

WebGL®

Programming Guide

*Interactive 3D Graphics Programming
with WebGL*



Kouichi Matsuda ■ Rodger Lea

Webgl Programming Guide

Jos Dirksen



Webgl Programming Guide:

WebGL Programming Guide Kouichi Matsuda, Rodger Lea, 2013 With this book students will learn step by step through realistic examples building their skills as they 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 Students will 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 WebGL best practices it will give a library of code to jumpstart projects

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

Professional WebGL Programming Andreas Anyuru, 2012-04-19 Everything you need to know about developing hardware accelerated 3D graphics with WebGL As the newest technology for creating 3D graphics on the web in both games applications and on regular websites WebGL gives web developers the capability to produce eye popping graphics This book teaches you how to use WebGL to create stunning cross platform apps The book features several detailed examples that show you how to develop 3D graphics with WebGL including explanations of code snippets that help you understand the why behind the how You will also develop a stronger understanding of WebGL development from coverage

that Provides a comprehensive overview of WebGL and shows how it relates to other graphics related technologies Addresses important topics such as the WebGL graphics pipeline 3D transformations texturing and lighting Teaches you how to write vertex shaders and fragment shaders for WebGL Includes a lot of useful guidelines tips and tricks for WebGL performance optimizations Professional WebGL Programming is the first book on the market to delve into this fascinating topic and it puts you on your way to mastering the possibilities that exist with WebGL **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 Superbible Graham Sellers,Richard S Wright

Jr.,Nicholas Haemel,2015-07-20 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

Real-Time 3D Graphics with WebGL 2 Farhad Ghayour, Diego Cantor, 2018-10-31 This book is a complete course on computer graphics covering topics such as rendering 3D math lighting cameras and much more It will be your trust worthy companion in developing immersive experiences with WebGL a hardware accelerated technology in the browser without installing additional software

GPU Pro 360 Guide to 3D Engine Design Wolfgang Engel, 2018-12-07 This book gathers all the content from the GPU Pro series Vols 1 7 2010 2016 into a convenient single source anthology covering mobile GPUs and the architecture of tile based GPUs It covers ready to use ideas and procedures that can help solve many computer graphics programming challenges The articles by leading programmers contained in this volume focus on new and interesting ways to solve existing rendering problems

Data Sketches Nadieh Bremer, Shirley Wu, 2021-02-09 In Data Sketches Nadieh Bremer and Shirley Wu document the deeply creative process behind 24 unique data visualization projects and they combine this with powerful technical insights which reveal the mindset behind coding creatively Exploring 12 different themes from the Olympics to Presidents Royals and from Movies to Myths Legends each pair of visualizations explores different technologies and forms blurring the boundary between visualization as an exploratory tool and an artform in its own right This beautiful book provides an intimate behind the scenes account of all 24 projects and shares the authors personal notes and drafts every step of the way The book features Detailed information on data gathering sketching and coding data visualizations for the web with screenshots of works in progress and reproductions from the authors notebooks Never before published technical write ups with beginner friendly explanations of core data visualization concepts Practical lessons based on the data and design challenges overcome during each project Full color pages showcasing all 24 final data visualizations This book is perfect for anyone interested or working in data visualization and information design and especially those who want to take their work to the next level and are inspired by unique and compelling data driven storytelling

Learning HTML5 Game Programming James L. Williams, 2011-09-27 Get Started Fast with HTML5 Online Game Programming HTML5 will transform web and mobile gaming As new browsers rapidly adopt it HTML5 will do everything legacy technologies such as Flash and Silverlight have

