

CS174 Final Exam Review

Raytracing Summary

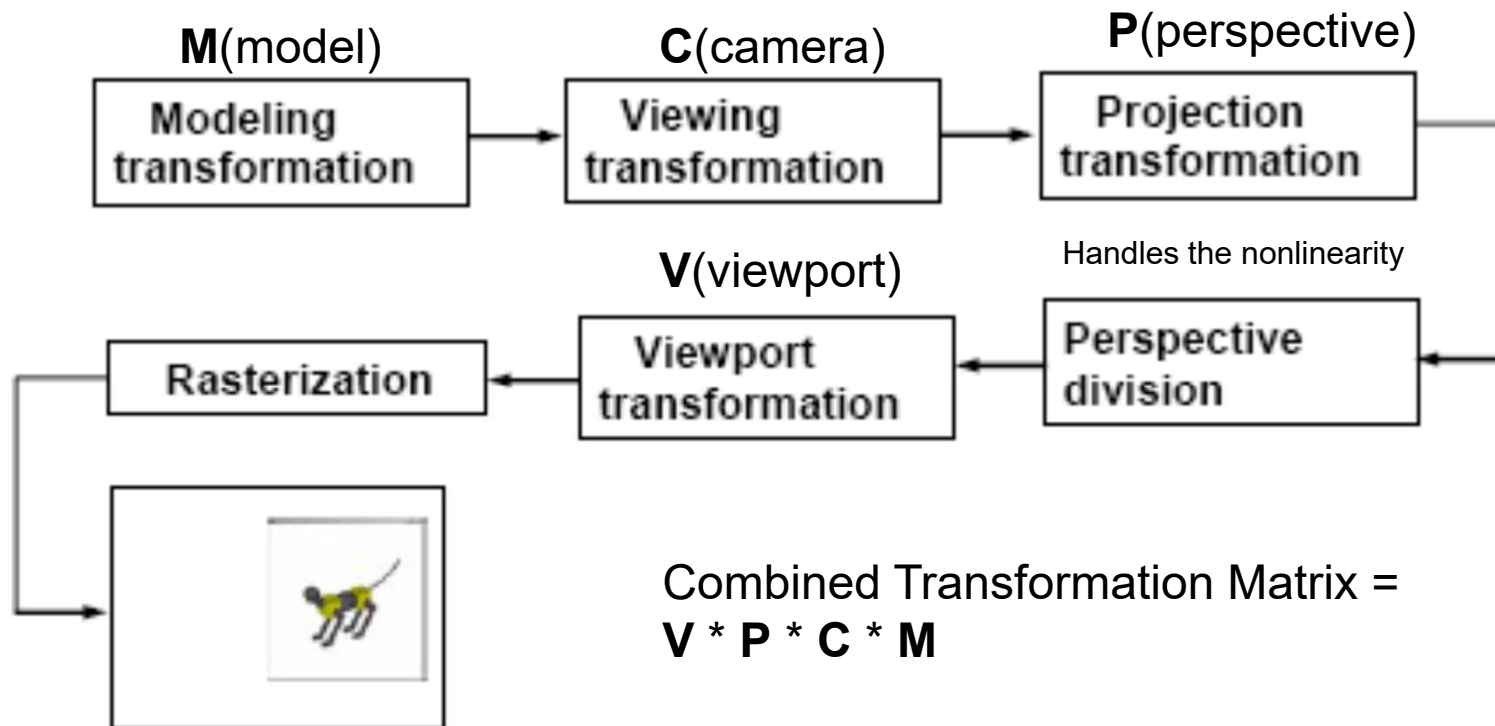
View dependent

Computationally expensive

Good for refraction and reflection effects

Anything involving Raytracing is fair game. You should be “experts” now.

Z-Buffer Graphics Pipeline



Illumination and Shading

- Memorize all equations involved in the Phong model: ambient, specular, diffuse
- What are inputs to those equations, what do they mean? For example, what does exponent “ n ” refer to?
- How do we calculate the reflectance vector?
- How do specular and diffuse shadings change as light location or viewpoint change?

Illumination: Continued

- Phong illumination model
 - A phenomenological model that's good in practice
 - Good for specular effects
- Flat shading
 - Fastest method
 - Lower quality results
- Gouraud Shading
 - Color vertices and interpolate colors at pixels
- Phong Shading
 - Color pixels by interpolating normals at each pixel

Normal Vectors

- Be able to calculate the normal of
 - A plane
 - An arbitrary implicit function
 - A sphere
 - A parametric surface

Affine Transformations

- May not preserve angles
- May not preserve edge lengths
- Always preserve parallel lines
- Always preserve “in-betweenness”
- Always preserve ratios along a line

Transformations

- How do we transform a line with a matrix?
- How do we transform a plane with a matrix?
- What are the series of transformations that reflect a point across a line?

Transformations (continued)

- What are the transformations that will convert one line segment to a different line segment?
- Given two coordinate systems, find the matrix that transforms points from one to the other
- Given a picture, be able to identify the set of OpenGL commands that turn a box (square or cube) into that picture

Projections

- Given an orthographic projection, what happens to moving objects?
- Calculate the vanishing point of a line given the equation of the line and the perspective transformation
- What is the implicit formula for an edge of the camera plane in camera space?

Perspective Projection (including perspective division)

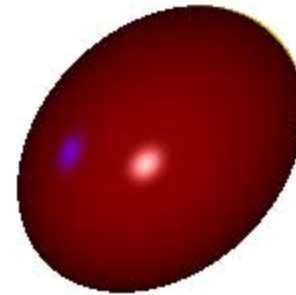
- May not preserve parallel lines
- Always preserve “in-betweenness”
- May not preserve ratios along a line
- (Think about the railroad tracks)

Rasterizing

- Given $y = ax + b$, how do we change the equation to be in terms of $y+1$ so we can rasterize lines efficiently?
- Given a line, which pixels will be turned on using the midpoint rasterization algorithm?

Spheres and Conic Sections

- What is the parametric formula for a cylinder?
- What is the surface of revolution, for a 2D profile curve rotated around an axis?
- What does a sphere look like under perspective projection?



Example of perspective projection of a sphere

Curves and Splines

- Given two Bezier or Hermite splines, what conditions force the combined curve to be C^1 continuous?
- Given two Bezier or Hermite splines with the same endpoints, how do the other control points affect them?
- Given a formula for a parametric equation, calculate the implicit form of the equation

Animation

- Don't memorize formulas, but understand the concepts
 - Forward and Inverse Kinematics
 - Dynamics (kinematics + mass and force)
 - Hooke's Law ($\text{Stress} = \text{elasticity} * \text{strain}$)
 - Explicit vs Implicit Euler time integration
 - Mass-Spring-Damper system (Deformable Solids)
 - Lennard-Jones potentials (Fluids)
 - Articulated Body Dynamics (Human/animal animation)
 - Behavioral animation (Human/animal animation)