Physics Effects Tools User's Guide

PlayStation®Vita Programmer Tool Runtime Library Release 3.50

Document serial number: 000004892117

Document serial number: 000004892117

Table of Contents

1 Plug-in Overview

Purpose and Characteristics

JFtPhysicsEffectsTools are the 3ds Max and Maya plug-ins that output JFtPfx files (in XML format) for Physics Effects, a physics simulation library that reproduces a behavior of a rigid body.

Main Functions

The main functions offered by JFtPhysicsEffectsTools plug-in are as follows:

- Function to create physics attributes used by the Physics Effects library and to assign the attributes to an object
- Function to output JFtPfx files (in XML format) used by the Physics Effects library

Operating Environment

- CPU : 1 GHz or above
- VGA : OpenGL supported
- Screen resolution: 1024 x 768 or above

Reference Materials

For details on the parameters, refer to the following documents.

- "Physics Effects Overview", "Physics Effects Reference"

2 Usage Methods of 3ds Max Version

Available Versions of 3ds Max

- Autodesk 3ds Max 2011 (64-bit version)
- Autodesk 3ds Max 2012 (64-bit version)

Setup of 3ds Max Plug-in

First of all, under an arbitrary folder, prepare the following 3ds Max plug-in files of the version you use.

- JFtPfxHelpers.dlo
- JFtPfxTools.dlu
- JFtPfxXMLExporter.dle

Next, start 3ds Max and then specify the folder under which the plug-in files are placed by selecting **Customize -> Configure System Paths… -> 3rd Party Plug-Ins -> Add…** from the menu bar. Lastly, restart 3ds Max.

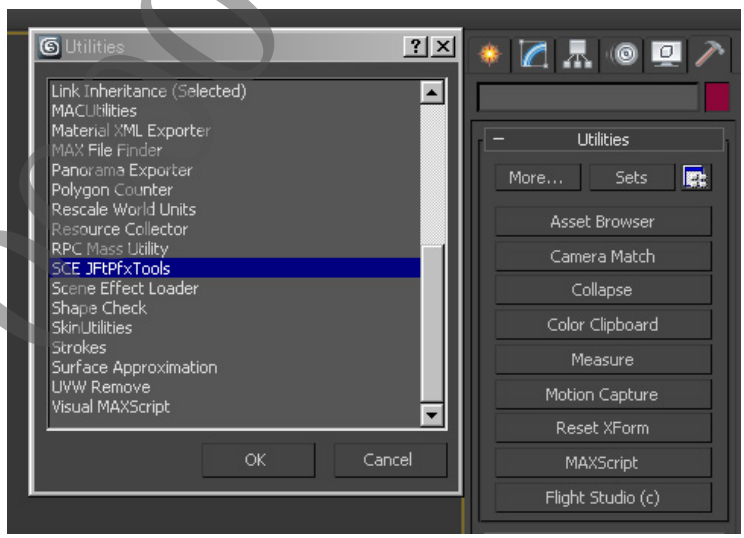
Basic Processing Procedure

This section explains the basic procedure for JFtPhysicsEffectsTools plug-in.

(1) Start "JFtPfxTools"
(2) Create RigidBody/RigidShape and Assign the Attributes to an Object
(3) Create RigidJoint
(4) Create WorldInfo
(5) Output JFtPfx file

(1) Start "JFtPfxTools"

Select "SCE JFtPfxTools" from **Utilities -> More…** of the command panel of 3ds Max and start the UI of the plug-in.



(2) Create RigidBody/RigidShape and Assign the Attributes to an Object

To create RigidBody and RigidShape, input an arbitrary name in the **Name** box under the **Create** category of the UI and then click the **Create RigidBody/Shape** button in the state in which an object is selected. If **Yes** under the **Assign to object** category is selected, the created RigidBody and RigidShape will be assigned to the selected object. If **No** is selected, the attributes will not be assigned and they will be created at the center of the selected object.

