# OpenGL
## Programming Guide

### Eighth Edition
### The Official Guide to Learning OpenGL, Version 4.3



**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, function-centric 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.

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- Additional new techniques for optimizing graphics program performance

**DAVE SHREINER,** Director of Graphics and GPU Computing at ARM, Inc., has been active in OpenGL development since its inception. He created the first commercial OpenGL training course and has taught OpenGL programming for twenty years. **GRAHAM SELLERS,** co-author of *OpenGL SuperBible,* manages OpenGL Software Development at AMD. He authored many OpenGL feature specifications and helped bring OpenGL ES to desktop computers. **JOHN KESSENICH,** OpenGL Shading Language Specification Editor, consults at LunarG, Inc., building compiler technology for GLSL. He helped develop OpenGL 2.0 and OpenGL ES 2.0 at 3Dlabs and Intel. **BILL LICEA-KANE,** a Principal Member of Technical Staff at AMD, is a co-author of *OpenGL Shading Language Guide,* and chairs the OpenGL Shading Language Technical subgroup.

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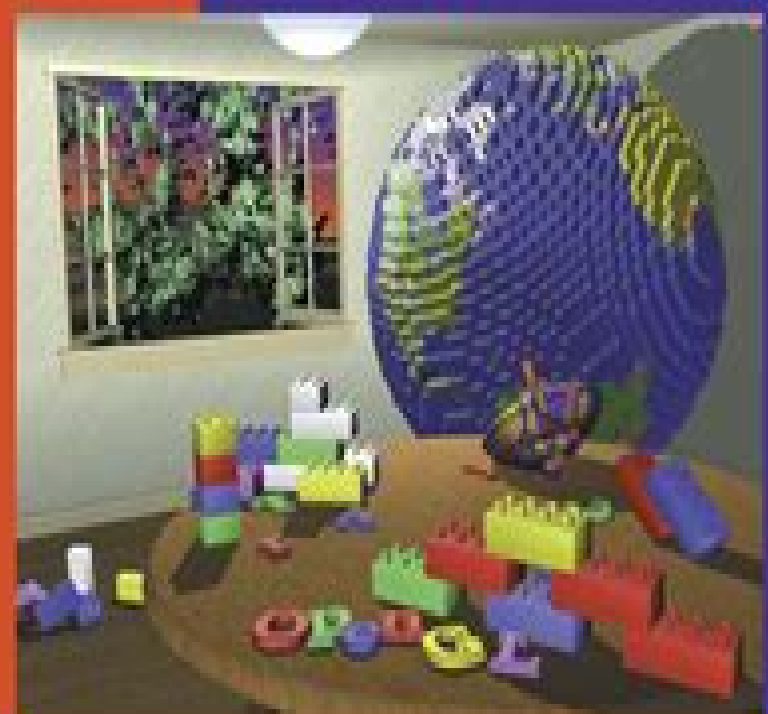
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**Dave Shreiner**

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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     *OpenGL Programming Guide* Jackie Neider,Tom Davis,Mason Woo,OpenGL Architecture Review Board,1993 This book explains how to create graphics programs using OpenGL Release 1 It presents the overall architecture of OpenGL and discusses in detail every function included in the specification Numerous programming examples in C show how to use OpenGL functions     *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 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 varyings 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* John Kessenich,Graham Sellers,Dave Shreiner,2016-07-25 Complete Coverage of OpenGL 4 5 the Latest

