CSE 5542 Real Time Rendering

Instructor: Han-Wei Shen  (hwshen@cse.ohio-state.edu)

Credit:  3

Class:  MWF 10:20 am – 11:15 am DL 317

Office hours: MWF 11:15 – 12: 20 pm  DL 789

Web:  http://www.cse.ohio-state.edu/~hwshen/5542

Prerequisite:  3901 (560) or 3902 or 3903
             math 2568 (568) or 571
             permission from the instructor
Instructor Permission?

• This is a low level graphics programming class, where you will learn how to directly control GPUs by writing OpenGL and shader code
• You need to be fluent in programming
• We will use WebGL, which is in Javascript. But prior experience with C/C++ will suffice.
• You need to be comfortable with linear algebra (vector and matrix calculations)
Textbook


- Very easy to read!
- Help you to understand the lectures and prepare for exams
- Many WebGL/GLSL examples
Reference Book

- *OpenGL 4.0 Shading Language Cookbook*

  - Focused on the shading language
  - Many good examples
  - Very easy to read
  - Remember it uses the latest GLSL, but your machine may not support it (for example, Macs)
Reference Book


- The latest OpenGL standard
- Best book to learn programming ‘modern’ OpenGL
- You are recommended to use this version only
Grading

- Five Labs: 60 %
- Midterm Exam: 20 %
- Final Exam: 20%

• Grader: Joseph Baker
• Office Hours:
• Grader Office:
What is Computer Graphics?

• Computer-generated images or sequences of images (i.e., animations, movies)
• The scientific study of techniques and methods for generating such images
• Not simply trying for photorealism!
  – Painterly effects
  – Sketches, toon shading
  – etc
Some 3-D Computer Graphics Applications

- Manufacturing design (CAD)
- Movies, TV, commercials
  - Animations
  - Special effects mixed with live footage
- Visual arts
- Video games
- Scientific visualization
- Simulation of natural phenomena
What will I learn from this course?

- A basic understanding of graphics hardware/software
- Learn how to use OpenGL/GLSL to control graphics hardware for 2D/3D drawing
- Advanced real time rendering algorithms
Specific Topics

• Overview of Graphics Hardware and Software
• Coordinate systems
• OpenGL geometry drawing
  – OpenGL vertex buffer objects
• OpenGL coordinate systems
• OpenGL Shading Language
  – Vertex and fragment shaders
• 3D Transformation and Viewing
Specific Topics

• Illumination
  – Flat, Gourald, Phong shading models
  – Fixed function pipeline and shaders

• Visibility and Z-buffering

• Texture Mapping
  – Image and procedural textures

• Bump, environment, and projective texture mapping
Specific Topics

• Real time shadows

• Advanced topics in shaders
  – Geometry shader
  – Tessellation shader

• Advanced topics in rendering and graphics applications
Where do I do my labs?

- Your own machine
- Graphics PC Lab – CL 112D
- Graphics cards that supports at least OpenGL 2.1
- Platforms: PC, Mac OS X or Linux
- All your labs will run on web browsers