Figure 1 Before Assigning RigidBody/RigidShape to Box

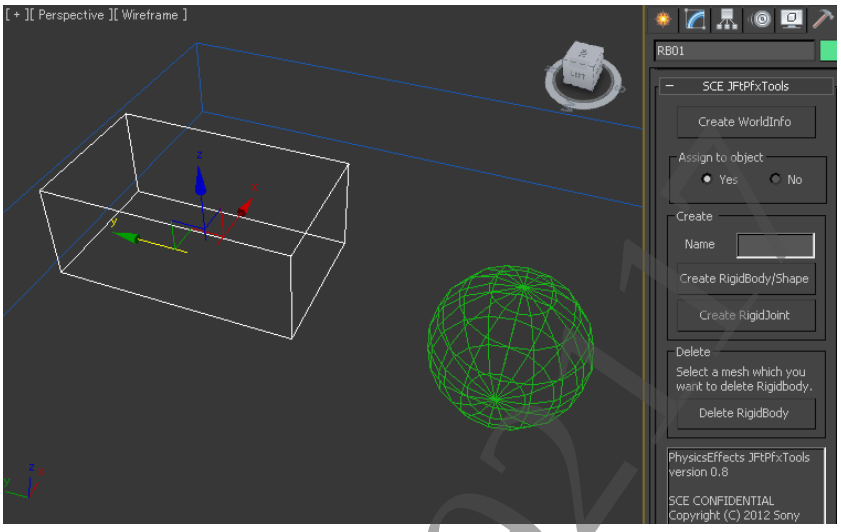


Figure 2 After Assigning RigidBody/RigidShape to Box

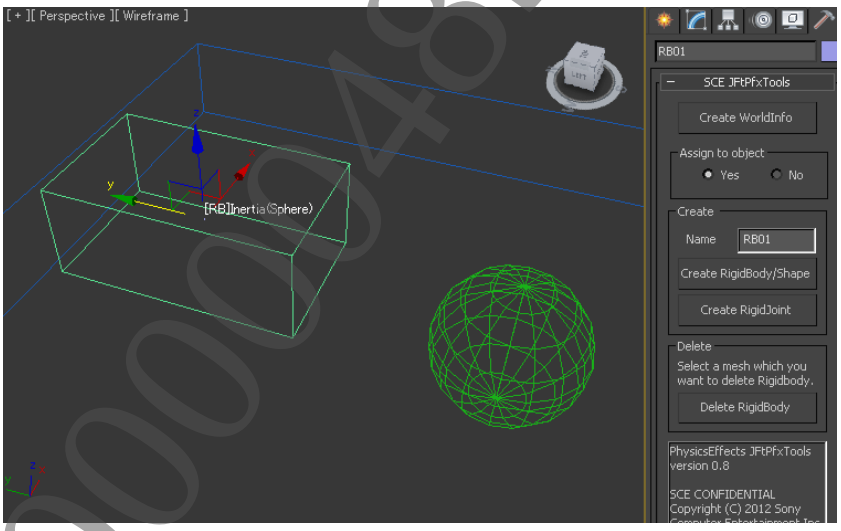
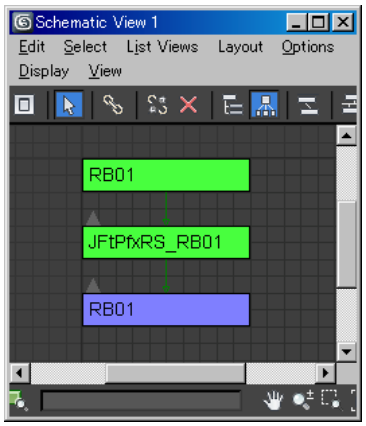


Figure 2 shows the state where RigidBody and RigidShape are assigned to the Box positioned in the center.

Rigid Body sets the mass, friction coefficient, inertia tensor or other settings.

Rigid Shape mainly sets the collision shape. When any one of **Sphere**, **Box**, **Cylinder** or **Capsule** is specified in **ObjectType**, its basic shape is output. In the case that **ConvexMesh** or **LargeMesh** is specified, the actual geometry information is output.

Figure 3 Schematic View After RigidBody/RigidShape Is Assigned to Box



(3) Create RigidJoint

To create a joint used in the physics simulation, select two RigidBodies (select the parent first and then the child) and click the **Create RigidJoint** button.

