

600 – Computer Graphic & Animation

Course Contents:

Basic background : 2D and 3D Transformations, Cyrus-Beck line clipping algorithm, Polygon clipping. 3D Viewing : Viewing pipeline, Parallel and Perspective projections, view volumes, clipping

Representing Curves and Surfaces: Parametric, curves, continuity conditions, cubic splines, Hermite interpolation, Bezier curves and surfaces, B-spline Curves- uniform nonrational, cubic periodic, open uniform, uniform, nonuniform rational types (NURBS), Subdividing curves, Displaying spline curves using forward difference scheme, parametric bicubic surfaces.

Solid Modelling: Sweep representation, Constructive solid geometry methods, representation through Octrees, Binary Space Partitioning trees.

Visible Surface Determination: Issues in Visible surface determination Coherence, perspective view, extents and bounding volume, backface culling, Z-Buffer and A-Buffer Algorithms, use of Binary Space Partitioning trees, representing 3D data using Octrees, Boolean operations on Octrees, marching cubes, Visible surface ray tracing.

Illumination Models & Rendering: Diffuse and Specular illumination model, reflection vector computation, Shading models for polygons – polygon mesh shading, Gouraud and Phong Shading, problems with interpolated shading, Bump mapping, Transparency, shadows, Ray tracing.

Introduction to Animation: Perception, Animation production, use in film and videos, orientation representation and interpolation – Euler angle representation, motion display considerations.

Animation – Low Level Control: Motion along a curve – computing arc length, speed control – sine interpolation User specified distance time functions, path following, key-frame systems – shape interpolation, free-form deformations, Morphing – 2D object warping.

Animation – High Level Control : Hierarchical modeling and Kinematics – inverse kinematics, Jacobian, rigid body simulation, collision detection, Particle systems – particle generation, attributes, termination, rendering, Flocking behavior – interacting with other members, leader, collision avoidance, modeling water, fire, explosions, waves, clouds.

Main Reading:

1. Foley, Van Dam, Feiner, Hughes, Computer Graphics – Principles and Practices 2nd edition, 1997, Addison Wesley.
2. Rick Parent, “Computer Animation: Algorithms and Techniques, 2001,, Morgan-Kaufman,
3. Hearn & Baker, Computer Graphics, 2nd Edition., 2003, Prentice Hall of India.

Supplementary Reading:

1. Woo, Neider, Davis, Shreiner, “Open GL Programming Guide” 3rd edition, 2000, Pearson Education.
2. D.A. Rogers, Procedural Elements for Computer Graphics, 2001, 2nd Edition, Tata McGraw Hill.
3. Alan Watt and Mark Watt, “Advanced animation and Rendering techniques”, 1992, Addison – Wesley.