

Computer Graphics

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Course Goal

The goal of this course is to provide an introduction to the theory and practice of computer graphics. The course will assume a good background in programming in C or C++ and a background in mathematics including familiarity with the theory and use of coordinate geometry and of linear algebra such as matrix multiplication.

Overview

- Textbook
 - Ed Angel, Interactive Computer Graphics, A Top-down Approach with OpenGL (Fourth Edition), Addison-Wesley
- These lectures cover Chapters 1-6 in detail and survey Chapters 7-11

Objectives

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

Prerequisites

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

Resources

- Can run OpenGL on any system
 - Windows
 - Linux
 - Mac
- Get GLUT from web if needed

References

- Other helpful references
 - OpenGL: A Primer, Ed Angel, Addison-Wesley, (Second Edition), 2005
 - Designed for students who need more programming information
 - The OpenGL Programmer's Guide (the Redbook), Addison-Wesley,
 - The OpenGL Reference Manual (The Blue book), Addison-Wesley,
 - The definitive references

References (continued)

- Other References:
 - Introduction to Computer Graphics, **James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Richard L. Phillips**, ISBN: 0-201-60921-5, Addison Wesley, 1994.

Web Resources

- www.opengl.org
- www.cs.kent.edu/~farrell/cg05/reference/
- www.cs.unm.edu/~angel

Grade Calculations

- Midterm 30%
- Final 30%
- Class Assignments 40%.
- Notes: Assignments will primarily be programming assignments requiring implementation of applications employing the theory covered in the lectures and the books. There will however be some theoretical homeworks and questions as well. Students are reminded that completion of both theory and programming parts of the homework are necessary to achieve a good grade.

Outline: Part 1

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

Outline: Part 2

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

Outline: Part 3

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

Outline: Part 4

- Part 5: Implementation
- Text: Chapter 7
 - 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
 - Buffers
 - Bitmaps and Pixel Maps
 - Texture Mapping
 - Compositing and Transparency

Outline: Part 6

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

Outline: Part 7 & 8

- Part 7: Hierarchy
- Text: Chapter 10
 - Tree Structured Models
 - Traversal Methods
 - Scene Graphs
- Part 8: Curves and Surfaces
- Text: Chapter 11