Figure 4 After Selecting Box and Sphere of RigidBody

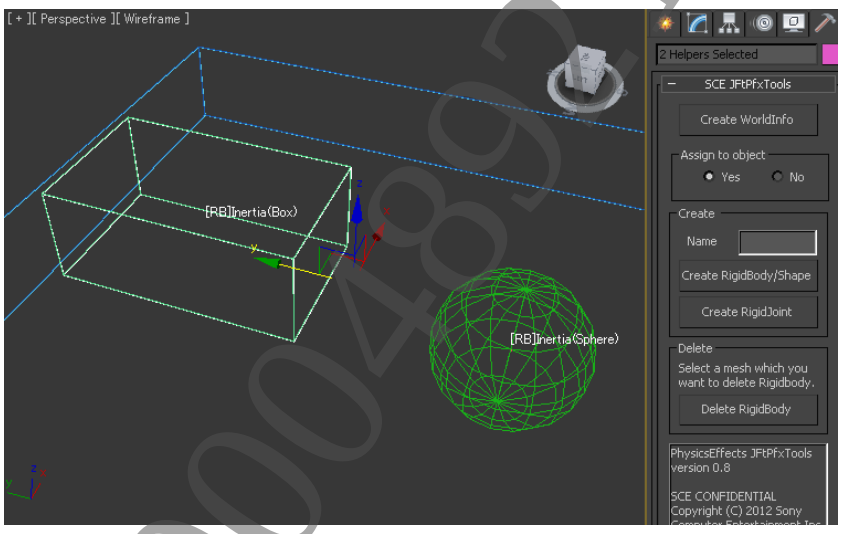


Figure 5 After Creating RigidJoint between Box and Sphere

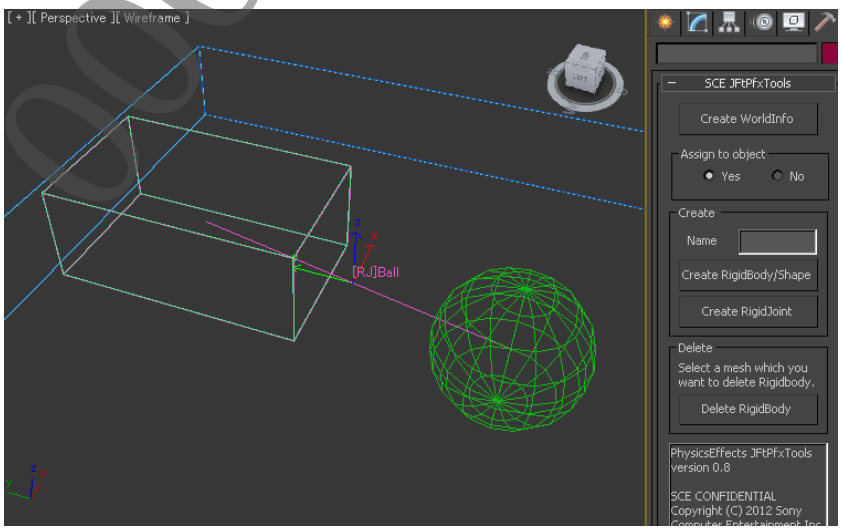


Figure 5 shows the state where RigidJoint has been created for the selected parent and child RigidBodies.

The joint types (**Ball**, **Fix**, **Hinge**, **Slider**, **SwingTwist**, and **Universal**) can be selected from the **JointType** attribute of Rigid Joint.

(4) Create WorldInfo

World Info is used for specifying the calculation range of the physics simulation. Note that WorldInfo must be created before outputting the JFtPfx files. By selecting the objects you want to use in the physics simulation and clicking the **Create WorldInfo** button, WorldInfo having sufficient size to include all the selected objects can be created.

Figure 6 Before Creating WorldInfo

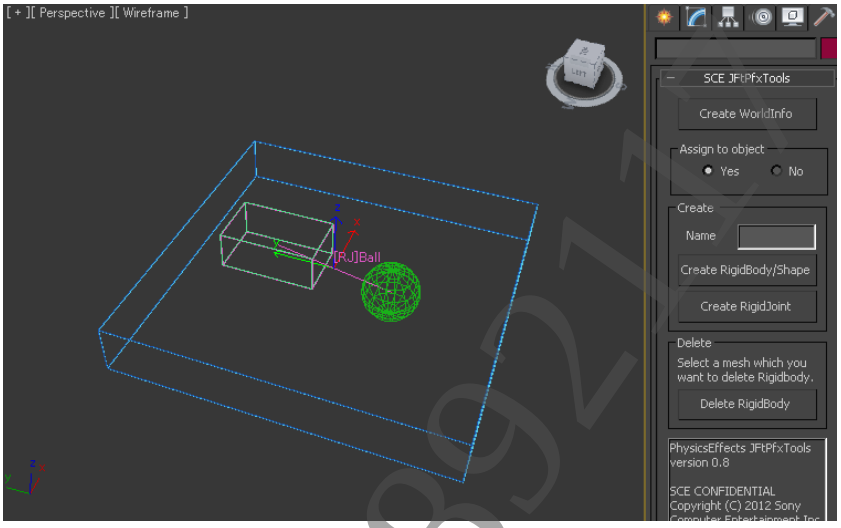
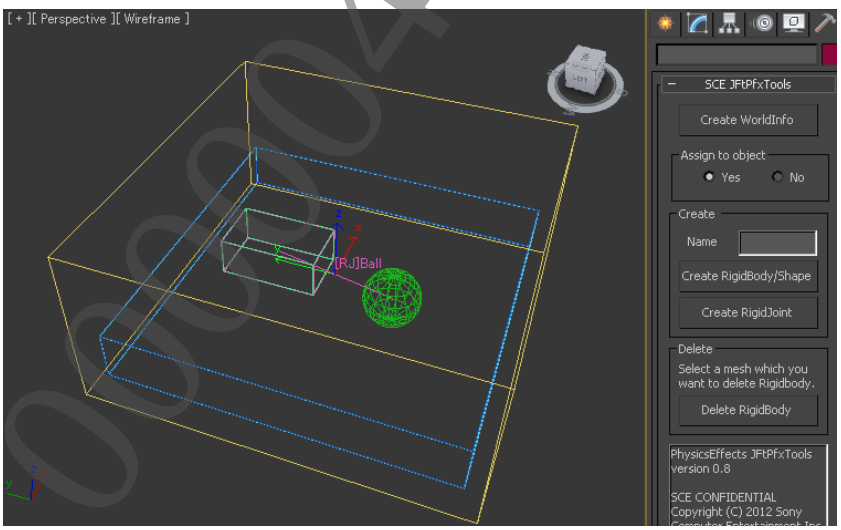


