Course Information

• **INSTRUCTOR:** Professor Jing Hua (jinghua@wayne.edu),

• **CREDITS:** 3

• **PREREQUISITES:** CSC 2200 or 5050, MAT 2250.
  – C/C++/Java, Linear Algebra

http://www.cs.wayne.edu/~jinghua/5870/csc5870.htm
Course Information

- **LECTURES:** Tuesday & Thursday, 02:30PM - 03:45PM
- **OFFICE HOURS:** Thursdays, 1:30PM - 2:30PM
  (5057 Woodward, STE 14109.1)
Textbooks

**REQUIRED TEXTBOOK:**


Grading Scheme

- Warmup assignment 10%
- Assignment 1: 25%
- Assignment 2: 20%
- Written exam: 45%
- Course Project: 20%
Overview

• What is computer graphics?

• Why computer graphics?

• Graphics pipeline
What is Computer Graphics?

- Computer technology used to create, manipulate and communicate visual information.
Why Computer Graphics?

• Computer Animation
• Computer Aided Design
• Architecture
• Visualization
• Medical Applications
• Video Games
• Computer Simulation
• ...
Computer Animation
Computer Simulation
Computer Simulation
Enemy at the Gate

- video\Animation\4enemyatthegates.mov
Video Games
Computer Aided Design (CAD)
Architecture
Digital Art

- Cactus with a sombrero
- Haystacks in a sunset
- Milk jug and a bowl
Visualization
Visualization (Isosurfaces)
Visualization (Volume Rendering)
Medical Applications
Virtual Colonoscopy
3D Face Tracking
Single Camera:
Face Tracking and Gaze Estimation
Vehicle Detection and Depth Estimation with a Single Camera
Goal

- A comprehensive overview of computer graphics
- The graphics pipeline
- State-of-art techniques in computer graphics related fields
- Future research and work in computer graphics
Content

• Introduction
  – Overview, definition
  – Various application examples and areas
  – Graphics history
  – Graphics software and hardware systems
  – Graphics programming
  – User-computer interface
Content (cont.)

- **Graphics Device and Hardware**
  - Hardware, display devices, I/O peripherals
  - Vector and raster graphics system
  - Interaction techniques
Content (cont.)

- **Geometry and Mathematics**
  - Basic mathematics relevant to graphics
  - Coordinate systems
  - Geometric primitives
  - *Curves, and surfaces*
  - Solid and volumetric models
  - 2D and 3D geometric transformation
  - Parallel and perspective projection
  - Data structures
• Scene composition
  – 2D and 3D geometric transformation
  – Object hierarchies
  – Viewing and clipping
  – Parallel and perspective projection
  – Object and image order rendering
Content (cont.)

• Rendering
  – Rendering pipeline
  – Scan-conversion: lines and polygons
  – Shading/lighting (illumination models)
  – Color perception and color models
  – Basic optics
  – Visibility
Content (cont.)

- Image-based techniques
  - Sampling
  - Filtering
  - Anti-aliasing
  - Image analysis and manipulation
Content (cont.)

• Advanced Topics
  – Animation
  – Transparency and shadows
  – Texture mapping
  – Ray tracing, radiosity
  – Image-based rendering and modeling
  – Advanced modeling techniques
  – Case studies
  – Software packages
  – ............
Content (cont.)

• Learn something you are interested through the course project
  – Interesting topic
  – Hand-on experience
  – Special instruction
A Classical Classification

Image Processing

2D Images

Computer Graphics

3D Models

Computer Vision
Graphics Pipeline

Modeling → Rendering
Rendering Pipeline

Model → Geometry Processing → Projection → Rasterization → Display
Next few weeks

• Graphics Hardware
  • Display Devices
  • Input Devices

• Graphics Software
  • OpenGL
  • FLTK

• Explain each step in the graphics rendering pipeline.
Questions???
Questionnaire
Next Class

• **Overview of Graphics Systems**
  – Demos
    • VR
    • CG & VIS applications