

# CCS333-AUGMENTED REALITY/VIRTUAL REALITY

## 2.3) KINEMATICS MODELING:

Kinematics modeling deals with the study of motion in the absence of forces or torques. It is concerned with the geometry and motion characteristics of objects without considering the causes of motion. In computer graphics and animation, kinematics is applied to model the movement of objects and characters. Key concepts include:

### 1. JOINT HIERARCHIES:

- Objects can be connected through joint hierarchies, where the motion of one object affects its connected objects. This is commonly used in character animation.

### 2. FORWARD KINEMATICS (FK):

- FK involves determining the position and orientation of an end-effector (e.g., a hand) based on the rotations of connected joints.

### 3. INVERSE KINEMATICS (IK):

- IK is used to calculate the joint rotations needed to place an end-effector at a specific position and orientation. It is often employed for animating characters' limbs.

### 4. CONSTRAINTS:

- Constraints are applied to limit the range of motion or maintain specific relationships between objects, contributing to more realistic animations.

### 5. KEYFRAME ANIMATION:

- Keyframe animation involves specifying significant poses or frames, and the computer interpolates between them to create smooth motion.

### 6. SKELETAL ANIMATION:

- Skeletal animation involves attaching a character's mesh to a skeleton, and the motion is defined by the movement of the skeleton's joints.

### 7. MOTION CAPTURE (MOCAP):

- MoCap involves capturing real-world movements and applying them to virtual characters, providing realistic and natural animations.

## 8. PHYSICS-BASED ANIMATION:

- Physics-based animation integrates principles of physics to simulate realistic motion, including effects like gravity, collisions, and dynamics.