Figure 7 After Creating WorldInfo



(5) Output JFtPfx file

To output the JFtPfx files (in XML format), select **Export** from the 3ds Max menu after setting RigidBody and other attributes, and then select **File Types -> JFtPfx(*.XML)** to save the files. Note that WorldInfo must be created before outputting the JFtPfx files.

The value of each attribute is output after being converted from the coordinate system of 3ds Max to that of JFtPfx files (i.e. from Z-Up to Y-Up).

Other Processing

Delete RigidBody, RigidShape, and RigidJoint

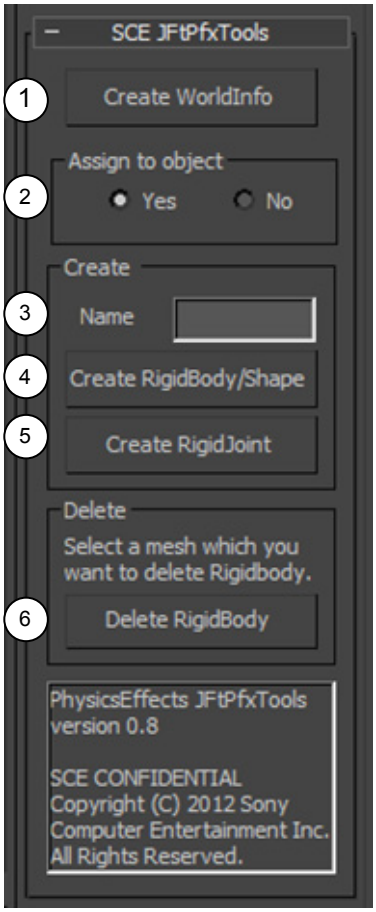
By selecting the target object and then clicking the **Delete RigidBody** button of the UI, RigidBody, RigidShape and RigidJoint assigned to the object can be deleted.

Create Compound Shape

At the time of RigidBody creation, it is possible to create a compound shape by selecting multiple objects and then clicking the **Create RigidBody/Shape** button. Using the compound shape enables the multiple objects to be simulated as a single RigidBody.

3 Explanation of 3ds Max Version UI and Usage Methods

SCE JFtPfxTools



1 Create WorldInfo
- Creates WorldInfo
By clicking the button in the state in which objects are selected, WorldInfo having sufficient size to include all the selected objects is created.

2 Assign to object
- Specifies whether to assign RigidBody and RigidShape to the object when creating the attributes
If **Yes** is selected, the attributes are created and assigned to the object. On the other hand, if **No** is selected, the attributes are created with no assignment.

