# 9.9.2 Physics - Rigid Body - Rigid Body Properties



# Rigid Body Properties

## Main properties

Rigid Body panel.

***Type***

Role of the rigid body in the simulation. Active objects can be simulated dynamically, passive object remain static.

***Active***
Object is directly controlled by simulation results. The possibility to select this type also available with *Add Active* button in the *Physics* tab of the *Tool Shelf*.

***Passive***
Object is directly controlled by animation system. Thus, this type is not available for Rigid Body Dynamics. The possibility to select this type also available with *Add Passive* button in the *Physics* tab of the *Tool Shelf*.

***Dynamic***
Enables/disables rigid body simulation for object.

***Animated***
Allows the rigid body additionally to be controlled by the animation system.

***Mass***

Specifies how heavy the object is and “weights” irrespective of gravity. There are predefined mass preset available with the *Calculate Mass* button in the *Physics* tab of the *Tool Shelf*.

***Calculate Mass***

Automatically calculate mass values for Rigid Body Objects based on volume. There are many useful presets available from the menu, patching real-world objects.

Also you can have *Custom* mass material type, which is achieved by setting a custom density value ($kg/m^3$).

## Rigid Body Collisions

Rigid Body Collisions panel.

## General settings

***Surface Response***

***Friction***

Resistence of object to movement. Specifies how much velocity is lost when objects collide with each other.

***Bounciness***

Tendency of object to bounce after colliding with another (“0” - stays still, “1” - perfectly elastic). Specifies how much objects can bounce after collisions.

***Collision Groups***

Allows rigid body collisions allocate on different groups (maximum 20).

## Collision shapes

The *Shape* option determines the collision shape of the object. The following Collision Shapes are available:

- **Primitive shapes** : these are best in terms of memory/performance but don’t necessarily reflect the actual shape of the object. They’re calculated based on the object’s bounding box. The center of gravity is always in the middle for now.
    - ***Box***

      Box-like shapes (i.e. cubes), including planes (i.e. ground planes). The size per axis is calculated from the bounding box.
    - ***Sphere***

      Sphere-like shapes. The radius is the largest axis of the bounding box.
    - ***Capsule***

      This points up the Z-Axis.
    - ***Cylinder***

      This points up the Z-Axis. The height is taken from the z-axis, while the radius is the larger of the x/y-axes.
    - ***Cone***

      This points up the Z-Axis. The height is taken from the z-axis, while the radius is the larger of the x/y-axes.
- **Mesh based shapes** : these are calculated based on the geometry of the object so they are a better representation of the object. The center of gravity for these shapes is the object origin.
    - ***Convex Hull***

      A mesh-like surface encompassing (i.e. shrinkwrap over) all vertices (best results with fewer vertices). Convex approximation of the object, has good performance and stability.

- ***Mesh***

  Mesh consisting of triangles only, allowing for more detailed interactions than convex hulls. Allows to simulate concave objects, but is rather slow and unstable.

The changing collision shape is available also with *Change Shape* button in the *Physics* tab of the *Tool Shelf*.

### Mesh source

Users can now specify the mesh *Source* for *Mesh* bases collision shapes:

***Base***
: The base mesh of the object.

***Deform***
: Includes any deformations added to the mesh (shape keys, deform modifiers).

***Deforming***
: Rigid body deforms during simulation.

***Final***
: Includes all modifiers.

### Collision Margin

***Margin***
: Threshold of distance near surface where collisions are still considered (best results when non-zero).

The collision margin is used to improve performance and stability of rigid bodies. Depending on the shape, it behaves differently: some shapes embed it, while others have a visible gap around them.

The margin is *embedded* for these shapes:

- Sphere
- Box
- Capsule
- Cylinder
- Convex Hull: Only allows for uniform scale when embedded.

The margin is *not embedded* for these shapes:

- Cone
- Active Triangle Mesh
- Passive Triangle Mesh: Can be set to 0 most of the time.

## Rigid Body Dynamics

Rigid Body Dynamics panel.

This panel is available only for *Active* type of rigid bodies.

***Deactivation*:**

***Enable Deactivation***
: Enable deactivation of resting rigid bodies. Allows object to be deactivated during the simulation (improves performance and stability, but can cause glitches).

***Start Deactivated***
: Starts objects deactivated. They are activated on collision with other objects.

***Linear Vel***
: Specifies the linear deactivation velocity below which the rigid body is deactivated and simulation stops simulating object.

***Angular Vel***
: Specifies the angular deactivation velocity below which the rigid body is deactivated and simulation stops simulating object.

***Damping*:**

***Translation***
: Amount of linear velocity that is lost over time.

***Rotation***
: Amount of angular velocity that is lost over time.