Keyframe Animation

These icons refer to explanatory videos on the class web site

anim2.mp4

Forward Kinematics: Transformation Hierarchies

Determine Object Locations?

Ground
Inverse Kinematics (IK): Things Need to Move to a Particular Location – What Parameters Will Make Them Do That?

Of course, there will always be target locations that can never be reached. Think about that spot in the middle of your back that you can never scratch! 😊

Forward Kinematics solves the problem “if I know the link transformation parameters, where are the links?”. Inverse Kinematics (IK) solves the problem “if I know where I want the end of the chain to be (X*, Y*), what transformation parameters will put it there?”

Particle Systems: A Cross Between Modeling and Animation?

The basic process is:

- Emit
- Random Number Generator
- Display
- Update
Particle Systems Examples

A Particle System to Simulate Colliding Galaxies in *Cosmic Voyage*
Particles Don’t Actually Have to Be “Particles”

Newton’s first law:
force = mass * acceleration
or
acceleration = force / mass

D-D₀

D₀ = unloaded spring length

\[(D - D₀) = \frac{F}{k}\]

k = spring stiffness in Newtons/meter or pounds/inch

Or, if you know the displacement, the force exerted by the spring is:

\[F = k(D - D₀)\]

This is known as Hooke’s law

Animating using the Physics of a Mesh of Springs

“Lumped Masses”

+Y
Functional Animation:
Make the Object \textit{Want} to Move Towards a Goal Position

\begin{equation}
mx + cx + kx = 0
\end{equation}
Functional Animation:
While Making it Want to Move Away from all other Objects

\[ m\ddot{x} = \sum F_{\text{repulsive}} \]

Repulsion Coefficient
\[ F_{\text{repulsive}} = C_{\text{repulsive}} \cdot d \]
Distance between the boundaries of the 2 bodies
Repulsion Exponent

Total Goal – Make the Free Body Move Towards its Final Position
While Being Repelled by the Other Bodies

\[ m\ddot{x} + c\dot{x} + kx = \sum F \]

Increasing the Stiffness
Stiffness = 3
Stiffness = 6
Stiffness = 9

Increasing the Repulsion Coefficient
Repulse = 10
Repulse = 30
**Computer Graphics**

**Functional Animation**

Avoid.mp4

**Motion Capture as an Input for Animation**

Motion Capture is for Faces Too

Tron I –

Probably should have used physics, but didn’t
Card Trick

Pixar Animated Shorts