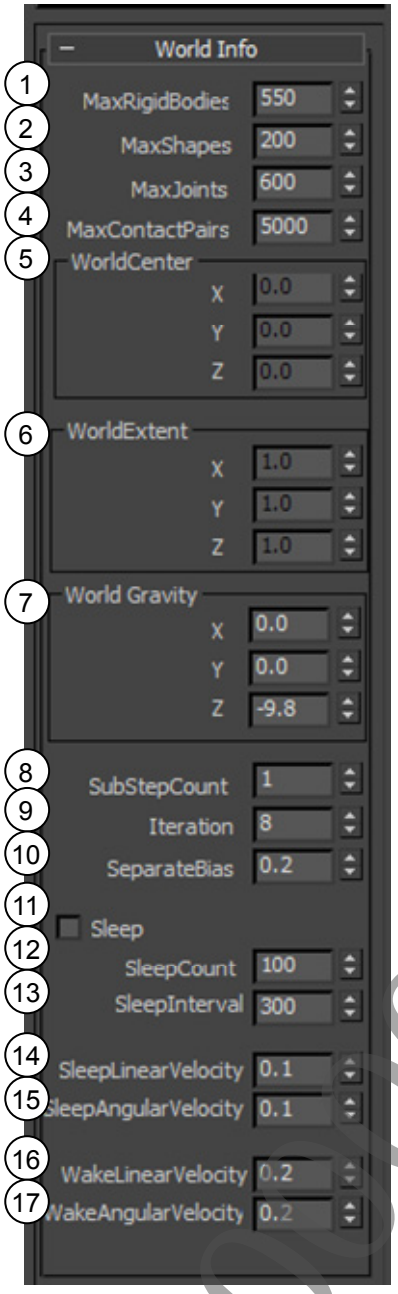
3 Name
- Specifies the name of RigidBody/RigidShape or RigidJoint at the time of the creation
The name for each attribute can be specified.

4 Create RigidBody/Shape
- Creates RigidBody/RigidShape
By clicking the button in the state in which an object is selected, RigidBody and RigidShape are created in the center of the selected object.

5 Create RigidJoint
- Creates RigidJoint
By clicking the button in the state in which two RigidBodies are selected (select the parent first and then the child), RigidJoint is created between the selected RigidBodies.

6 Delete RigidBody
-Deletes RigidBody/RigidShape
By clicking the button in the state in which an object with RigidBody assigned is selected, RigidBody and RigidShape are deleted. In addition, if RigidJoint is assigned to the selected object, the attribute is also deleted.

World Info



1 **MaxRigidBody**
Maximum number of rigid bodies

2 **MaxShapes**
Maximum number of shapes

3 **MaxJoints**
Maximum number of joints

4 **MaxContactPairs**
Maximum number of contacts

5 **WorldCenter**
Center position of WorldInfo

6 **WorldExtent**
Size of WorldInfo

7 **World Gravity**
Amount of gravity

8 **SubStepCount**
Number of substeps

9 **Iteration**
Number of iterations for the solver calculation

10 **SeparateBias**
Bias value used for preventing penetration when a collision occurs

11 **Sleep**
ON/OFF of the sleep function

12 **SleepCount**
Count of the sleep function

13 **SleepInterval**
Interval of sleep checks

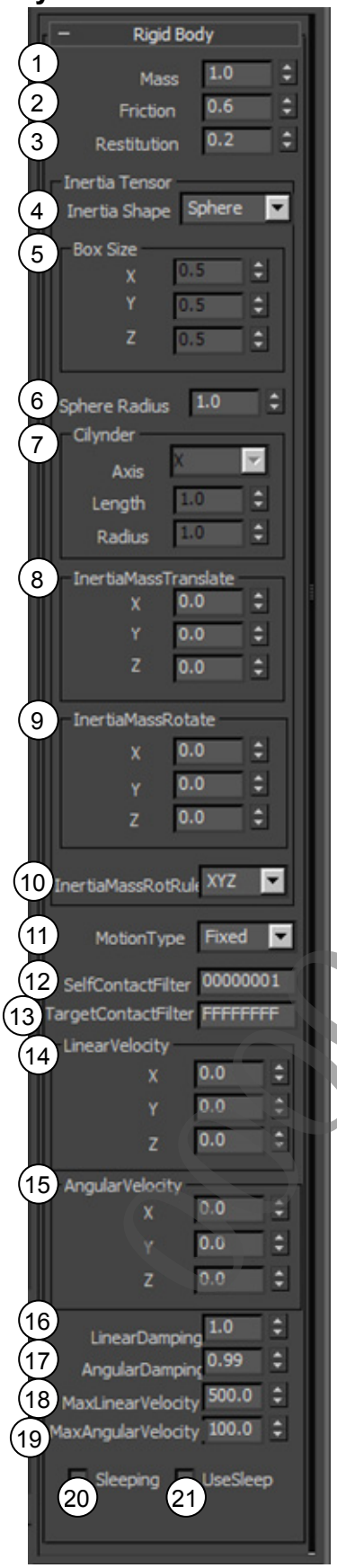
14 **SleepLinearVelocity**
The linear velocity to enter sleep

