

Overview of Rigging

Overview of Rigging – Quick?Reference Notes

1. What Is Rigging?

Aspect	Description
Definition	The process of creating a skeletal structure (bones, joints, controls) that drives the deformation of a 3D model for animation.
Purpose	Enables animators to pose characters, objects, or mechanical parts efficiently and realistically.
Typical Pipeline Position	Comes after modeling and UV/texturing, before animation and rendering.

2. Core Concepts & Terminology

Term	Meaning
Bone / Joint	Hierarchical elements that define rotation/translation axes; bones are visualized as lines, joints as pivot points.
Skeleton	Complete hierarchy of bones that mimics the anatomy or mechanical layout of the asset.
Control (Ctrl)	User?friendly objects (curves, shapes, nulls) that drive one or more bones; they hide the underlying hierarchy from the animator.
Constraint	A rule that forces one object to follow another (e.g., Parent, Point, Orient, Aim, IK, Spline).
IK (Inverse Kinematics)	Solver that calculates joint rotations from an end?effector's position, useful for limbs and chains.
FK (Forward Kinematics)	Direct rotation of each joint; gives precise control over each segment.
Blend / Switch	Mechanism to interpolate between FK and IK or between different pose sets.
Skinning / Weight Painting	Binding mesh vertices to bones and assigning influence weights (how much each bone moves a vertex).

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Deformer	Any modifier that alters geometry based on rig data (e.g., BlendShape , Lattice , Cluster).
Driver / Expression	Mathematical link that drives an attribute based on another attribute's value.
Rigging Layer	Logical grouping (e.g., Skeleton , Controls , Deformers) to keep the scene organized.

3. Rigging Workflow – Step?by?Step

1. Preparation

- Clean topology: quads, uniform edge flow, proper edge loops.
- Establish naming conventions (e.g., `joint_spine_01`, `ctrl_arm_L`).
- Freeze transforms and reset pivots.

2. Skeleton Creation

- Place joints according to anatomy or mechanical design.
- Set correct joint orientations (XYZ or ZXY) to avoid gimbal lock.
- Build hierarchy (parent?child relationships).

3. Control System

- Add **control curves** or **nulls** for each major region (spine, head, limbs, fingers).
- Group controls with offset groups to preserve zeroed transformations.
- Add custom attributes (e.g., `FK_IK_Switch`, `FootRoll`) on master control.

4. Constraints & Solvers

- Apply **parent/point/orient constraints** to connect controls to joints.
- Set up **IK handles** for limbs; add pole vectors.
- Create **IK/FK blend** using reverse nodes or `blendColors`.

5. Skinning / Weight Painting

- Bind mesh to skeleton (smooth bind, rigid bind, or dual quaternion).

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- Paint vertex weights manually or use automatic tools (heat map, weight transfer).
- Test deformation: rotate joints, check for “pinching” or “stretching”.

6. Deformers & Secondary Motion

- Add **BlendShapes** for facial expressions or muscle bulges.
- Use **clusters**, **lattices**, or ****springs**