

OpenGL ES 3.0 Programming Guide

Second Edition



Dan Ginsburg ■ **Budirijanto Purnomo**

With Earlier Contributions from **Dave Shreiner** and **Aaftab Munshi**
Foreword by **Neil Trevett**, President, Khronos Group

OpenGL ES Programming Guide

**Dan Ginsburg, Budirijanto
Purnomo, Dave Shreiner, Aaftab Munshi**



OpenGL ES Programming Guide:

OpenGL ES 2.0 Programming Guide Aaftab Munshi, Dan Ginsburg, Dave Shreiner, 2008-07-24 OpenGL ES 2.0 is the industry's leading software interface and graphics library for rendering sophisticated 3D graphics on handheld and embedded devices. With OpenGL ES 2.0 the full programmability of shaders is now available on small and portable devices including cell phones, PDAs, consoles, appliances, and vehicles. However, OpenGL ES differs significantly from OpenGL. Graphics programmers and mobile developers have had very little information about it until now. In the OpenGL ES 2.0 Programming Guide, three leading authorities on the OpenGL ES 2.0 interface, including the specification's editor, provide start-to-finish guidance for maximizing the interface's value in a wide range of high-performance applications. The authors cover the entire API, including Khronos-ratified extensions. Using detailed C-based code examples, they demonstrate how to set up and program every aspect of the graphics pipeline. You'll move from introductory techniques all the way to advanced per-pixel lighting, particle systems, and performance optimization. Coverage includes: Shaders in depth, creating shader objects, compiling shaders, checking for compile errors, attaching shader objects to program objects, and linking final program objects. The OpenGL ES Shading Language: variables, types, constructors, structures, arrays, attributes, uniforms, varying, precision, qualifiers, and invariance. Inputting geometry into the graphics pipeline and assembling geometry into primitives. Vertex shaders, their special variables, and their use in per-vertex lighting, skinning, and other applications. Using fragment shaders, including examples of multitexturing, fog, alpha test, and user clip planes. Fragment operations: scissor test, stencil test, depth test, multisampling, blending, and dithering. Advanced rendering: per-pixel lighting with normal maps, environment mapping, particle systems, image post-processing, and projective texturing. Real-world programming challenges: platform diversity, C portability, OpenKODE, and platform-specific shader binaries.

[OpenGL ES 3.0 Programming Guide](#) Dan Ginsburg, Budirijanto Purnomo, Dave Shreiner, Aaftab Munshi, 2014-02-28 OpenGL ES™ is the industry's leading software interface and graphics library for rendering sophisticated 3D graphics on handheld and embedded devices. The newest version, OpenGL ES 3.0, makes it possible to create stunning visuals for new games and apps without compromising device performance or battery life. In the OpenGL ES™ 3.0 Programming Guide, Second Edition, the authors cover the entire API and Shading Language. They carefully introduce OpenGL ES 3.0 features such as shadow mapping, instancing, multiple render targets, uniform buffer objects, texture compression, program binaries, and transform feedback. Through detailed, downloadable C-based code examples, you'll learn how to set up and program every aspect of the graphics pipeline. Step by step, you'll move from introductory techniques all the way to advanced per-pixel lighting and particle systems. Throughout, you'll find cutting-edge tips for optimizing performance, maximizing efficiency with both the API and hardware, and fully leveraging OpenGL ES 3.0 in a wide spectrum of applications. All code has been built and tested on iOS 7, Android 4.3, Windows, OpenGL ES 3.0 Emulation, and Ubuntu Linux, and the authors demonstrate how to build OpenGL ES code for each platform. Coverage

includes EGL API communicating with the native windowing system choosing configurations and creating rendering contexts and surfaces Shaders creating and attaching shader objects compiling shaders checking for compile errors creating linking and querying program objects and using source shaders and program binaries OpenGL ES Shading Language variables types constructors structures arrays attributes uniform blocks I O variables precision qualifiers and invariance Geometry vertices and primitives inputting geometry into the pipeline and assembling it into primitives 2D 3D Cubemap Array texturing creation loading and rendering texture wrap modes filtering and formats compressed textures sampler objects immutable textures pixel unpack buffer objects and mipmapping Fragment shaders multitexturing fog alpha test and user clip planes Fragment operations scissor stencil and depth tests multisampling blending and dithering Framebuffer objects rendering to offscreen surfaces for advanced effects Advanced rendering per pixel lighting environment mapping particle systems image post processing procedural textures shadow mapping terrain and projective texturing Sync objects and fences synchronizing within host application and GPU execution This edition of the book includes a color insert of the OpenGL ES 3 0 API and OpenGL ES Shading Language 3 0 Reference Cards created by Khronos The reference cards contain a complete list of all of the functions in OpenGL ES 3 0 along with all of the types operators qualifiers built ins and functions in the OpenGL ES Shading Language