15 **SleepAngularVelocity**
The angular velocity to enter sleep

16 **WakeLinearVelocity**
The linear velocity to wake from sleep

17 **WakeAngularVelocity**
The angular velocity to wake from sleep

Rigid Body



1 Mass
Mass

2 Friction
The friction coefficient

3 Restitution
The restitution coefficient

4 Inertia Shape
Type of inertia tensor shape

5 Box Size
Size of inertia tensor box

6 Sphere Radius
Radius of inertia tensor sphere

7 Cylinder
Length, radius and axis of inertia tensor cylinder

8 InertiaMassTranslate
Parallel translation of the inertia tensor

9 InertiaMassRotate
Rotation of the inertia tensor

10 InertiaMassRotRule
Rotation order of the inertia tensor

11 MotionType
Type of motion

12 SelfContactFilter
Contact filter of the rigid body itself

13 TargetContactFilter
Contact filter of collision target

14 LinearVelocity
The linear velocity

15 AngularVelocity
The angular velocity

16 LinearDamping
The linear damping

17 AngularDamping
The angular damping

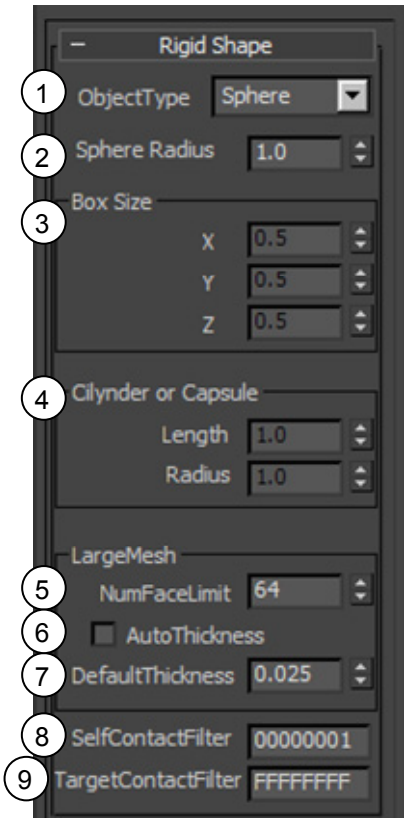
18 MaxLinearVelocity
Maximum value of the linear velocity

19 MaxAngularVelocity
Maximum value of the angular velocity

20 Sleeping
Whether the rigid body is in sleep mode

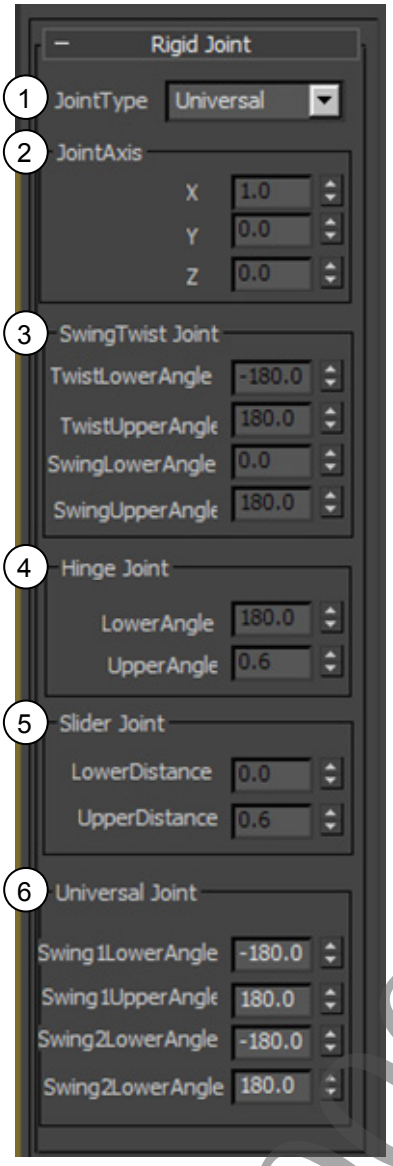
21 UseSleep
Whether or not to use the sleep function

Rigid Shape



1 **ObjectType**
Type of shape
2 **Sphere Radius**
Radius of sphere
3 **Box Size**
Size of box
4 **Cylinder or Capsule**
Length and radius of capsule and cylinder
5 **NumFaceLimit**
Maximum number of triangles that can be held in one island mesh of large mesh
6 **AutoThickness**
Automatic calculation of large mesh thickness
7 **DefaultThickness**
Thickness of large mesh
8 **SelfContactFilter**
Contact filter of the rigid body itself
9 **TargetContactFilter**
Contact filter of collision target

Rigid Joint



1 **JointType**
Type of joint
2 **JointAxis**
Settings of joint axes
3 **Swing Twist Joint**
The motion range of SwingTwist Joint
4 **Hinge Joint**
The motion range of Hinge Joint
5 **Slider Joint**
The motion range of Slider Joint
6 **Universal Joint**
The motion range of Universal Joint

4 Usage Methods of Maya Version

Available Versions of Maya

- Autodesk Maya 2011 (64-bit version)
- Autodesk Maya 2012 (64-bit version)

Setup of Maya Plug-in

First, under the search path, prepare the following Maya plug-in files of the version you use.

