CSE 3541/5541: Computer Game and Animation Techniques

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

Credit: 3

Office hour: MWF 1:30PM – 2:00PM, DL 583

Prerequisite: CSE 3901 or 3902 or 3903 (project design)
MATH 2568 (linear algebra)
or instructor permission

Webpage:
General Requirements

• Enthusiastic about Computer Graphics
• Fluent in C/C++/C#/javascript programming
• Comfortable with linear algebra (vector and matrix calculations)
• Ready to learn the fast-changing technology by yourself
Optional 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 each day. (No points after 5 days.)

• Grader: Jiayuan Wang; Congrong Ren
• 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?

A cluster of points

Stanford Bunny
Graphics Topics 1: Geometry

How to represent 3D objects?

Triangle mesh
Polygon mesh
Tetrahedral mesh
Graphics Topics 1: Geometry

How to represent 3D objects?

Volumetric data (CT Scan)
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 over time!
Graphics Topics 3: Animation
Graphics Topics 3: Animation

FLEX
Unified GPU Physics
Applications: Games
Applications: Movies

Special Effects (in the past)
Applications: Movies

Special Effects (today)
Applications: Computer-Aided Design
Applications: Fashion Design
Applications: Fashion Design
Applications: Virtual Reality
Applications: Virtual Humans

Siren by Unreal Engine (2018)
Applications: Virtual Humans
Augmented Reality (AR) is the future!
Augmented Reality (AR) is the future!
Graphics Curriculum

5542: Real-time Rendering  5545: Advanced Computer Graphics

5543: Geometry  5544: Visualization
Computer Animation Techniques

• Real-time animation: fast, for games/VR/AR, 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 the game/animation production pipeline
• Learn how to implement basic animation effects using the Unity game 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
- A good graphics card
- Platforms: PC, Mac OS X (or Linux?)