The OpenGL ES 2.0 Programming Guide Aaftab Munshi, Dan Ginsburg, Dave Shreiner, 2009 The first comprehensive guide to developing 3D graphic applications on mobile devices from the leading authorities on OpenGL ES

OpenGL® ES 2.0 Programming Guide Aaftab Munshi, Dave Shreiner, Dan Ginsburg, 2008 OpenGL ES 2 0 is the industry's leading software interface and graphics library for rendering sophisticated 3D graphics on handheld and embedded devices With OpenGL ES 2 0 the full programmability of shaders is now available on small and portable devices including cell phones PDAs consoles appliances and vehicles However OpenGL ES differs significantly from OpenGL Graphics programmers and mobile developers have had very little information about it until now In the OpenGL ES 2 0 Programming Guide three leading authorities on the Open GL ES 2 0 interface including the specification's editor provide start to finish guidance for maximizing the interface's value in a wide range of high performance applications The authors cover the entire API including Khronos ratified extensions Using detailed C based code examples they demonstrate how to set up and program every aspect of the graphics pipeline You'll move from introductory techniques all the way to advanced per pixel lighting particle systems and performance optimization Coverage includes Shaders in depth creating shader objects compiling shaders checking for compile errors attaching shader objects to program objects and linking final program objects The OpenGL ES Shading Language variables types constructors structures arrays attributes uniforms varying's precision qualifiers and invariance Inputting geometry into the graphics pipeline and assembling geometry into primitives Vertex shaders their special variables and their use in per vertex lighting skinning and other applications Using fragment shaders including examples of multitexturing fog alpha test and user clip planes Fragment operations scissor test stencil test depth

test multisampling blending and dithering Advanced rendering per pixel lighting with normal maps environment mapping particle systems image post processing and projective texturing Real world programming challenges platform diversity C portability OpenKODE and platform specific shader binaries

OpenGL Programming Guide Dave Shreiner,2010

OpenGL is a powerful software interface used to produce high quality computer generated images and interactive applications using 2D and 3D objects bitmaps and color images The OpenGL Programming Guide Seventh Edition provides definitive and comprehensive information on OpenGL and the OpenGL Utility Library The previous edition covered OpenGL through Version 2.1 This seventh edition of the best selling red book describes the latest features of OpenGL Versions 3.0 and 3.1 You will find clear explanations of OpenGL functionality and many basic computer graphics techniques such as building and rendering 3D models interactively viewing objects from different perspective points and using shading lighting and texturing effects for greater realism In addition this book provides in depth coverage of advanced techniques including texture mapping antialiasing fog and atmospheric effects NURBS image processing and more The text also explores other key topics such as enhancing performance OpenGL extensions and cross platform techniques This seventh edition has been updated to include the newest features of OpenGL Versions 3.0 and 3.1 including Using framebuffer objects for off screen rendering and texture updates Examples of the various new buffer object types including uniform buffer objects transform feedback buffers and vertex array objects Using texture arrays to increase performance when using numerous textures Efficient rendering using primitive restart and conditional rendering Discussion of OpenGL's deprecation mechanism and how to verify your programs for future versions of OpenGL This edition continues the discussion of the OpenGL Shading Language GLSL and explains the mechanics of using this language to create complex graphics effects and boost the computational power of OpenGL The OpenGL Technical Library provides tutorial and reference books for OpenGL The Library enables programmers to gain a practical understanding of OpenGL and shows them how to unlock its full potential Originally developed by SGI the Library continues to evolve under the auspices of the Khronos OpenGL ARB Working Group an industry consortium responsible for guiding the evolution of OpenGL and related technologies

WebGL Programming

Guide Kouichi Matsuda,Rodger Lea,2013-07-04 Using WebGL you can create sophisticated interactive 3D graphics inside web browsers without plug ins WebGL makes it possible to build a new generation of 3D web games user interfaces and information visualization solutions that will run on any standard web browser and on PCs smartphones tablets game consoles or other devices WebGL Programming Guide will help you get started quickly with interactive WebGL 3D programming even if you have no prior knowledge of HTML5 JavaScript 3D graphics mathematics or OpenGL You ll learn step by step through realistic examples building your skills as you move from simple to complex solutions for building visually appealing web pages and 3D applications with WebGL Media 3D graphics and WebGL pioneers Dr Kouichi Matsuda and Dr Rodger Lea offer easy to understand tutorials on key aspects of WebGL plus 100 downloadable sample programs each demonstrating a specific