- JFtPfxJointNode.mll
- JFtPfxRigidBodyNode.mll
- JFtPfxRigidBodyNodeManip.mll
- JFtPfxRigidShapeNode.mll
- JFtPfxRigidShapeNodeManip.mll
- JFtPfxWorldInfoNode.mll
- JFtPfxXMLExport.mll

Also, prepare the following MEL script files under the search path of the script.

- JFtPfxTools.mel
- AETemplates\AEJFtPfxJointNodeTemplate.mel
- AETemplates\AEJFtPfxRigidBodyNodeTemplate.mel
- AETemplates\AEJFtPfxRigidShapeNodeTemplate.mel
- AETemplates\AEJFtPfxWorldInfoNodeTemplate.mel

Then start Maya and check if the above plug-in files are successfully loaded by selecting **Windows -> Setting/Preferences -> Plug-in Manager** from the menu bar.

Basic Processing Procedure

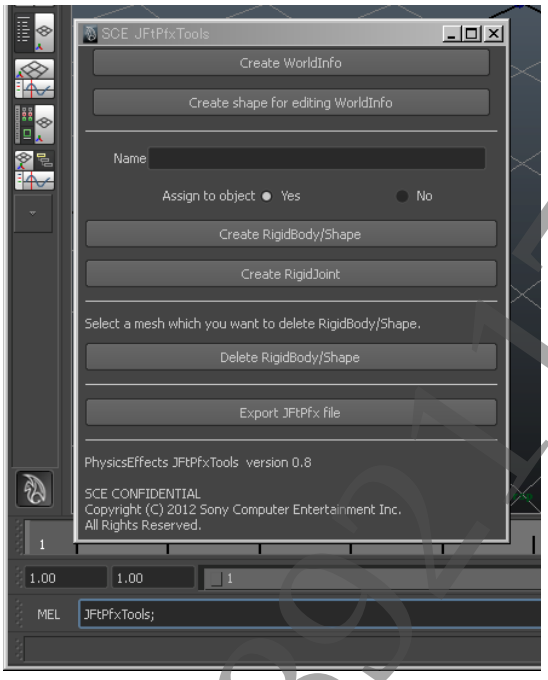
This section explains the basic procedure for JFtPhysicsEffectsTools plug-in.

(1) Start "JFtPfxTools"
(2) Create RigidBody/RigidShape and Assign the Attributes to an Object
(3) Create RigidJoint
(4) Create WorldInfo
(5) Output JFtPfx file

(1) Start "JFtPfxTools"

To start the UI of the plug-in, input the following command using the command line of the Maya main window.

```
source JFtPfxTools.mel;
JFtPfxTools;
```



(2) Create RigidBody/RigidShape and Assign the Attributes to an Object

To create RigidBody and RigidShape, input an arbitrary name in the **Name** box of the UI and then click the **Create RigidBody/Shape** button in the state in which an object is selected. If **Yes** under the **Assign to object** item is selected, the created RigidBody and RigidShape will be assigned to the selected object. If **No** is selected, the attributes will not be assigned and they will be created at the center of the selected object.

