**CS465:** Computer Graphics I

Professor: Steve Marschner

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**Introduction**

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**Computer graphics:** The study of creating, manipulating, and using visual images in the computer.

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**Problems in graphics**

- 2D imaging
  - compositing and layering
  - digital filtering
  - color transformations
- 2D drawing
  - illustration, drafting
  - text, GUIs

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**Problems in graphics CONT’D**

- 3D modeling
  - representing 3D shapes
  - polygons, curved surfaces, …
  - procedural modeling
**Problems in graphics cont’d**

- **3D modeling**
  - representing 3D shapes
  - polygons, curved surfaces, …
  - procedural modeling

- **DIFFERENTIAL GEOMETRY**
  - Hands—Qwrf

- **GRAMMARS**

**Problems in graphics cont’d**

- **3D rendering**
  - 2D views of 3D geometry
  - projection and perspective
  - removing hidden surfaces
  - lighting simulation

**Problems in graphics cont’d**

- **3D rendering**
  - 2D views of 3D geometry
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**Problems in graphics cont’d**

- **Integration**
  - Hands—Qwrf

**Problems in graphics cont’d**

- **Interaction**
  - 2D graphical user interfaces
  - 3D modeling interfaces
  - virtual reality
Problems in graphics cont'd

- Interaction
  - 2D graphical user interfaces
  - 3D modeling interfaces
  - virtual reality

Problems in graphics cont'd

- Animation
  - keyframe animation
  - physical simulation

Problems in graphics cont'd

- Animation
  - keyframe animation
  - physical simulation

Graphics Applications

- Entertainment
  - film production
  - film effects
  - games
Graphics Applications

- Entertainment
  - film production
  - film effects
  - games
- Science and engineering
  - computer-aided design
  - scientific visualization
- Graphic Arts
- Fine Arts

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- Graphic Arts

In this course

- You will:
  - explore fundamental ideas
  - learn math essential to graphics
  - implement key algorithms
  - write cool programs
- You will not:
  - learn OpenGL or DirectX
    (though you will understand basically how they work)
  - write big programs

Mechanics
**Topics**

- Images and image processing
- Mathematical background
- Rendering 3D scenes
- Geometric transformations
- The graphics pipeline
- Modeling in 2D and 3D
- Color science

**Images**

- What is an image?
- Compositing
- Resampling

**Mathematical background**

- Review of bits of:
  - linear algebra
  - geometry
  - calculus
  - differential geometry

**Rendering**

- ray tracing
- shading & shadows
- transparency
- texture mapping

**Geometric transformations**

- affine transforms
- perspective transforms
- viewing

rotate, then translate

translate, then rotate
Graphics pipeline

• rasterization
• interpolation
• z-buffer
• vertex and fragment ops

Modeling

• splines
• parametric surfaces
• triangle meshes