Pro OGRE 3D Programming

Gregory Junker

Apress®

Pro OGRE 3D Programming

Copyright © 2006 by Gregory Junker

All rights reserved. No part of this work may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without the prior written permission of the copyright owner and the publisher.

ISBN-13: 978-1-59059-710-1

ISBN-10: 1-59059-710-9

Library of Congress Cataloging-in-Publication data is available upon request.

Printed and bound in the United States of America 9 8 7 6 5 4 3 2 1

Trademarked names may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, we use the names only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

Lead Editor: Matt Wade
Technical Reviewer: Steve Streeting
Editorial Board: Steve Anglin, Ewan Buckingham, Gary Cornell, Jason Gilmore, Jonathan Gennick, Jonathan Hassell, James Huddleston, Chris Mills, Matthew Moodie, Dominic Shakeshaft, Jim Sumser, Keir Thomas, Matt Wade
Project Manager: Kylie Johnston
Copy Edit Manager: Nicole LeClerc
Copy Editor: Ami Knox
Assistant Production Director: Kari Brooks-Copony
Production Editor: Laura Esterman
Compositor/Artist: Kinetic Publishing Services, LLC
Proofreader: Lori Bring
Indexer: Broccoli Information Management
Cover Designer: Kurt Krames
Manufacturing Director: Tom Debolski

Distributed to the book trade worldwide by Springer-Verlag New York, Inc., 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax 201-348-4505, e-mail orders-ny@springer-sbm.com, or visit http://www.springeronline.com.

For information on translations, please contact Apress directly at 2560 Ninth Street, Suite 219, Berkeley, CA 94710. Phone 510-549-5930, fax 510-549-5939, e-mail info@apress.com, or visit http://www.apress.com.

The information in this book is distributed on an “as is” basis, without warranty. Although every precaution has been taken in the preparation of this work, neither the author(s) nor Apress shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the information contained in this work.

The source code for this book is available to readers at http://www.apress.com in the Source Code/Download section.

Contents

Foreword xiii
About the Author xv
About the Technical Reviewer xvii
Acknowledgments xix
Introduction xxi

CHAPTER 1 What Is This Ogre? 1

The Ogre 3D SDK 1
Where Does It Fit? 3
Features 4
Origins 5
Prerequisite Knowledge 6

CHAPTER 2 Capturing the Beast 9

Platform Support 9
Dependencies 9
Ogre Binary SDK 10
Ogre Source Distribution 11
Installing an SDK 11
Microsoft Visual C++ .NET 2003 (VC 7.1) 11
Visual C++ 2005 21
Other Free IDE/Compiler Combinations on Windows 21
Building from Source 23
Linux 23
Graphics Drivers 24
Dependencies 25
Conclusion 36

CHAPTER 3 Ogre Design Overview 37

Design Philosophy 37
Design Highlights 38
Subsystem Overview 46

Ogre Managers 49
Conclusion 50

CHAPTER 4 Ogre First Steps 51

Ogre Initialization: Quick Start 51
plugins.cfg 51
Ogre.cfg 53
Ogre.log 55
Render Window 56
Render Loop 58
Ogre Initialization: Manual 59
Root 59
Main Rendering Loop 73
Conclusion 75

CHAPTER 5 Ogre Scene Management 77

Scene Manager 78
Scene Manager Types 78
Scene Object Creation 79
Spatial Relationships and 3D Transforms 82
Movable Scene Objects 89
World Geometry 95
Static Geometry 97
Scene Management by Example 98
The Simple Things 98
Scene Manager Features 102
Conclusion 112

CHAPTER 6 Ogre Materials 113

Materials 101 114
Basic Object Shading 114
Texture Mapping 116
Programmable Shading 116
Materials and Application Design 117
Batching 117
Material Cloning 118
GPU Shaders 118
Techniques and Schemes 118

Material Composition 119
Pass 120
Entities 121
Materials by Example 121
Materials and the Fixed-Function Pipeline 121
Materials and the Programmable Pipeline 128
A More Complex Example: Offset (Parallax) Mapping 134
Conclusion 142

CHAPTER 7 Resource Management 143

Conceptual Overview 143
Resource Management 144
Resource Management in Practice 150
Resource Locations 150
Resource Initialization 152
Resource Unloading 152
Ogre Archives 156
Archive 156
ArchiveManager 156
Custom Resource Loading via Archive Implementation 157
Conclusion 157

CHAPTER 8 Ogre Render Targets 159

Conceptual Overview 159
Render Window 160
Viewports 160
Render Texture 161
Render Target Classes 162
Render Window by Example 162
Render-to-Texture by Example 165
Demo_RenderToTexture 165
Demo_Fresnel 168
Conclusion 170

CHAPTER 9 Animation 171

Types of Animation Support in Ogre 171
Animation 172
Controllers 180
Animation vs. Controller 180

Animation by Example 181
Demo_SkeletalAnimation 181
Conclusion 187

CHAPTER 10 Billboards and Particles 189

Billboards 189
Billboard Sets 190
Billboard Creation 191
Billboard Chains and Ribbon Trails 195
Particle Systems 197
Particle System Basics 197
Emitters 201
Affectors 201
Particle System Renderers 202
Conclusion 206

CHAPTER 11 Dynamic Shadows 207

Shadow Techniques 209
Overview 209
Stencil Shadowing 210
Texture Shadowing 214
Modulative Shadow Blending 221
Additive Shadow Masking 221
Conclusion 225

CHAPTER 12 Ogre 2D and Compositing 227

Ogre in Two Dimensions 227
Overlays 227
Runtime Overlay Example 234
Compositor Framework 235
Compositor Example 235
Compositor Chains 242
Notes on Compositor Usage 244
Conclusion 245

APPENDIX A Ogre Tools and Add-Ons 247

Official Tools and Utilities 247
Exporters and Plug-Ins 247
Command-Line Tools and Utilities 248

Third-Party Tools and Utilities 249
Exporters and Plug-Ins 249
Digital Content Creation 250
Ogre Addons 251
COLLADA 251
Paging Scene Manager 251
Streaming Video 251
Physics Library Connectors 252
Script Bindings 252
External Projects Using Ogre 253

APPENDIX B Script Attribute Reference 255

Material Script Attributes 255
Top-Level Material Attributes 255
Technique Attributes 255
Pass Attributes 256
Texture-Unit Attributes 258
GPU Program Attributes 260
Compositor Script 264
Technique Attributes 264
Target Attributes 264
Pass Attributes 264
Clear-Pass Attributes 265
Stencil-Pass Attributes 265
Particle Script Attributes 265
Particle System Definition Attributes 265
Particle Emitter Definition Attributes 266
Standard Particle Affectors 267
Overlay Script Attributes 269
Overlay Attribute 269
Element and Container Attributes 270
Element- and Container-Specific Attributes 270
Font Definition Script Attributes 271

INDEX 273