WebGL topic You'll move from basic techniques such as rendering animating and texturing triangles all the way to advanced techniques such as fogging shadowing shader switching and displaying 3D models generated by Blender or other authoring tools This book won't just teach you WebGL best practices it will give you a library of code to jumpstart your own projects Coverage includes WebGL's origin core concepts features advantages and integration with other web standards How and basic WebGL functions work together to deliver 3D graphics Shader development with OpenGL ES Shading Language GLSL ES 3D scene drawing representing user views controlling space volume clipping object creation and perspective Achieving greater realism through lighting and hierarchical objects Advanced techniques object manipulation heads up displays alpha blending shader switching and more Valuable reference appendixes covering key issues ranging from coordinate systems to matrices and shader loading to web browser settings This is the newest text in the OpenGL Technical Library Addison Wesley's definitive collection of programming guides and reference manuals for OpenGL and its related technologies The Library enables programmers to gain a practical understanding of OpenGL and the other Khronos application programming libraries including OpenGL ES and OpenCL All of the technologies in the OpenGL Technical Library evolve under the auspices of the Khronos Group the industry consortium guiding the evolution of modern open standards media APIs

OpenGL Programming Guide Dave Shreiner, The Khronos OpenGL ARB Working, 2009-07-21 Please note that this title's color insert referred to as Plates within the text is not available for this digital product OpenGL is a powerful software interface used to produce high quality computer generated images and interactive applications using 2D and 3D objects bitmaps and color images The OpenGL Programming Guide Seventh Edition provides definitive and comprehensive information on OpenGL and the OpenGL Utility Library The previous edition covered OpenGL through Version 2.1 This seventh edition of the best selling red book describes the latest features of OpenGL Versions 3.0 and 3.1 You will find clear explanations of OpenGL functionality and many basic computer graphics techniques such as building and rendering 3D models interactively viewing objects from different perspective points and using shading lighting and texturing effects for greater realism In addition this book provides in depth coverage of advanced techniques including texture mapping antialiasing fog and atmospheric effects NURBS image processing and more The text also explores other key topics such as enhancing performance OpenGL extensions and cross platform techniques This seventh edition has been updated to include the newest features of OpenGL Versions 3.0 and 3.1 including Using framebuffer objects for off screen rendering and texture updates Examples of the various new buffer object types including uniform buffer objects transform feedback buffers and vertex array objects Using texture arrays to increase performance when using numerous textures Efficient rendering using primitive restart and conditional rendering Discussion of OpenGL's deprecation mechanism and how to verify your programs for future versions of OpenGL This edition continues the discussion of the OpenGL Shading Language GLSL and explains the mechanics of using this language to create complex graphics effects and boost the computational power of OpenGL The OpenGL Technical

Library provides tutorial and reference books for OpenGL The Library enables programmers to gain a practical understanding of OpenGL and shows them how to unlock its full potential Originally developed by SGI the Library continues to evolve under the auspices of the Khronos OpenGL ARB Working Group an industry consortium responsible for guiding the evolution of OpenGL and related technologies

Learning OpenGL ES for iOS Erik Buck, 2012-07-31 Get Started Fast with Modern OpenGL ES Graphics Programming for iPhone iPod touch and iPad OpenGL ES technology underlies the user interface and graphical capabilities of Apple's iPhone iPod touch and iPad as well as devices ranging from video game consoles and aircraft cockpit displays to non Apple smartphones In this friendly thorough introduction Erik M Buck shows how to make the most of Open GL ES in Apple's iOS environment This highly anticipated title focuses on modern efficient approaches that use the newest versions of OpenGL ES helping you avoid the irrelevant obsolete and misleading techniques that litter the Internet Buck embraces Objective C and Cocoa Touch showing how to leverage Apple's powerful elegant GLKit framework to maximize your productivity achieve tight platform integration and deliver exceptionally polished apps If you've written C or C++ code and know object oriented programming basics this title brings together everything you need to fully master OpenGL ES graphics for iOS including downloadable examples specifically designed to jumpstart your own projects Coverage includes Understanding core OpenGL ES computer graphics concepts and iOS graphics architecture Integrating Cocoa Touch with OpenGL ES to leverage the power of Apple's platform Creating textures from start to finish opacity blending multi texturing and compression Simulating ambient diffuse and specular light Using transformations to render 3D geometric objects from any point of view Animating scenes by controlling time through application logic Partitioning data to draw expansive outdoor scenes with rolling terrain Detecting and handling user interaction with 3D geometry Implementing special effects ranging from skyboxes to particles and billboards Systematically optimizing graphics performance Understanding the essential linear algebra concepts used in computer graphics Designing and constructing a complete simulation that incorporates everything you've learned

