Advanced Computer Graphics

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Princeton University
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Overview

- Introduction
  - What is this course about?

- Review
  - What background will I need?

- Syllabus
  - What will I learn in this course?

- Mechanics
  - How with the course work?
Introduction

• What is computer graphics?
  ◦ Imaging = representing 2D images
  ◦ Modeling = representing 3D objects
  ◦ Rendering = constructing 2D images from 3D models
  ◦ Animation = simulating changes over time

Background

• Image Processing
  ◦ Basic signal processing
  ◦ Filtering, resampling, warping, ...

• Rendering
  ◦ Polygon rendering pipeline
  ◦ Ray tracing

• Modeling
  ◦ Basic 3D object representations
  ◦ Polygonal meshes

• Animation
  ◦ Basic principles
Background

- Image Processing
  - Basic signal processing
  - Filtering, resampling, warping, ...
- Rendering
  - Polygon rendering pipeline
  - OpenGL
- Modeling
  - Basic 3D object representations
  - Polygonal meshes
- Animation
  - Basic principles

Background

- Image Processing
  - Basic signal processing
  - Filtering, resampling, warping, ...
- Rendering
  - Polygon rendering pipeline
  - Ray tracing
- Modeling
  - Basic 3D object representations
  - Polygonal meshes
- Animation
  - Basic principles

3D Geometric Primitives

Modeling Transformation

Lighting

Viewing Transformation

Projection Transformation

Clipping

Scan Conversion

Image
Background

- Image Processing
  - Basic signal processing
  - Filtering, resampling, warping, ...

- Rendering
  - Polygon rendering pipeline
  - Ray tracing

- Modeling
  - Basic 3D object representations
  - Polygonal meshes

- Animation
  - Basic principles
CS526 Syllabus

• Rendering
  ○ Lighting models
  ○ Global Illumination
  ○ Visibility
  ○ Image-based rendering

• Modeling
  ○ Polygonal meshes
  ○ Spline & subdivision surfaces
  ○ Volumetric representations

• Animation
  ○ Kinematics
  ○ Passive dynamics
  ○ Active dynamics
CS526 Syllabus

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Plenoptic function
Light fields & lumigraphs
Imposters

Representation
Simplification
Manipulation

Hoppe
CS526 Syllabus

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Topologies

- Continuity

Turk

Implicit

- Voxels
- BSPs
**CS526 Syllabus**

- **Rendering**
  - Lighting models
  - Global Illumination
  - Visibility
  - Image-based rendering

- **Modeling**
  - Polygonal meshes
  - Spline & subdivision surfaces
  - Volumetric representations

- **Animation**
  - Kinematics
  - Passive dynamics
  - Active dynamics
    - Articulated figures
    - Motion capture
    - Inverse kinematics
  - Particle systems
    - Spring-mass systems
CS526 Syllabus

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  - Kinematics
  - Passive dynamics
  - Active dynamics

Coursework

- Class participation
  - Do the readings
  - Contribute ideas in class

- Midterm exam
  - 2-4PM on Friday Nov 22

- Thought exercises
  - Answer written questions

- Programming assignments
  - Write code

- Final project
  - Do something cool!
Readings

- Book

- Papers
  - Both classical and recent research papers
  - Assigned for almost every lecture
  - Course web page has list and pdfs

- Resources
  - Related papers
  - Course notes
  - Software

Class Participation

- Contribute ideas in class
  - Do the readings before class

- Lecture snippet
  - 10 minute presentation at end of class
    - on some method or idea or algorithm
    - that everybody should know
  - Choose something that interests you!
Thought Exercises

- Written homeworks
  - Two or three questions
  - Some specific questions
  - Some open-ended questions

- Schedule
  - Five times during semester
  - Due at midnight on Sundays
  - The first one will be available Sunday PM and due one week later

Programming Assignments

- Write small programs
  - MS Visual Studio
  - C++ infrastructure code will be provided

- Schedule
  - Monte Carlo path tracer (due 10/14)
  - Progressive mesh viewer (due 11/18)

- Collaboration
  - Individual work
  - Rules are same as CS426

- Art contest
  - Free points
Final Projects

- Do something cool!
  - Get started on your research

- Schedule
  - Due in Jan 2003

Conclusion

- Course web page: