CSE 3541/5541: Computer Game and Animation Techniques

Instructor:  Huamin Wang (whmin@cse.ohio-state.edu)

Credit: 3

Office hours: MWF 2:50PM – 3:30PM, DL 583

Webpage: http://www.cse.ohio-state.edu/~whmin/courses/cse3541-2014-spring/main.html

Prerequisite:  CSE 3901 or 3902 or 3903 (project design)
MATH 2568 (linear algebra)
or permission from the instructor
Instructor Permission?

- Enthusiastic about Computer Graphics
- Fluent in C/C++/C#/javascript programming
- Comfortable with linear algebra (vector and matrix calculations)
- Ready to learn fast-changing technology by yourself
Textbook

Reference books

Reference Website

http://www.unity3d.com
Grading

- Five Labs: 45%
- Final Lab: 15%
- Exam: 25%
- Three written assignments: 15%
- Deadlines are deadlines!
- 10% penalty after each day. (No points after 5 days.)

- Grader: TBA
- Office Hours: TBA
- Grader Office: TBA
Attendance?

- It is not mandatory but highly recommended, because:
  1. Slides cannot cover everything…
  2. Details on labs and assignments…
  3. Interesting demos and videos.
  4. Schedule changes and updates.
  5. Exam preparation.
Graphics Topics 1: Geometry

How to represent 3D objects?

Point clouds

Stanford Bunny
Graphics Topics 1: Geometry

How to represent 3D objects?

Triangle meshes,
Polygon meshes, …
Graphics Topics 1: Geometry

How to represent 3D objects?

Volumetric Data
(CT scan data)
Graphics Topics 2: Rendering

How to generate images?
Graphics Topics 2: Rendering

How to generate images?
Graphics Topics 3: Animation

Animation is about changing the objects!
Graphics Topics 3: Animation

Change the shape!
Graphics Topics 3: Animation

Real-Time GPU Animation Demo
Graphics Applications

Electronic games

Movies/TV/Commercials

Computer-Aided Design (CAD)

Visual arts

Scientific visualization
Graphics Curriculum

5542: Real-time Rendering

5545: High-Quality Rendering

5543: Geometry

5544: Visualization
Computer Animation Techniques

- Real-time animation: fast, for games, lower quality, has to be robust
- Offline animation: slow, for movies (both animation movies and special effects), high-quality,
- Today’s offline technique is tomorrow’s real-time technique!
What will you learn from this course?

• A basic understanding of animation production pipeline
• Learn how to implement basic animation effects using Unity engine
• Some advanced animation algorithms and concepts
Specific Topics: Math

- Vector and linear algebra
- Transformation and matrices
- Numerical solvers
- Numerical differential equations and integration
- Interpolation
Specific Topics: Physics

- Newton’s three laws of motion
- Forward and inverse kinematics
- Contact: collision and friction
- Deformation: elasticity, plasticity, fracture
- Fluid dynamics
Specific Topics: Animation

- Some basic graphics knowledge
  - Geometry
  - Rendering
- Key framing
- Motion capture
- Path finding
- Physically based simulation
  - Particle, springs, cloth, deformable body, rigid body, fluid…
Where do I do my labs?

- Your own machine … or
- Graphics PC Lab – CL 112D
- A sufficiently new graphics cards
- Platforms: PC, Mac OS X (or Linux?)