OpenGL Programming Guide Dave Shreiner, Graham Sellers, John Kessenich, Bill Licea-Kane, 2013-03-19 Includes Complete Coverage of the OpenGL Shading Language Today's OpenGL software interface enables programmers to produce extraordinarily high quality computer generated images and interactive applications using 2D and 3D objects color images and programmable shaders OpenGL Programming Guide The Official Guide to Learning OpenGL Version 4.3 Eighth Edition has been almost completely rewritten and provides definitive comprehensive information on OpenGL and the OpenGL Shading Language This edition of the best selling Red Book describes the features through OpenGL version 4.3 It also includes updated information and techniques formerly covered in OpenGL Shading Language the Orange Book For the first time this guide completely integrates shader techniques alongside classic functioncentric techniques Extensive new text and code are presented demonstrating the latest in OpenGL programming techniques OpenGL Programming Guide Eighth Edition provides clear explanations of OpenGL functionality

and techniques including processing geometric objects with vertex tessellation and geometry shaders using geometric transformations and viewing matrices working with pixels and texture maps through fragment shaders and advanced data techniques using framebuffer objects and compute shaders New OpenGL features covered in this edition include Best practices and sample code for taking full advantage of shaders and the entire shading pipeline including geometry and tessellation shaders Integration of general computation into the rendering pipeline via compute shaders Techniques for binding multiple shader programs at once during application execution Latest GLSL features for doing advanced shading techniques Additional new techniques for optimizing graphics program performance

iPhone 3D Programming Philip Rideout, 2010-05-03 What does it take to build an iPhone app with stunning 3D graphics This book will show you how to apply OpenGL graphics programming techniques to any device running the iPhone OS including the iPad and iPod Touch with no iPhone development or 3D graphics experience required iPhone 3D Programming provides clear step by step instructions as well as lots of practical advice for using the iPhone SDK and OpenGL You ll build several graphics programs progressing from simple to more complex examples that focus on lighting textures blending augmented reality optimization for performance and speed and much more All you need to get started is a solid understanding of C and a great idea for an app Learn fundamental graphics concepts including transformation matrices quaternions and more Get set up for iPhone development with the Xcode environment Become familiar with versions 1.1 and 2.0 of the OpenGL ES API and learn to use vertex buffer objects lighting texturing and shaders Use the iPhone s touch screen compass and accelerometer to build interactivity into graphics applications Build iPhone graphics applications such as a 3D wireframe viewer a simple augmented reality application a spring system simulation and more

OpenGL Programming Guide : the Official Guide to Learning OpenGL, Version 4.3, 2013

OpenGL ES 3.2 Reference Guide Khronos Group,

The IOS Game Programming Collection (Collection) Michael Daley, Rod Strougo, Ray Wenderlich, 2011-12-30 The iOS Game Programming Collection consists of two bestselling eBooks Learning iOS Game Programming A Hands On Guide to Building Your First iPhone Game Learning Cocos2D A Hands on Guide to Building iOS Games with Cocos2D Box2D and Chipmunk Since the launch of the App Store games have been the hottest category of apps for the iPhone iPod touch and iPad That means your best chance of tapping into the iPhone iPad Gold Rush is to put out a killer game that everyone wants to play and talk about While many people think games are hard to build they actually can be quite easy and this collection is your perfect beginner s guide Learning iOS Game Programming walks you through every step as you build a 2D tile map game Sir Lamorak s Quest The Spell of Release which is free in the App Store You can download and play the game you re going to build while you learn about the code You learn the key characteristics of a successful iPhone game and important terminology and tools you will use Learning Cocos2D walks you through the process of building Space Viking which is free on the App Store a 2D scrolling game that leverages Cocos2D Box2D and Chipmunk As you build Space Viking you ll learn

everything you need to know about Cocos2D so you can create the next killer iOS game This collection helps you Plan high level game design components and difficulty levels Use game loops to make sure the right events happen at the right time Render images create sprite sheets and build animations Use tile maps to build large game worlds from small reusable images Create fire explosions smoke sparks and other organic effects Deliver great sound via OpenAL and the iPhone s media player Provide game control via iPhone s touch and accelerometer features Craft an effective intuitive game interface Build game objects and entities and making them work properly Detect collisions and ensuring the right response to them Polish test debug and performance tune your game Install and configure Cocos2D so it works with Xcode 4 Build a complete 2D action adventure game with Cocos2D Build your game s main menu screen for accessing levels Use Cocos2D s Scheduler to make sure the right events happen at the right times Use tile maps to build scrolling game levels from reusable images Add audio and sound effects with CocosDenshion Cocos2D s sound engine Add gravity realistic collisions and ragdoll effects with Box2D and Chipmunk physics engines Add amazing effects to your games with particle systems Leverage Game Center in your game for achievements and leader boards Squeeze the most performance from your games

