

## Inverse Kinematics

Prometheus explains inverse kinematics and how to apply them using LR3D



Before explaining Inverse Kinematics let's see what FORWARD KINEMATICS is.

Objects can be linked to each other forming hierarchies, link structures like a skeletal structure(bones).

Root objects are usually called 'parents' and linked objects 'children'. So I'll use this kind of naming.

A parent object can have as many children as you like but the opposite is not true.

In LR3D you can link an object to a parent object like so:

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Select the 'child' object(can select more than one if you like).

Press the Link toolbar button. Now click the parent object or select it from the SceneList.

That was it. Now, when you move, rotate, scale the parent object the children will be transformed accordingly.

That's Forward Kinematics: Parent objects controlling children.

## INVERSE KINEMATICS

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Just the opposite. Child controlling all objects up to the root bone.

I won't explain the details here. All I want is to introduce this concept to you.

i.e

Say we have three bone objects(upper arm, forearm, hand) linked forming an arm.

Bending/rotating the arm to pose it would be a three rotations operation.

First the upper arm then forearm and last the hand(Forward Kinematics).

This is the standard procedure but there are times when this can become a very difficult task.

What if you have to bend the arm so that it reaches for some thing, a 'target' object?

Using Inverse Kinematics you just select the hand bone(last in the hierarchy) and move it to the 'target' object.

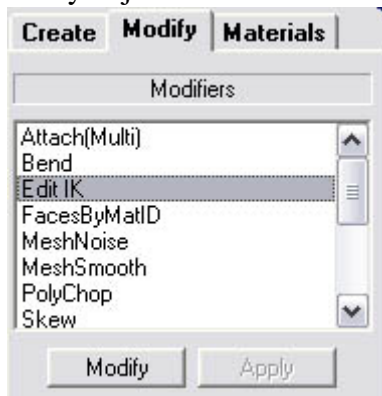
Parent bones will be rotated accordingly saving you from extra work.

There are many ways to implement IK. LR3D uses a CCD(Cyclic Coordinate Descent) algorithm.

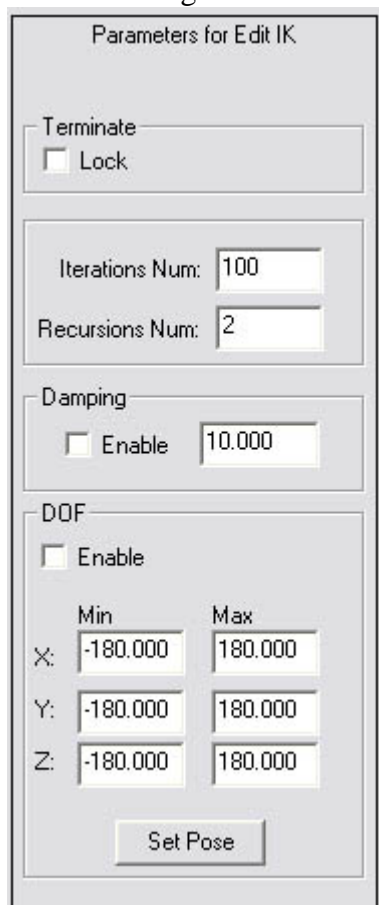
All you have to do is select the last object in the hierarchy(or any other child) and move it.

## EDITING IK

Every object's IK data can be edited using the Edit IK modifier.



### Edit IK Dialog



(\*Angles in degrees)

Terminate: Recursion stops to this object.

Iterations Num: Number of algorithm iterations.

Recursions Num: How many parent objects up the hierarchy.

Damping: Rotation damp angle.

DOF(Degrees Of Freedom): Restrict the XYZ axes angles an object can be rotated.

Set Pose: If the object is already rotated store its orientation angles else DOF will not work correctly.

\*IK will work for Numerical Position dialog, Align dialog, manual positioning(move tool).Must have the IK toolbar button pressed first.

Prometheus