



Advanced Computer Graphics

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Princeton University
COS 526, Fall 2002



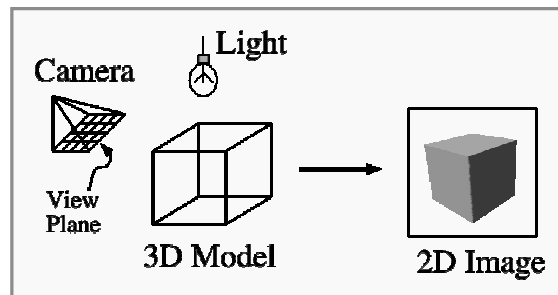
Overview

- 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

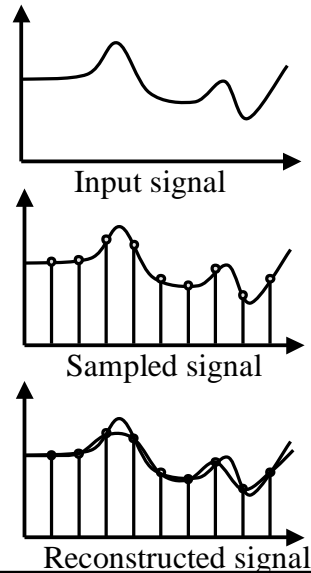


- Image Processing
 - Basic signal processing
 - Filtering, resampling, warping, ...
- Rendering
 - Polygon rendering pipeline
 - Ray tracing
- Modeling
 - Basic 3D object representations
 - Polygonal meshes
- Animation
 - Basic principles

Background



- Image Processing
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- Rendering
 - Polygon rendering pipeline
 - OpenGL
- Modeling
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- Animation
 - Basic principles

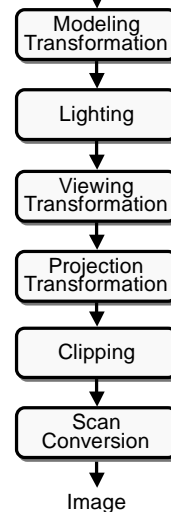


Background



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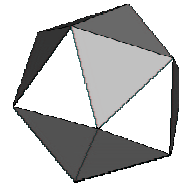
3D Geometric Primitives



Background



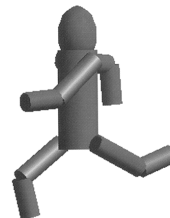
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Angel, Plate 1

CS526 Syllabus

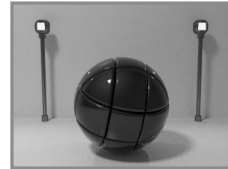
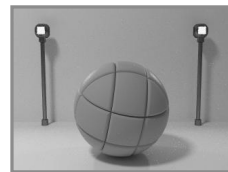


- Rendering
 - Lighting models
 - Global Illumination
 - Visibility
 - Image-based rendering
- Modeling
 - Polygonal meshes
 - Spline & subdivision surfaces
 - Volumetric representations
- Animation
 - Kinematics
 - Passive dynamics
 - Active dynamics

CS526 Syllabus



- Rendering
 - Lighting models ← { Radiometry
 - Global Illumination ← { Direct Illumination
 - Visibility ← { BRDFs
 - Image-based rendering
- Modeling
 - Polygonal meshes
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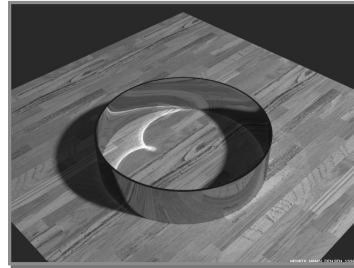


Greenberg et al.

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- Rendering
 - Lighting models
 - Global Illumination ← { Monte Carlo path tracing
Radiosity
 - Visibility
 - Image-based rendering
- Modeling
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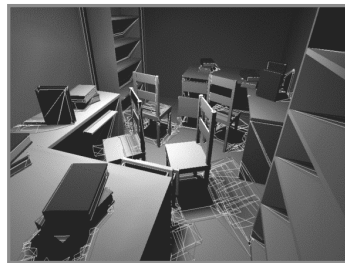