IOS 5 Programming Pushing the Limits Rob Napier,Mugunth Kumar,2011-12-20 Provides information on using iOS 5 to create applications for the iPhone iPad and iPod Touch

iOS 6 Programming Pushing the Limits Rob Napier,Mugunth Kumar,2012-11-20 Learn to build extraordinary apps for iPhone iPad and iPod touch iOS is the hottest development platform around and iOS 6 adds a new and deeper dimension to explore This guide offers serious information for serious programmers who know the basics and are ready to dive into the advanced features of iOS You ll learn to create killer apps for the iPad iPhone and iPod touch including how to maximize performance and make more money from your apps with in app purchases Topics covered include security multitasking running on multiple platforms blocks and functional programming advanced text layout and much more App development for iPhones and iPads is a lucrative and exciting venture books on this topic are steady bestsellers This advanced guide helps experienced developers take full advantage of the latest platform upgrade iOS 6 Provides in depth background on maximizing your apps with Apple s iPhone SDK 6 0 including the major new APIs and building applications for the new iPad Covers keeping control of multitasking increasing income with in app purchases key value observing with Cocoa running on multiple platforms advanced text layout building a Core foundation and more iOS 6 Programming Pushing the Limits gives experienced mobile developers a wealth of knowledge for creating outstanding iPhone and iPad apps on the latest platform

OpenGL Programming Guide Mason Woo,Jackie Neider,Tom Davis,OpenGL Architecture Review Board,1997 Explaining how graphics programs using Release 1 1 the latest release of OpenGL this book presents the overall structure of OpenGL and discusses in detail every OpenGL feature including the new features introduced in Release 1 1 Numerous programming examples in C show how to use OpenGL functions Also includes 16 pages of full color examples

GPU Pro 6 Wolfgang Engel,2015-07-28 The latest edition of this bestselling game development reference offers proven

tips and techniques for the real time rendering of special effects and visualization data that are useful for beginners and seasoned game and graphics programmers alike Exploring recent developments in the rapidly evolving field of real time rendering GPU Pro6 Advance *Learning Html5 by Creating Fun Games* Rodrigo Silveira,2013-01-01 By teaching HTML5 by developing exciting games the reader will see concrete applications for each of the concepts and will also have a powerful deliverable at the end of each chapter a fully functional game We learn the various concepts using very abstract examples how to model animals foods or fictitious machines This makes learning and understanding a lot easier and much more enjoyable If you are are looking to get a good grounding in how to use the new awesome technology that is HTML5 this book is for you Basic knowledge of HTML and or HTML5 is welcome but optional The book is a friendly and exciting reference for beginners iOS Game Development Thomas Lucka,2016-04-19 The book offers information about the iOS platform It explains the use of OpenGL ES for 2D 3D graphics and OpenAL for sound both of which are recommended for game performance on the iOS platform It covers new APIs such as the GLKit GameKit and Box2D Physics Engine **Learn iOS 8 App Development** James Bucanek,2014-12-09 Learn iOS 8 App Development is both a rapid tutorial and a useful reference You ll quickly get up to speed with Swift Cocoa Touch and the iOS 8 SDK It s an all in one getting started guide to building useful apps You ll learn best practices that ensure your code will be efficient and perform well earning positive reviews on the iTunes App Store and driving better search results and more revenue The iOS 8 SDK offers powerful new features and this book is the fastest path to mastering them and the rest of the iOS SDK for programmers with some experience who are new to iPhone and iPad app development Many books introduce the iOS SDK but few explain how to develop apps optimally and soundly This book teaches both core Swift language concepts and how to exploit design patterns and logic with the iOS SDK based on Swift and the Cocoa Touch framework Why spend months or years discovering the best ways to design and code iPhone and iPad apps when this book will show you how to do things the right way from the start Get an accelerated treatment of the core fundamentals of Swift Develop your first app using Xcode s advanced interface design tools Build your first iPhone app using the code that you re given as you walk through this book Finally debug and distribute your first app on Apple s iTunes App Store Learn how to create apps for any model of iPhone the iPod Touch the iPad or build universal apps that run on all of them After reading this book you ll be creating professional quality apps ready to upload to the app store making you the prestige and the money you seek

Whispering the Strategies of Language: An Emotional Quest through **Opengl Es Programming Guide**

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