CSE 167: Introduction to Computer Graphics

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University of California, San Diego
Fall Quarter 2010
Today

- Course overview
- Course organization
What is computer graphics

Applications:
- Movie, TV special effects
- Video games
- Scientific visualization
- GIS (Geographic Information Systems)
- Medical visualization
- Industrial design
- Simulation
- Communication
- Etc.
What is computer graphics?

- Rendering
- Modeling
- Animation
Rendering

- **Synthesis of a 2D image from a 3D scene description**
  - Rendering algorithm interprets data structures that represent the scene in terms of geometric primitives, textures, and lights

- **2D image is an array of pixels**
  - Red, green, blue values for each pixel

- **Different objectives**
  - Photorealistic
  - Interactive
  - Artistic
Photorealistic rendering

- Physically-based simulation of light, camera
- Shadows, realistic illumination, multiple light bounces
- Slow, minutes to hours per image
- Special effects, movies
- CSE168: Rendering Algorithms
Photorealistic rendering
Interactive rendering

- Produce images within milliseconds
- Using specialized hardware, graphics processing units (GPUs)
- Standardized APIs (OpenGL, DirectX)
- Often “as photorealistic as possible”
- Hard shadows, fake soft shadows, only single bounce of light
- Games
- CSE167
Interactive rendering
Artistic rendering

- Stylized
- Artwork, illustrations, data visualization
Artistic rendering
Modeling

- Creating 3D geometric data
  - The “model” or the “scene”
- By hand
  - Autodesk (Maya, AutoCAD), LightWave 3D, …
- Free software
  - Blender
- Not as easy to use as Notepad…

Maya Screenshot
Modeling

- Basic 3D models consist of array of triangles
- Each triangle stores 3 vertices
- Each vertex contains
  - xyz position
  - Color
  - Etc.
Modeling

- Procedural: by writing programs
- Scanning real-world objects
Modeling

Procedural tree

Procedural city

Scanned statue
Animation

- Deforming or editing the geometry
- Change over time
- Faces, articulated characters, ...
- CSE169: Computer Animation (not offered this year)
Animation
Physics simulation
Questions?
Today

- Course overview
- Course organization
Course Staff

Instructor
- Jürgen Schulze, Ph.D.
  Research Scientist at Calit2

Teaching Assistants
- Han Suk Kim, CSE graduate student
- Iman Sadeghi, CSE graduate student

Tutors
- Phi Nguyen, CSE senior
- Haili Wang, CSE senior
Course Organization

**Lecture**
- Tue/Thu, 2:00pm-3:20pm, WLH 2005

**Homework Grading**
- Fridays (only on due dates) 2pm-5pm, CSE lab 260

**Instructor Office Hour**
- Tue 3:30pm-4:30pm, Atkinson Hall room 2125

**Office Hours in Lab**
- Han Suk Kim: Mon/Thu 9:30am-11:30am
- Phi Nguyen: Tue/Thu 11:30am-12:30pm
- Haili Wang: Tue/Thu 3:30pm-4:30pm
- Iman Sadeghi: TBD
- For updates see the course web site
Prerequisites

**Familiarity with**

- Linear algebra
- C++
- Object oriented programming
In this class

- Rendering 3D models
  - Camera simulation
  - Interactive viewing
  - Lighting
  - Shading
- Modeling
  - Triangle meshes
  - Parametric surfaces
- Applying linear algebra, C++, OpenGL
- Foundation for advanced graphics courses (CSE168, CSE169, CSE 190 on shader programming)
Web Site

Course web site:

- [http://graphics.ucsd.edu/twiki/bin/view.pl/Classes/CSE167Fall2010](http://graphics.ucsd.edu/twiki/bin/view.pl/Classes/CSE167Fall2010)

- Contains:
  - Schedule
  - Slides
  - Recommended reading
  - Homework assignments
  - Grading
  - Exam information
WebCT

- Go to http://webct.ucsd.edu and select CSE167
- Log in with your Active Directory account
- Find discussion board, chat, etc.
Textbooks

- **Required:**
  Peter Shirley: *Fundamentals of Computer Graphics*, any edition (Google Books has full text version)

- **Recommended (available on-line):**
  *OpenGL Programming Guide*
Programming Projects

- Find assignments and schedule on class web site
- Base code (for Windows and Linux) and documentation on class web site
- Use EBU3B 2xx labs or your own PC
- Individual assistance by TAs and tutors during lab hours
- Turn in by demonstration to TA or tutor during lab hours or homework grading hours. Demonstration can be done on lab PC or personal laptop computer.
Programming Projects

- **Project 1**: Matrices, Vectors, and Coordinate Transformations
- **Project 2**: Interactive Viewing
- **Project 3**: Rasterization
- **Project 4**: Lighting and Texturing
- **Project 5**: Scene Graphs
- **Project 6**: Shader Programming
- **Final Project**
Tests

Two in-class written tests. Closed book, handwritten index card is permitted.

First exam:
- Thu 10/21, 2:00pm-3:20pm, WLH 2005

Second exam:
- Tue 11/23, 2:00pm-3:20pm, WLH 2005
Grading

- Homework Projects 1-6: 10% each
- Written exams: 10% each
- Final project: 20%
- Late submission policy for homework projects:
  75% of original grade if you present your project within seven days of the due date
Questions?
Next Lecture

- Tue 9/28 at 2pm
- Topic: Homogeneous Coordinates
- Preparation:
  Refresh three dimensional vector/matrix calculations
- Lab session (optional):
  Introduction to base code and homework assignment #1:
  Han Suk Kim, CSE lab 260, Monday Sept 27, 9:30am