

Modules

Computer Animation

Computer Animation refers to any time sequence of visual changes in a scene.

Design of Animation Sequence

An animation sequence is defined with following steps:-

1. Storyboard layout
2. Object definitions
3. Key-frame specifications
4. Generation of in-between frames

Storyboard Layout

Story board is an outline of an action. It defines the motion sequence as a set of basic events that are to take place. Depending on the type of animations to be produced, the story board consist of a set of rough sketches.

An object definition is given for each participant in the action. Object can be defined in terms of basic terms shapes such as polygon, rectangle etc. A

A key frame is a detailed drawing of the scene at a certain time in the animation sequence. Within each ~~to~~ key frame each object is positioned according to the time for that frame.

Generation of in between frames are the intermediate frames between the key frames. The number of in between needed is determined by the media to be

used to display the animation.

- * There are several other tasks depending on their application. They include motion verification, editing, production and synchronization of sound track.

General computer Animation Functions.

- Animation packages such as wavefront provide special functions for designing the animation and processing individual objects.
- One function available in animation packages is provided to store and manage the object database. Object shapes and associated parameters are stored and updated in the database.
- Other object functions include those for motion generation and those for object rendering.
- Motions can be generated according to specified generation using 2-D and 3-D transformations.
- Standard functions can be applied to identify visible surfaces and apply the rendering algorithm.
- Another function simulate camera movements. Standard motions are zooming, panning and tilting.

Raster Animation

- On Raster system the user can generate real-time animation in limited application using raster operations.
- A simple method for translation in the XY plane is to transfer a rectangular block of pixel values from one location to another.

- To rotate a block of pixels, the user need to determine the percent of area coverage for those pixel that overlap the rotated block.

- Sequences of raster operations can be executed to produce real time animation of either 2-D or 3-D object as long as the user restrict the animation to motions in the project plane. Then no viewing or visible surface algorithms need be invoked.

- Colour table transformation is a method for animate objects along two-dimensional motion path.

- Here we predefined object at successive positions along the motion path and set the successive blocks of pixel values to colour table entries.

- Set the pixels at the first position of the object to ON values and set ^{the} pixels at other object positions to the background colour.

- The animation is then accomplished by changing the colour table values so that the object is on at successively positions along the animation path as the preceding position is set to the background intensity.

Computer Animation Languages

Animation functions include a graphic editor, a key frame generator and in-between generator and standard graphic routines

- * The graphic editor allows to design & modify object shapes.

- * A standard function in animation specification is scene description. It includes the positioning of objects and light sources.

- * Another standard function is action specification. It involves the layout of motion paths for the objects & camera.

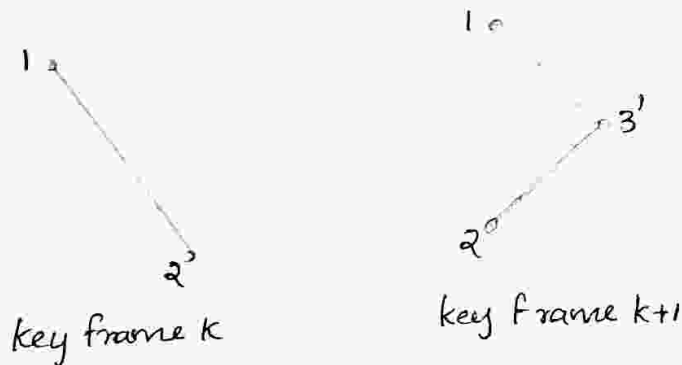
- * Keyframe systems are specialized animation languages designed to generate the in-betweens from the user specified key-frames. Each object in the scene is defined as a set of rigid bodies connected at the joints and with a limited number of degrees of freedom.
- * Parameterized systems allow object motion characteristics to be specified as part of the object definitions. The adjustable parameters control such object characteristics as degree of freedom, motion-limitations & allowable shape changes.
- * Scripting systems allow object specification & animation sequences to be defined with a user input script.

Keyframe Systems

- * Motion parts can be:-
 - ① Kinetic description - spline curves
(Kinematic description)
 - ② Physically based - specifying the forces acting on the object to be animated.
- * For complex scenes, separate the frames into individual components called cels (celluloid transparency).
- * With complex object transformation the shapes of the object may change over time.
- * If all surfaces are described with polygon meshes, then the number of edges per polygon can change from one frame to the next. Thus the total no. of line segments can be different in different frames.

Morphing

- Transformation of object shapes from one form to another is called morphing.
- Morphing methods can be applied to any motion or transition involving a change in shape.
- Given two keyframes for an object transformation, adjust the object specification in one of the frames so that the no. of polygon edges is same for 2 frames.
- A straight line segment k is transformed into two line segments in key frame $k+1$



An edge with vertex positions 1 and 2 in key frame k evolves into two connected edges in key frame $k+1$

Edge parameters,

- No. of line segments
$$L_{\max} = \max(L_k, L_{k+1}) \quad L_{\min} = \min(L_k, L_{k+1})$$

- No. of edges, $N_e = L_{\max} \bmod L_{\min}$
- No. of sections, $N_s = \text{int} \left(\frac{L_{\max}}{L_{\min}} \right)$

Motion Specifications

There are several ways in which the motions of an object can be specified in an animation system.

- ① Direct motion specification
- ② Goal directed system
- ③ Kinematics & Dynamics

Direct motion specification

- The straightforward method for defining a motion sequence is direct specification of the motion parameters.
- Explicitly gives the rotation angles and translation vectors.
- When the geometric transformation matrices are applied to transform coordinate position.
- The path of bouncing ball can be represented by using sine curve.

$$y(x) = A |\sin(\omega x + \sigma_0)| e^{-kx}$$

- where 'A' is the initial amplitude, ω is the angular frequency, σ_0 is the phase angle, k is the damping constant.

Goal directed System (specify actions also)

- Specify the motions that are to take place in general terms that abstractly describe the actions. This systems are referred to as goal directed because they determine specific motion parameters

given the goals of the animation.

Kinematics & Dynamics

- * With a kinematics description, specify the animation by giving motion parameter (position, velocity and acceleration) without reference to the forces that cause the motion. For constant velocity (zero acceleration) designate the motion of rigid body in a scene by giving an initial position & velocity vector for each object.
- * An alternative approach is to use inverse kinematics in inverse kinematics, specify the initial & final position of an object and specify time & ~~the animation~~ and the motion parameters are computed by the system.
- * The system then determines the motion parameters of other nodes to accomplish the desired motion.
- * Dynamic description requires specification of forces that produce the velocities and acceleration. Descriptions of object behaviour under the influence of forces are generally referred as physical based modelling.