Jensen

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- Rendering
 - Lighting models
 - Global Illumination
 - Visibility ← { Shadow algorithms
Discontinuity meshing
Visibility skeleton
 - Image-based rendering
- Modeling
 - Polygonal meshes
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- Animation
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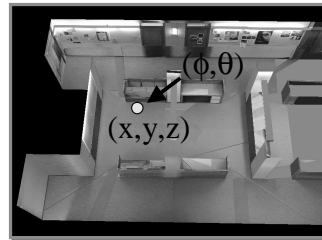


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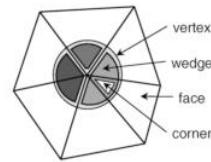
- Rendering
 - Lighting models
 - Global Illumination
 - Visibility
 - Image-based rendering ← { Plenoptic function
Light fields & lumigraphs
Imposters
- Modeling
 - Polygonal meshes
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- Animation
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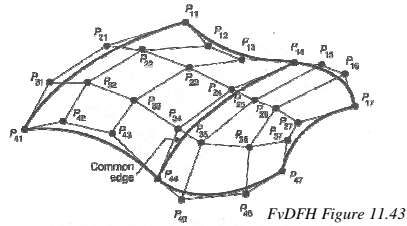
- Rendering
 - Lighting models
 - Global Illumination
 - Visibility
 - Image-based rendering
- Modeling
 - Polygonal meshes ← { Representation
Simplification
Manipulation
 - Spline & subdivision surfaces
 - Volumetric representations
- Animation
 - Kinematics
 - Passive dynamics
 - Active dynamics



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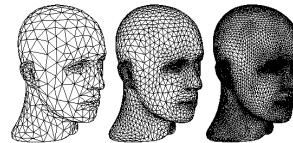
- Rendering
 - Lighting models
 - Global Illumination
 - Visibility
 - Image-based rendering



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

Topology
Continuity

- Animation
 - Kinematics
 - Passive dynamics
 - Active dynamics

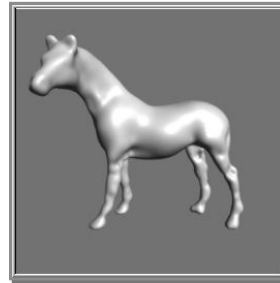


Zorin & Schroeder

CS526 Syllabus



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



Turk

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

Implicits
Voxels
BSPs

- Animation
 - Kinematics
 - Passive dynamics
 - Active dynamics

CS526 Syllabus



- Rendering
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 - Visibility
 - Image-based rendering



Gleicher et al.

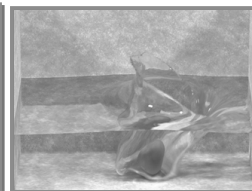
- Modeling
 - Polygonal meshes
 - Spline & subdivision surfaces
 - Volumetric representations

- Animation
 - Kinematics ← { Articulated figures
 - Passive dynamics ← { Motion capture
 - Active dynamics ← { Inverse kinematics

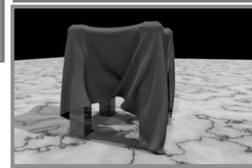
CS526 Syllabus



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- Modeling
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 - Volumetric representations



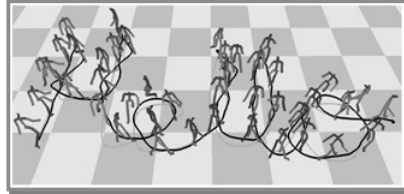
Fedkiw

- Animation
 - Kinematics ← { Particle systems
 - Passive dynamics ← { Spring-mass systems
 - Active dynamics ← {

CS526 Syllabus



- Rendering
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 - Image-based rendering



Gleicher et al.

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



Hodgins et al.

- Animation
 - Kinematics
 - Passive dynamics
 - Active dynamics
- ← { Controllers
Learning
Planning

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**
 - Alan Watt and Mark Watt, "Advanced Animation and Rendering Techniques," ACM Press, 1992.
- **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

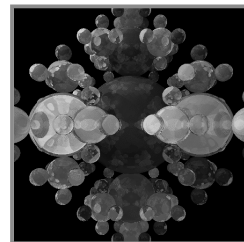


- Written homeworks
 - Two or three questions
 - Some specific questions
 - Some open-ended questions
- Schedule
 - Five times during semester
 - Due at midnight on Sundays
 - The first one will be available Sunday PM and due one week later

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



Percy

Final Projects



- Do something cool!
 - Get started on your research
- Schedule
 - Due in Jan 2003

Conclusion



- Course web page:
 - <http://www.cs.princeton.edu/courses/cs526/index.html>