done and much more In Learning HTML5 Game Programming pioneering developer James L Williams gives you all the knowledge code and insights you ll need to get started fast Williams combines detailed explanations of HTML5 s key innovations with examples including two case study applications that address the entire development process He guides you through setting up a state of the art HTML5 development environment making the most of HTML5 s canvas tag SVG vector graphics and WebGL 3D and targeting diverse mobile and social platforms It s all here from the essentials of online game design to the nitty gritty details of performance optimization About the Website All code samples and answers to chapter exercises are available for download at www.informit.com title 9780321767363 and on Github at <https://github.com/jwill/html5> game book Coverage includes Understanding the HTML5 innovations that make it possible to create amazingly rich games Setting up a state of the art open source HTML5 game development environment Using JavaScript to drive sophisticated interactions between users and games Building basic games fast with the prototype based Simple Game Framework SGF Generating movement and gameplay with the canvas tag and surface Creating games with SVG vector graphics using the Rapha lJS Javascript library Using Three js to build powerful WebGL 3D games with far less complexity Developing games without JavaScript using Google Web Toolkit GWT or CoffeeScript Building a complete multiplayer game server using Node js and WebSockets Planning and choosing tools for mobile game development with HTML5 Optimizing game performance with offline cache minification and other techniques Learning HTML5 Game Programming is the fastest route to success with HTML5 game development whether you re a long time game developer or a web mobile programmer building games for the first time

Mastering WebGL Kameron Hussain,Frahaan Hussain,2024-01-18 Mastering WebGL Crafting Advanced 3D Web Experiences is an indispensable resource for any web developer or graphic designer looking to elevate their skill set in the realm of advanced 3D web graphics WebGL the web based graphics library has revolutionized how we experience graphics on the web and this book serves as your comprehensive guide to mastering its potential Starting with a brief history of WebGL and its evolution the book quickly moves into hands on practical examples You ll explore the fundamentals of 3D graphics programming and the unique characteristics of programming for the web The book dives deep into core WebGL concepts including rendering shaders lighting models and more ensuring that you grasp the theory behind these essential elements As you progress Mastering WebGL unveils the more intricate aspects of WebGL You ll learn how to create complex 3D models add interactive elements and integrate WebGL with other web technologies like HTML5 and JavaScript The book also dedicates a significant portion to optimization techniques ensuring your web applications run smoothly and efficiently What sets this book apart is its practical approach Each chapter includes real world examples code snippets and projects allowing you to apply what you ve learned immediately Whether it s creating stunning visual effects building immersive online games or developing interactive educational tools this book has you covered The final chapters of the book are devoted to advanced topics including virtual reality and augmented reality experiences on the web using WebGL You ll also

find insightful discussions on the future of 3D web graphics and how WebGL is shaping this landscape Mastering WebGL is more than just a programming guide it s a journey into the future of the web Whether you re a seasoned web developer a graphic designer venturing into web graphics or a student keen on understanding the cutting edge of web development this book is your gateway to mastering advanced 3D web experiences *WebGL Hotshot* Mitch Williams,2014-05-26 Every chapter starts with a mission briefing section that describes what is to be achieved by the end of the chapter This is followed with the decisions and steps required to accomplish the mission objective with challenges to take the project further The scope for the book thus mimics the reallife requirements of a developer and gets you ready to successfully build your own project If you are a web designer looking to expand your knowledge of 3D graphics concepts and broaden your existing skill set then this book is for you Those looking for an introduction to 3D graphics will benefit from WebGL Hotshot as it is a perfect guide to master 3D concepts helping you build and deploy 3D worlds much quicker The book assumes a basic knowledge of HTML though it can be learned concurrently while reading this book Basic programming knowledge is useful however the graphical nature of web 3D content allows you to learn programming through experimentation *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 **WebGL Beginner's Guide** Diego Cantor,2012 This book is a step by

step tutorial that includes complete source code for all of the examples covered Every chapter builds on top of the previous one thereby giving the reader an immediate feeling of progression Each block of code is explained and 3D web development concepts are diagrammed and covered in detail This book is written for JavaScript developers who are interested in 3D web development A basic understanding of the DOM object model and the jQuery library is ideal but not required No prior WebGL knowledge is expected

WebGL Beginner's Guide Diego Cantor, Brandon Jones, 2012-01-01 Become a master of 3D web programming in WebGL and JavaScript

