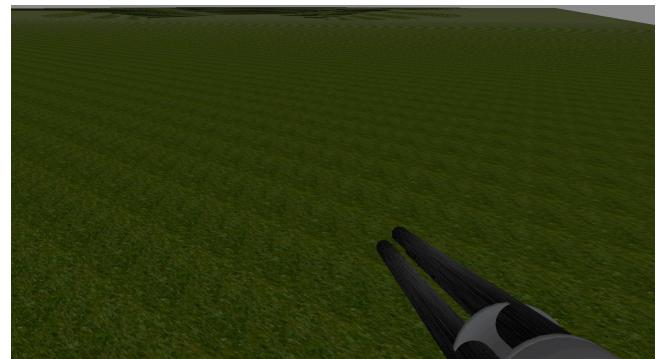


01: Introduction

Gatling Good, Kieran Ghataora, 2012-3



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Where there's Smoke..., Adam Coldrick, 2013-4

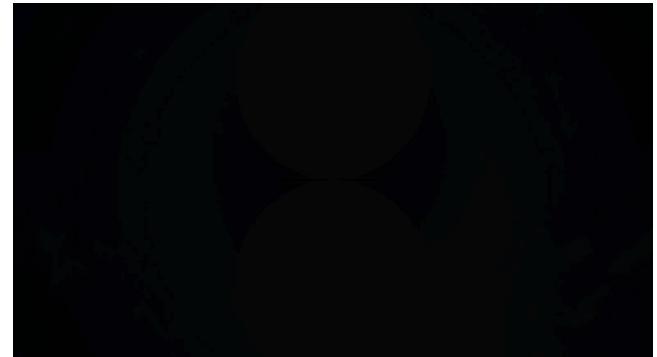


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Sunrise, Jonathan Calvert, 2013-4



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Ski Simulator, Oliver Skidmore 2013-4

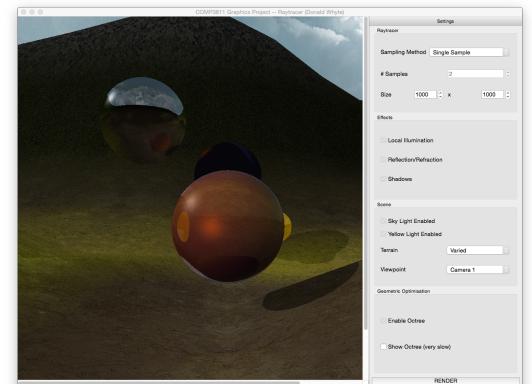


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Donald Whyte, Raytracer, 2013-4



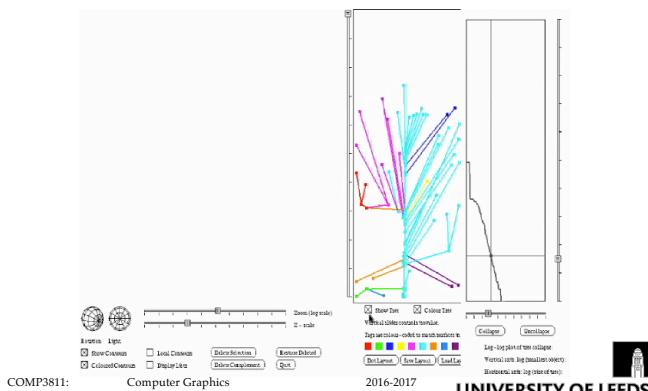
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Or . . .

3D Graphics



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- How to render (draw) images of 3D scenes
- And how to animate them
- Computationally expensive
 - So either offline or hardware-accelerated
- Based on mathematical models
 - Of the scene, of light, and of the camera

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Dependencies

- HCI / GUI Development
- Geometry
- Linear Algebra
- Calculus (a little bit)
- Programming in C/C++

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Objectives

- Appreciate the physical limitations on computational representation and display of visual scenes in three dimensions, including hardware-accelerated graphics
- Understand the use of 3D modelling to represent visual scenes, including geometric approximations of surfaces in general and including triangulated approximations.
- Understand the application of projective rendering to produce visual scenes in three dimensions;
- Understand how users navigate in and interact with three dimensional graphics;
- Develop the ability to implement graphical applications using industry standard hardware-accelerated graphical libraries (e.g. OpenGL);

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Syllabus

- Physics & biology of vision, colour, display technology, human-computer interaction, navigation, object manipulation and evaluation.
- 3D interface design and interaction; 3D geometric modelling and transformation; Orthographic and perspective transformations; Homogeneous coordinates.
- Triangulated surfaces, higher-order surfaces (e.g. Bézier surfaces).
- Scene construction and representation; Scene graphs and animation hierarchies
- Phong lighting and rendering equations
- Surface parametrization and textured surfaces.
- Phong & Gouraud shading.
- Projective rendering and the projective rendering pipeline. Standard libraries for real-time rendering (e.g., OpenGL).