Version Includes 4 5 4 4 SPIR V and Extensions The latest version of today s leading worldwide standard for computer graphics OpenGL 4 5 delivers significant improvements in application efficiency flexibility and performance OpenGL 4 5 is an exceptionally mature and robust platform for programming high quality computer generated images and interactive applications using 2D and 3D objects color images and shaders OpenGL Programming Guide Ninth Edition presents definitive comprehensive information on OpenGL 4 5 4 4 SPIR V OpenGL extensions and the OpenGL Shading Language It will serve you for as long as you write or maintain OpenGL code This edition of the best selling Red Book fully integrates shader techniques alongside classic function centric approaches and contains extensive code examples that demonstrate modern techniques Starting with the fundamentals its wide ranging coverage includes drawing color pixels fragments transformations textures framebuffers light and shadow and memory techniques for advanced rendering and nongraphical applications It also offers discussions of all shader stages including thorough explorations of tessellation geometric and compute shaders New coverage in this edition includes Thorough coverage of OpenGL 4 5 Direct State Access DSA which overhauls the OpenGL programming model and how applications access objects Deeper discussions and more examples of shader functionality and GPU processing reflecting industry trends to move functionality onto graphics processors Demonstrations and examples of key features based on community feedback and suggestions Updated appendixes covering the latest OpenGL libraries related APIs functions variables formats and debugging and profiling techniques **OpenGL? Programming Guide** Dave Shreiner,2007 **OpenGL Programming Guide** Dave Shreiner,OpenGL Architecture Review Board,2008 OpenGL Programming Guide Sixth Edition OpenGL is a powerful software interface used to produce high quality computergenerated images and interactive applications using 2D and 3D objects bitmaps and color images The OpenGL Programming Guide Sixth Edition provides definitive and comprehensive information on OpenGL and the OpenGL Utility Library The previous edition covered OpenGL through Version 2 0 This sixth edition of the best selling red book describes the latest features of OpenGL Version 2 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 sixth edition has been updated to include the newest features of OpenGL Version 2 1 including Using server side pixel buffer objects for fast pixel rectangle download and retrieval Discussion of the sRGB texture format Expanded discussion of the OpenGL Shading Language 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

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updated for OpenGL Versions 1 3 and 1 4 with many new example programs and colour slides bull Introduces the new shading technologies including the ARB vertex and fragment program extension bull Written under the auspices of the OpenGL Architectural Review Board the previous edition alone has sold more than 40 000 copies     **OpenGL programming guide** OpenGL Architecture Review Board,開放式圖形庫架構評審委員會,1993     **OpenGL programming guide** Jackie Neider,1995     **OpenGL Superbible** Richard S. Wright,Michael Sweet,1996 Until OpenGL SuperBible there has been scant material explaining how to use OpenGL under Windows This thorough resource shows developers the basics of OpenGL programming describes how OpenGL works with Windows and provides a comprehensive reference to all OpenGL functions and commands     **Vulkan Programming Guide** Graham Sellers,John Kessenich,2016-11-07 The Definitive VulkanTM Developer s Guide and Reference Master the Next Generation Specification for Cross Platform Graphics The next generation of the OpenGL specification Vulkan has been redesigned from the ground up giving applications direct control over GPU acceleration for unprecedented performance and predictability VulkanTM Programming Guide is the essential authoritative reference to this new standard for experienced graphics programmers in all Vulkan environments Vulkan API lead Graham Sellers with contributions from language lead John Kessenich presents example rich introductions to the portable Vulkan API and the new SPIR V shading language The author introduces Vulkan its goals and the key concepts framing its API and presents a complex rendering system that demonstrates both Vulkan s uniqueness and its exceptional power You ll find authoritative coverage of topics ranging from drawing to memory and threading to compute shaders The author especially shows how to handle tasks such as synchronization scheduling and memory management that are now the developer s responsibility VulkanTM Programming Guide introduces powerful 3D development techniques for fields ranging from video games to medical imaging and state of the art approaches to solving challenging scientific compute problems Whether you re upgrading from OpenGL or moving to open standard graphics APIs for the first time this guide will help you get the results and performance you re looking for Coverage includes Extensively tested code examples to demonstrate Vulkan s capabilities and show how it differs from OpenGL Expert guidance on getting started and working with Vulkan s new memory system Thorough discussion of queues commands moving data and presentation Full explanations of the SPIR V binary shading language and compute graphics pipelines Detailed discussions of drawing commands geometry and fragment processing synchronization primitives and reading Vulkan data into applications A complete case study application deferred rendering using complex multi pass architecture and multiple processing queues Appendixes presenting Vulkan functions and SPIR V opcodes as well as a complete Vulkan glossary Example code can be found here Example code can be found here https github com vulkanprogrammingguide examples     **Computer Graphics Programming in OpenGL with C++** V. Scott Gordon,John Clevenger,2024-03-12 This updated edition includes step by step instruction on modern OpenGL 4 0 GLSL shader programming with C along with the theoretical foundations of 3D computer graphics Every shader stage is explored from the

basics of modeling textures lighting shadows etc through advanced techniques such as tessellation noise maps water and stereoscopy This new edition includes expanded coverage of camera control refraction and a new chapter on ray tracing with bounding volume hierarchies for complex models The companion files include all the source code shaders model files skyboxes etc needed to run every example in the book

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