WebGL Tony Parisi, 2012 Get a quick introduction to WebGL the new standard for 3D rendering on the Web and a member of HTML5's family of technologies With this hands on guide you'll learn essential WebGL development and production concepts using the JavaScript 3D engine Three.js At the end of the book you'll put everything together and build a full 3D application with WebGL You don't have to be a game development wizard or have 3D graphics experience to get started If you use HTML CSS and JavaScript and have familiarity with JQuery and Ajax this book will help you gain a working knowledge of WebGL through clear and simple examples Understand core 3D graphics concepts and how to implement them in WebGL Create WebGL sample pages as you learn and build a racing game application in the final chapter Get to know the Three.js open source library in detail Develop working knowledge of graphics rendering texturing animation interaction and behaviors Seamlessly integrate 3D graphics with other content on the page Learn the tools file formats and techniques for developing robust and secure applications in a production environment WebGL Up and Running is an ideal introduction to the world of 3D programming on the web It's well written clear and fun I wish it had been around when I started learning WebGL

Giles Thomas LearningWebGL.com

OpenGL to WebGL Frahaan Hussain, Kameron Hussain, 2023-11-27 OpenGL to WebGL Bridging the Graphics Divide is an authoritative guide for developers and programmers looking to transition from the traditional OpenGL framework to the web based WebGL for graphics programming This comprehensive book provides a deep dive into the intricacies of both OpenGL and WebGL offering insights into their similarities and differences and the unique opportunities each presents With the increasing demand for web based applications and games understanding WebGL has become essential for graphics programmers This book begins with a thorough introduction to OpenGL its history and its pivotal role in the evolution of graphics programming It discusses the core concepts of OpenGL including its rendering pipeline shader programming and 3D rendering techniques As the focus shifts to WebGL readers will discover the nuances of developing graphics applications within a browser environment The book elucidates the challenges and advantages of WebGL over OpenGL particularly its accessibility and cross platform capabilities It covers essential topics such as WebGL's rendering pipeline integration with HTML5 and the use of JavaScript for shader programming Practical examples are a core component of this book providing readers with hands on experience in translating OpenGL code to WebGL These examples not only demonstrate the direct application of theory but also help in understanding the subtle differences in syntax and functionality between the two

frameworks Furthermore the book delves into advanced topics such as optimizing graphics performance in WebGL harnessing the power of GLSL OpenGL Shading Language and creating complex 3D graphics and animations for the web It also explores the future landscape of web based graphics programming and the role of emerging technologies OpenGL to WebGL Bridging the Graphics Divide is an invaluable resource for anyone looking to broaden their skills in graphics programming Whether you are an experienced OpenGL developer or a novice interested in web based graphics this book provides the knowledge and tools needed to excel in the evolving world of graphics programming

WebGL Gems Greg Sidelnikov, 2017-06 WebGL Gems is a 3D graphics programming book for game developers who wish to learn how to make games in web browsers Each of 32 gems contains detailed walkthrough with complete source code Table of Contents Gem 1 JavaScript Canvas Initializing 2D Context Ensuring Graphics Assets Are Fully Downloaded Loading Multiple Types Of Resources Simultaneously Initializing 3D Context Gem 2 Initializing WebGL Gem 3 Simplified WebGL Pipeline In WebGL Browser Takes Care of Double Buffering Drawing Basic Primitives And Then There Were Attributes What Exactly Is Varying From OpenGL to WebGL Gem 4 Clearing the Screen For JavaScript Purists Gem 5 Matrix Principles Introduction to Matrices Common 3D Matrices Model View Projection Matrix Gradual Discovery Birth of the Matrix Matrix Multiplication Multiplication Order Who Is Moving Who Is Staying Shadow Casting Basic Representation Translation and Rotation Starfield Demo Simple Particle Engine The Star Class Clipping Planes Starfield Demo Results Matrix Structure Sequential Order Homogeneous Coordinates Row Major and Column Major Matrix Notations Default Camera Position Efficient Cross Matrix Calculations Common Cross Matrix Operations Multiplication Tangent Metamorphosis Into Camera's View Matrix Other Common Matrix Operations Local and World Coordinate System Rotation Matrix Rotation Around Z axis Rotation Around X axis Rotation Around Y axis Translation Matrix Scale Matrix Using a 3D Matrix JavaScript Library Matrix Libraries And Where To Get One Matrix Library Examples Conclusion Gem 6 Simple Shader Example Simple Fragment Shader Shaders In a String Initializing Shader Program Multiple Shader Programs Drawing a Point Gem 7 Drawing a Point Creating Shader Program Manager Gem 8 Loading Shaders From Files Initializing WebGL Shaders From Files Gem 9 Loading Shaders From Files Loading Shaders Asynchronously Waiting for Shaders to Load Cache Busting Gem 10 Drawing in Space Gem 11 3D Transformations Translating Scaling 3D Transformations The Four Transformations Viewport Transformation The Viewing Transformation The Modeling Transformation The Modelview Transformation The Projection Transformation The Viewport Transformation 3D Transformation Order Gem 12 Draw Triangle Gem 13 Vector Class Vector Class Vector Representation Adding Vectors Subtracting Vectors Multiply Vectors Division Length Cross Product Dot Product Gem 14 Vertex Colored Triangle Binding To a Secondary Buffer Binding One Buffer At A Time One More Thing Gem 15 Drawing Multiple Triangles Gem 16 Controversial Texture Image Loader Appropriate Name Textures In Global Scope One More Thing Gem 17 Texture Mapped Triangle Creating Shader for Texture Mapping Gem 18 Test Cube Other Specimina Cube Primitives jsGem