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Hardware / Software

- OpenGL (on Win, OSX, Unix, iOS, Android, ...)
- C/C++ (because of OpenGL)
- Qt / GLUT / Linux (Lab machines)
 - Other platforms by permission only
 - i.e. OSX, Windows, Android, iOS

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Textbook

- “Required”
- Covers our material
- Roughly same order
- But uses GLUT
- And skips details
- Cheap
- Good starter book

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The must-have quick reference on OpenGL

3rd Edition
OPENGL®

A PRIMER

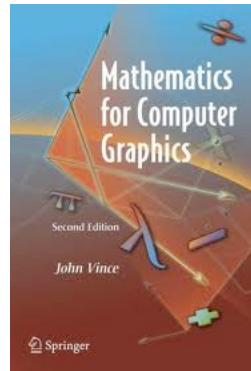
Edward Angel

FEATURES:

- Includes a complete, detailed listing of essential OpenGL functions and commands for quick reference.
- Offers a comprehensive treatment of OpenGL to get you started with OpenGL quickly.
- Provides many examples that demonstrate how to implement and apply the OpenGL functions in each chapter.
- Presents alert boxes to notify you of common pitfalls and solutions.

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Useful Reference

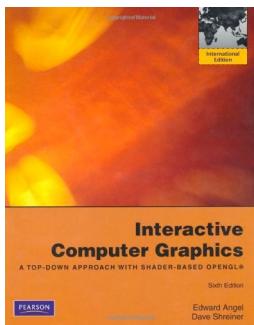


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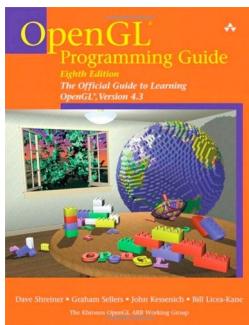
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Other Introductions



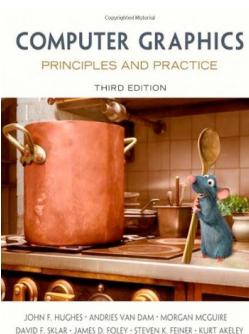
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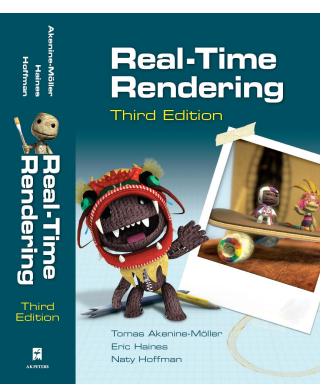
Professional Musts



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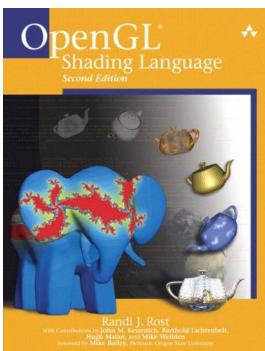
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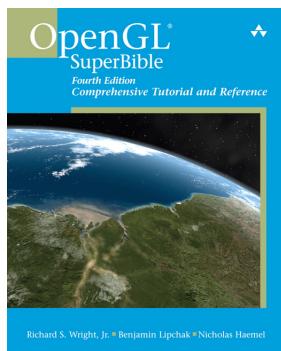
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Shaders, &c.



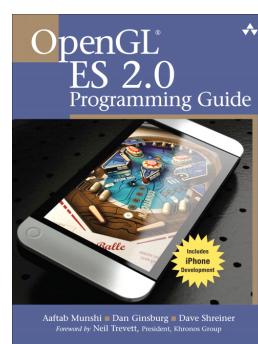
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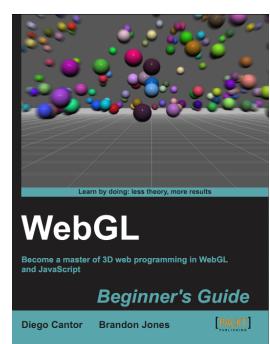
Mobile & Web GL



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Evaluation

Schedule

- 50% Examination
- 2 hours
- Closed book
- 50% Coursework
- 5 x 10% courseworks (2 weeks each)

| Week | Monday | Friday | Lecture 1 (Tuesday) | Lecture 2 (Thursday) | Assignment Due (Thursday) | Assignment Available (Thursday) |
|------|------------|------------|----------------------------------|-------------------------|------------------------------------|------------------------------------|
| 1 | 26/09/2016 | 30/09/2016 | Introduction / Physics & Biology | Rasterisation in 2D | | A1: Triangle Rasterisation (10%) |
| 2 | 03/10/2016 | 07/10/2016 | Linear Algebra in C++ | 2D Curves (Béziers) | | |
| 3 | 10/10/2016 | 14/10/2016 | 3D Lines & Planes | Geometric Modelling | A1: Triangle Rasterisation (10%) | A2: Platonic Wireframes (10%) |
| 4 | 17/10/2016 | 21/10/2016 | Rotation Matrices | Homogeneous Coordinates | | |
| 5 | 24/10/2016 | 28/10/2016 | Perspective Projection | The OpenGL Pipeline | A2: Platonic Wireframes (10%) | A3: Wireframe Modelling (10%) |
| 6 | 31/10/2016 | 04/11/2016 | | | | |
| 7 | 07/11/2016 | 11/11/2016 | Lighting & Shading | Mapping & Textures | A3: The Modeling Interface (10%) | A4: Shaded Textured Surfaces (10%) |
| 8 | 14/11/2016 | 18/11/2016 | User Interaction in 3D | Virtual Worlds | | |
| 9 | 21/11/2016 | 25/11/2016 | Hierarchical Animation | Blending | A4: Shaded Textured Surfaces (10%) | A5: Virtual World (10%) |
| 10 | 28/11/2016 | 02/12/2016 | Optimisation | Raytracing | | |
| 11 | 05/12/2016 | 09/12/2016 | Bézier Surfaces | Review | A5: Virtual World (10%) | |

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