Lecture O of 41:
Part B – Course Content

Advanced Computer Graphics:
Course Organization and Survey

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KSOL course page: http://www.kddresearch.org/Courses/CIS736
Instructor home page: http://www.cis.ksu.edu/~bhsu

Reading for Next Class:
Syllabus and Introductory Handouts

CIS 736 students: Advanced CG Topics 1 slides
Chapter 1: Eberly (2006) 3D Game Engine Design, 2nd

Course Overview

- Graphics Systems and Techniques
  - Main emphasis: shaders, lighting, mappings (textures, etc.) in OpenGL
  - Photorealistic rendering and animation (Maya 2011, Blender, Ogre3D)
  - 2-D, 3-D models: curves, surfaces, visible surface identification, illumination
  - Special topics: global illumination (ray tracing, radiosity), particle systems, fractals, scientific visualization (vis), and information visualization (inf)ry

- Operations
  - Surface modeling, mapping
  - Pipelines for display, transformation, illumination, animation

- Computer Graphics (CG): Duality with Computer Vision
  - Visualization and User Interfaces

- Applications
  - CAD/CAM/CAE: object transformations, surfacessolid modeling, animation
  - Entertainment: 3-D games, photorealistic animation, etc.
  - Analysis: info visualization, decision support, intelligent displays

Advanced CG Syllabus,
Part 1 of 2

- Project Topics for CIS 736
  - Advanced Topics in Computer Graphics (10)
    - Filters for Texturing – Week 2
    - Level-of-Detail Algorithms and Terrain – Week 3
    - More Mappings – Week 6
    - More on Animation – Week 8
    - Character Modeling and IK – Week 9
    - Global Illumination: Photon Maps (Radiosity) – Week 10
    - Advanced Lighting Models – Week 11
    - Advanced Ray-Tracing – Week 12
    - More on Scientific, Data, Info Visualization – Week 13
    - Fractals and L-Systems – Week 14

- Recommended Background Reading for CIS 736
  - Shared Lectures with CIS 536/636 (Introduction to Computer Graphics)
    - Regular in-class lectures (20) and labs (7)
    - Guidelines for paper reviews, Week 5
    - Preparing term project presentations, CG demos – Weeks 11-12

Online Recorded Lectures
for CIS 736 (Computer Graphics)

- Why Computer Graphics?
  - Developing Computational Capability
    - Rendering: synthesizing realistic-looking, useful, or interesting images
  - Animation: creating visual impression of motion
    - Image processing: analyzing, transforming, displaying images efficiently
  - Better Understanding of Data, Objects, Processes through Visualization
    - Visual summarization, description, manipulation
  - Virtual environments (VE), visual monitoring, interactivity
  - Human-computer intelligent interaction (HCI): training, tutoring, analysis, control systems

- Time is Right
  - Recent progress in algorithms and theory
  - Rapidly emergence of new I/O (display and data acquisition) technologies
  - Available computational power, improving price-performance-ratio of hardware
  - Growth and interest of graphics industries (e.g., games, entertainment, computer-aided design, visualization in science and business)
Special Topics: Computer-Generated Animation (CGA)

Jason Lawrence
Professor
Department of Computer Science
University of Virginia
http://www.cs.virginia.edu/~jdl/

Fractals: Iterated Function Systems (IFSs)

Fractal of the Day: http://sprott.physics.wisc.edu/fractals.htm

Information Visualization

Visible Decisions
SeeIT
© 1999 VDI http://www.advizorsolutions.com

Textbook and Recommended References

Required Textbook

Recommended References

Next Class

Photorealism

http://realismstudio.com

3-D Camera Model

http://www.imageart.com
Summary

- This course is a lot of work
  - Reading: Eberly 2 – big book, like Foley et al.
  - Programming assignments (4): expect to spend 10+ hours on each
  - Written assignments (4): about 6-10 hours
  - Term project: at least 30 hours (people have spent up to 60 or more)

- but it can also be fun
  - Visible results
  - Nifty algorithms, high-performance hardware
  - "Putting it all together": very interdisciplinary field
  - Decent job market for people with right development skills, ideas
  - Applicable to many other areas of CS and IT

Emphasis

- "Polygons to pixels pipeline": viewing, VSD, lighting, shading, texturing
- Other topics to be covered: animation, curves and surfaces, collisions
- Brief survey of: ray tracing, visualization and color, fractals
- Tutorials (GameDev aka Nehe): http://nehe.gamedev.net

Terminology

- Computer Graphics: Digital Synthesis, Manipulation of Visual Content
  - Geometry: representation and processing of surfaces
  - Animation: representation and manipulation of motion
  - Rendering: computationally reproducing appearance of light in scenes
  - Imaging: image acquisition, editing, processing

Different Approaches to Graphics

- Raster (bitmaps, picture elements aka pixels) vs. vector (lines)
- Sample-based (cf. Photoshop) vs. geometry-based (cf. OpenGL, Direct3D)

Purpose of Graphics

- Entertainment – games, visual effects in movies and television
- Communications – advertising, journalism
- Modeling / simulation – displaying objects, events via graphical user interfaces (GUI)
- Visualization – displaying events for analysis and understanding

Dual Problem: Inverse Input and Output

- Graphics (rendering): geometry to sample (image)
- Vision: sample to geometry