19 Loading Model Data from PLY Before Moving Forward LoadPLY Source Code Pseudo Code A Word Of Caution New Level Of Complexity Depth Test ConclusionGem 20 Imitating First Person walking Camera in 3D World Strafing Default DirectionAnd other Gems 21 32Greg Sidelnikov is a Game Developer and tutorial author of several software literature publication since 2003 This volume WebGL Gems is a special book for game developers who are looking to learn WebGL The book includes major insights into WebGL graphics library as well as several sections about how to make 2D games in WebGL on JavaScript canvas

Learning Three.js Jos Dirksen,2013 Learning Three js is a hands on guide which provides everything you need to start working with the powerful JavaScript library and start creating awesome in browser visualizations Learning Three js is written for anyone looking to get started with Three js or looking to improve their skills with the popular js library The book assumes some knowledge of javascript but you don t need any knowledge of Three js itself to follow the book

Real-Time 3D Graphics with WebGL 2 - Second Edition Farhad Ghayour,Diego Cantor,2018 A comprehensive guide with 80 examples on 3D programming in WebGL 2 covering computer graphics topics such as rendering 3D math camera and more Key Features Create visually stunning high performance 3D applications for the web with WebGL 2 A complete course on 3D computer graphics rendering 3D math lighting cameras and more Unlock a variety of new and advanced features offered in WebGL 2 Book Description As highly interactive applications have become an increasingly important part of the user experience WebGL is a unique and cutting edge technology that brings hardware accelerated 3D graphics to the web Packed with 80 examples this book guides readers through the landscape of real time computer graphics using WebGL 2 Each chapter covers foundational concepts in 3D graphics programming with various implementations Topics are always associated with exercises for a hands on approach to learning This book presents a clear roadmap to learning real time 3D computer graphics with WebGL 2 Each chapter starts with a summary of the learning goals for the chapter followed by a detailed description of each topic The book offers example rich up to date introductions to a wide range of essential 3D computer graphics topics including rendering colors textures transformations framebuffers lights surfaces blending geometry construction advanced techniques and more With each chapter you will level up your 3D graphics programming skills This book will become your trustworthy companion in developing highly interactive 3D web applications with WebGL and JavaScript What you will learn Understand the rendering pipeline provided in WebGL Build and render 3D objects with WebGL Develop lights using shaders 3D math and the physics of light reflection Create a camera and use it to navigate a 3D scene Use texturing lighting and shading techniques to render realistic 3D scenes Implement object selection and interaction in a 3D scene Cover advanced techniques for creating immersive and compelling scenes Learn new and advanced features offered in WebGL 2 Who this book is for This book is intended for developers who are interested in building highly interactive 3D applications for the web A basic understanding of JavaScript is necessary no prior computer graphics or WebGL knowledge is required Downloading the example code for this book You can download the example code

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OpenGL ES 3.0 Programming Guide Dan Ginsburg, Budirijanto Purnomo, Dave Shreiner, Aaftab Munshi, 2014-02-28 OpenGL ES TM 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.

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