survived yet another book production cycle with me, something for which she deserves more credit than I can ever express.