Introduction to Computer Graphics

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Objectives

- Broad introduction to Computer Graphics
  - Software
  - Hardware
  - Applications
- Top-down approach
- OpenGL

Text Book

- Ed Angel, Interactive Computer Graphics, A Top-down Approach with OpenGL (Fourth Edition)

- The lectures cover the material in Chapters 1-8
- Survey additional topics as time permits

Prerequisites

- Good programming skills in C (or C++)
- Basic Data Structures
  - Linked lists
  - Arrays
- Geometry
- Simple Linear Algebra

Requirements

- 3 Assigned Projects
  - Simple
  - Interactive
  - 3D
- Term Project
  - You pick

Resources

- Can run OpenGL on any system
  - Windows
  - Linux
  - Mac
- CS lab
  - Linux/mesa
  - Some Nvidia cards

References

- Other helpful references
  - OpenGL: A Primer (Second Edition), Ed Angel, Addison-Wesley, 2004
    - Designed for students who need more programming information
  - The OpenGL Programmer's Guide (the Redbook) and the OpenGL Reference Manual (The Blue book), Addison-Wesley,
    - The definitive references
    - New edition of red book just released

Web Resources

- www.opengl.org
- www.cs.unm.edu/~angel

Outline: Part 1

- Part 1: Introduction
- Text: Chapter 1
- Lectures 1-3
  - What is Computer Graphics?
  - Applications Areas
  - History
  - Image formation
  - Basic Architecture

Outline: Part 2

- Part 2: Basic OpenGL
- Text: Chapters 2-3
- Lectures 4-9
  - Architecture
  - GLUT
  - Simple programs in two and three dimensions
  - Interaction

Outline: Part 3

- Part 3: Three-Dimensional Graphics
- Text: Chapters 4-6
- Lectures 10-20
  - Geometry
  - Transformations
  - Homogeneous Coordinates
  - Viewing
  - Shading

Outline: Part 4

- Part 5: Implementation
- Text: Chapter 7
- Lectures: 21-23
  - Approaches (object vs image space)
  - Implementing the pipeline
  - Clipping
  - Line drawing
  - Polygon Fill
  - Display issues (color)

Outline: Part 5

- Part 4: Discrete Methods
- Text: Chapter 8
- Lectures 24-27
  - Buffers
  - Bitmaps and Pixel Maps
  - Texture Mapping
  - Compositing and Transparency

Outline: Part 6

- Part 6: Programmable Pipelines
- Text: Chapter 9
- Lectures 28-30
  - Shading Languages
  - GLSL
  - Vertex Shaders
  - Fragment Shaders

Outline: Part 7

- Part 7: Hierarchy
- Text: Chapter 10
- Lectures: 31-33
- Tree Structured Models
  - Traversal Methods
  - Scene Graphs

Outline: Part 8

- Part 8: Curves and Surfaces
- Text: Chapter 11
- Lectures: 34-38

Extra Lectures

- Marching Squares
- Virtual Trackball
- Display Issues
- Fractals
- Sampling and Aliasing
- Bump Mapping
- Environment Mapping
- Reflection and Transmission