

Computer Graphics

Topics for the Exam_02

Topics

- Coordinate systems
 - 2D Cartesian Coordinate
 - 3D Right-handed or Left-handed coordinate system
- Representation of Points and Vectors in 2d and 3d coordinates
- Representation of points and vectors in 2d and 3d homogenous coordinates
- Matrices
 - Matrix addition
 - Matrix Multiplication
 - Identity matrix
 - Matrix inverse
- Vectors
 - Vector length
 - Vector normalization
 - Inner product (Dot product)
 - Cross product
 - Angle between vectors
- **Transformations**
 - 2d and 3d translations
 - 2d and 3d rotations
 - 2d and 3d scale
 - 2d and 3d shear
 - Composite transforms
- **Window and Viewport**
- Mapping from window to viewport
- **Equation of lines and planes**
 - Equation of planes
 - Normal to planes
 - Finding equation of planes given 3 points
 - Finding equation of a plane given a point on the plane and plane normal
 - Parametric equations of lines
 - Finding distance of a point from a plane
 - Finding intersection of two planes
 - Finding intersection of a line and a plane
- **Composite matrix to make a vector to become an axis**
- **Composite matrix to rotate objects around a line or an axis in 3d by theta degrees**
- Composite matrix to make one coordinate system to coincide with the world coordinate system
- **Viewing in 3-dimensional space**
 - Steps to perform parallel projections in 3d space
 - Clipping against parallel view volume.
 - Steps to perform perspective projections in 3d space
 - Clipping against perspective view volume.

Computer Graphics

Topics for the Exam_02

Topics

- **Curves**

- Parametric Equations: Understanding the representation of curves using parameterized functions.
- General Parametric nth Order Curves: Represented as: $C(t)=G \cdot M \cdot T$
 - G is the geometry vector, M is the characteristic matrix, and T is the basis vector
 - G: Contains control points defining the curve.
 - Characteristic matrix M encodes the curve type (e.g., Hermite or Bezier)...
- Tangent vectors: Tangents describe the direction of the curve at any given point.
- Finding geometry vector and characteristic matrix for general nth order curves.
- Finding coefficients for general nth order curves.
- Finding blending functions for general nth order curves.

- **Surfaces**

- Representing surfaces using parametric forms.
- Surface Types: Bilinear ; Biquadratic ; Bicubic ; Mixed types (e.g., cubic-linear, cubic-quadratic).
- Calculation of tangent vectors and normal vectors on surfaces.
- Finding coefficients Matrix for Hermite, Bezier, and Mixed types (e.g., cubic-linear, cubic-quadratic)
- Finding geometry Matrix for Hermite, Bezier, and Mixed types (e.g., cubic-linear, cubic-quadratic).
- Finding blending surfaces for Hermite, Bezier, and Mixed types (e.g., cubic-linear, cubic-quadratic).

- **Ray Tracing**

- Lighting Models:
 - Ambient, diffuse, and specular lighting calculations.
- Surface Normals.
- Reflected Rays.
- Intersection Calculations:
 - Ray-plane intersections.
 - Ray-sphere intersections.
 - Ray-curved surface intersections.