OpenGL®
Programming Guide
Ninth Edition

The Official Guide to Learning OpenGL®, Version 4.5 with SPIR-V

John Kessenich • Graham Sellers • Dave Shreiner

The Khronos OpenGL ARB Working Group

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Yoshitaka Shibata

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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 **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

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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

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 Shading Language Randi J. Rost,Bill Licea-Kane,Dan Ginsburg,John Kessenich,Barthold Lichtenbelt,Hugh Malan,Mike Weiblen,2009-07-13 OpenGL Shading Language Third Edition extensively updated for OpenGL 3 1 is the experienced application programmer s guide to writing shaders Part reference part tutorial this book thoroughly explains the shift from fixed functionality graphics hardware to the new era of programmable graphics hardware and the additions to the OpenGL API that support this programmability With OpenGL and shaders written in the OpenGL Shading Language applications can perform better achieving stunning graphics effects by using the capabilities of both the visual processing unit and the central processing unit In this book you will find a detailed introduction to the OpenGL Shading Language GLSL and the new OpenGL function calls that support it The text begins by describing the syntax and semantics of this high level programming language Once this foundation has been established the book explores the creation and manipulation of shaders using new OpenGL function calls OpenGL Shading Language Third Edition includes updated descriptions for the language and all the GLSL entry points added though OpenGL 3 1 as well as updated chapters that discuss transformations

lighting shadows and surface characteristics The third edition also features shaders that have been updated to OpenGL Shading Language Version 1 40 and their underlying algorithms including Traditional OpenGL fixed functionality Stored textures and procedural textures Image based lighting Lighting with spherical harmonics Ambient occlusion and shadow mapping Volume shadows using deferred lighting Ward s BRDF model The color plate section illustrates the power and sophistication of the OpenGL Shading Language The API Function Reference at the end of the book is an excellent guide to the API entry points that support the OpenGL Shading Language   *3D Engine Design for Virtual Globes* Patrick Cozzi,Kevin Ring,2011-06-24 Supported with code examples and the authors real world experience this book offers the first guide to engine design and rendering algorithms for virtual globe applications like Google Earth and NASA World Wind The content is also useful for general graphics and games especially planet and massive world engines With pragmatic advice throughout

OpenGL Programming Guide ,2007   OpenGL Programming Guide : the Official Guide to Learning OpenGL, Version 4.3 ,2013   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   CUDA for Engineers Duane Storti,Mete Yurtoglu,2015-11-02 CUDA for Engineers gives you direct hands on engagement with personal high performance parallel computing enabling you to do computations on a gaming level PC that would have required a supercomputer just a few years ago The authors introduce the essentials of CUDA C programming clearly and concisely quickly guiding you from running sample programs to building your own code Throughout you ll learn

from complete examples you can build run and modify complemented by additional projects that deepen your understanding All projects are fully developed with detailed building instructions for all major platforms Ideal for any scientist engineer or student with at least introductory programming experience this guide assumes no specialized background in GPU based or parallel computing In an appendix the authors also present a refresher on C programming for those who need it Coverage includes Preparing your computer to run CUDA programs Understanding CUDA s parallelism model and C extensions Transferring data between CPU and GPU Managing timing profiling error handling and debugging Creating 2D grids Interoperating with OpenGL to provide real time user interactivity Performing basic simulations with differential equations Using stencils to manage related computations across threads Exploiting CUDA s shared memory capability to enhance performance Interacting with 3D data slicing volume rendering and ray casting Using CUDA libraries Finding more CUDA resources and code Realistic example applications include Visualizing functions in 2D and 3D Solving differential equations while changing initial or boundary conditions Viewing processing images or image stacks Computing inner products and centroids Solving systems of linear algebraic equations Monte Carlo computations **Seventh International Conference on Parallel and Distributed Systems** Yoshitaka Shibata,2000 Presents 66 contributions from the July 2000 conference The technical areas covered are multimedia systems group communications checkpointing and commitment Web based computing distributed shared memory multicast object oriented programming routing fault tolerant systems high performance databases parallel systems mobile systems distributed algorithms multi agent systems and parallel and distributed query processing Annotation copyrighted by Book News Inc Portland OR **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 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 OpenGL Architecture Review Board ARB Steering Group now part of the Khronos 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 Programming Guide* Dave Shreiner,Randi J. Rost,OpenGL Architecture Review Board,OpenGL Architecture Review Board Staff,2006   *OpenGL Programming Guide* Dave Shreiner,OpenGL Architecture Review Board,2004 Fully 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 Superbible* Graham Sellers,Richard S. Wright,Nicholas Haemel,2015-07-11 OpenGL SuperBible Seventh Edition is the definitive programmer s guide tutorial and reference for OpenGL 4 5 the world s leading 3D API for real time computer graphics The best introduction for any developer it clearly explains OpenGL s newest APIs key extensions shaders and essential related concepts You ll find up to date hands on guidance for all facets of modern OpenGL development both desktop and mobile The authors explain what OpenGL does how it connects to the graphics pipeline and how it manages huge datasets to deliver compelling experiences Step by step they present increasingly sophisticated techniques illuminating key concepts with worked examples They introduce OpenGL on several popular platforms and offer up to date best practices and performance advice This extensively updated edition introduces many new OpenGL 4 5 4 4 features including important ARB and KHR extensions that are now part of the standard It thoroughly covers the latest Approaching Zero Driver Overhead AZDO performance features and demonstrates key enhancements with new example applications Coverage includes A practical introduction to real time 3D graphics including foundational math Core techniques for rendering transformations and texturing Shaders and the OpenGL Shading Language GLSL in depth Vertex processing drawing commands primitives fragments and framebuffers Compute shaders harnessing graphics cards for more than graphics Pipeline monitoring and control Managing loading and arbitrating access to data Building larger applications and deploying them across platforms Advanced rendering light simulation artistic and non photorealistic effects and more Reducing CPU overhead and analyzing GPU behavior Supercharging performance with AZDO persistent maps and bindless textures Preventing and debugging errors New applications texture compression text drawing font rendering with distance fields high quality texture filtering and OpenMP Bonus material and sample code will be made available   **OpenGL**

SuperBible Graham Sellers,Richard Wright,Nicholas Haemel,2015 OpenGL SuperBible Seventh Edition is the definitive programmer s guide tutorial and reference for OpenGL 4 5 the world s leading 3D API for real time computer graphics The best introduction for any developer it clearly explains OpenGL s newest APIs key extensions shaders and essential related concepts You ll find up to date hands on guidance for all facets of modern OpenGL development both desktop and mobile The authors explain what OpenGL does how it connects to the graphics pipeline and how it manages huge datasets to deliver compelling experiences Step by step they present increasingly sophisticated techniques illuminating key concepts with worked examples They introduce OpenGL on several popular platforms and offer up to date best practices and performance advice This revised and updated edition introduces many new OpenGL 4 5 features including important ARB and KHR extensions that are now part of the standard It thoroughly covers the latest Approaching Zero Driver Overhead AZDO performance features and demonstrates key enhancements with new example applications Coverage includes A practical introduction to real time 3D graphics including foundational math Core techniques for rendering transformations and texturing Shaders and the OpenGL Shading Language GLSL in depth Vertex processing drawing commands primitives fragments and framebuffers Compute shaders harnessing graphics cards for more than graphics Pipeline monitoring and control Managing loading and arbitrating access to data Building larger applications and deploying them across platforms Advanced rendering light simulation artistic and non photorealistic effects and more Reducing CPU overhead and analyzing GPU behavior Supercharging performance with persistent maps bindless textures and fine grained synchronization Preventing and debugging errors New applications texture compression text drawing font rendering with distance fields high quality texture filtering and OpenMP Bonus material and sample code are available at openglsuperbible com

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