Figure 8 Before Assigning RigidBody/RigidShape to Box

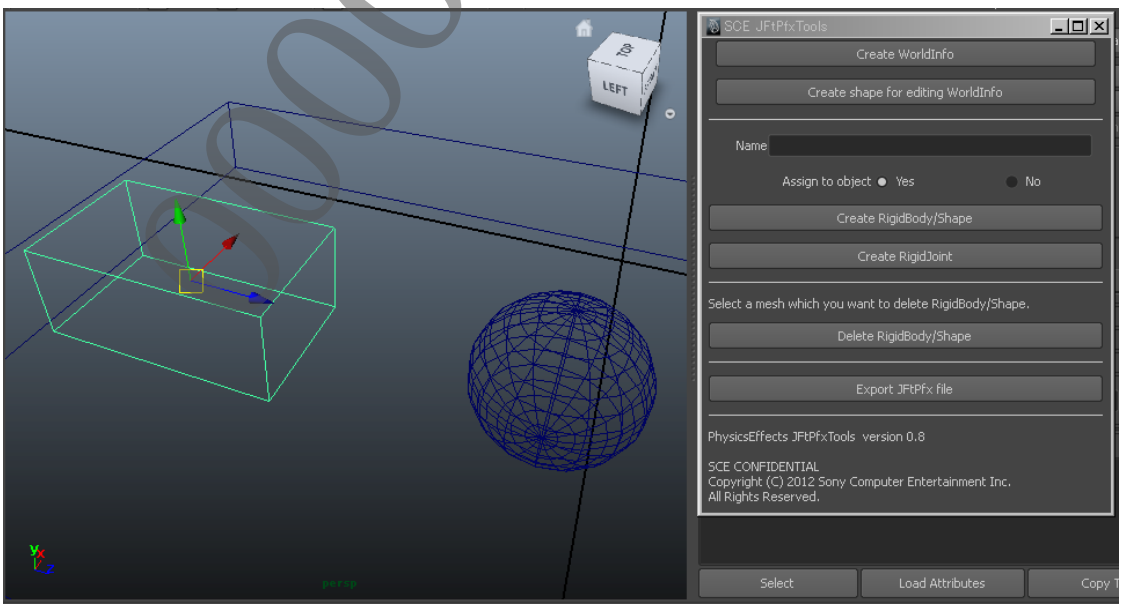


Figure 9 After Assigning RigidBody/RigidShape to Box

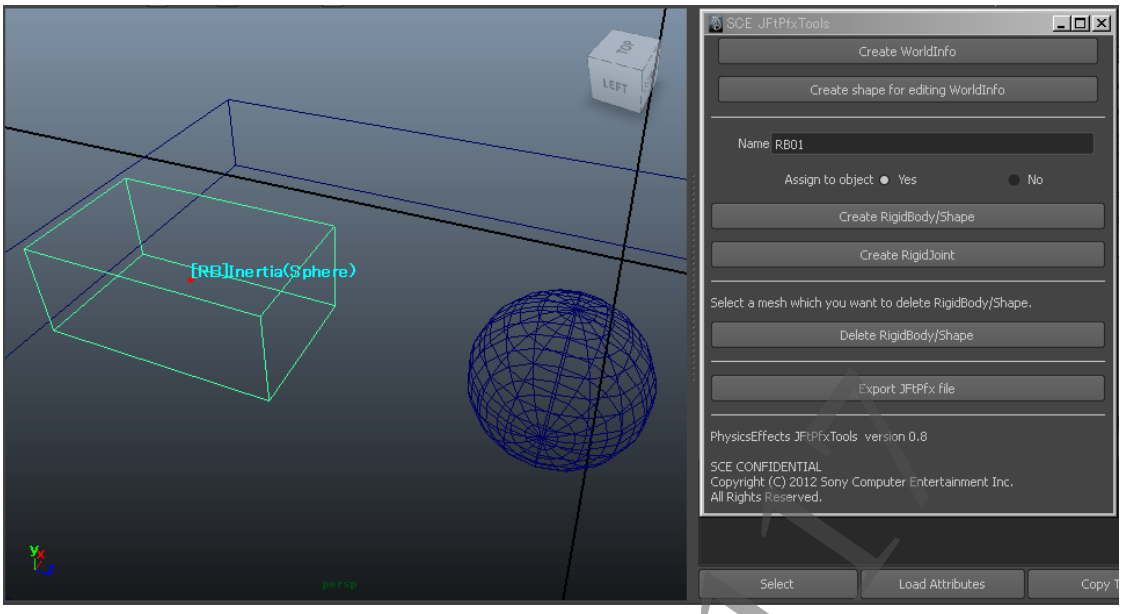


Figure 9 shows the state where RigidBody and RigidShape are assigned to the Box positioned in the center.

RigidBody sets the mass, friction coefficient, inertia tensor or other settings.

RigidShape mainly sets the collision shape. When any one of **Sphere**, **Box**, **Cylinder** or **Capsule** is specified in **ShapeType**, its basic shape is output. In the case that **ConvexMesh** or **LargeMesh** is specified, the actual geometry information is output.

Figure 10 Hypergraph Hierarchy After RigidBody/RigidShape Is Assigned to Box

(3) Create RigidJoint

To create a joint used in the physics simulation, select two RigidBodies (select the parent first and then the child) and click the **Create RigidJoint** button.

Figure 11 After Selecting Box and Sphere of RigidBody

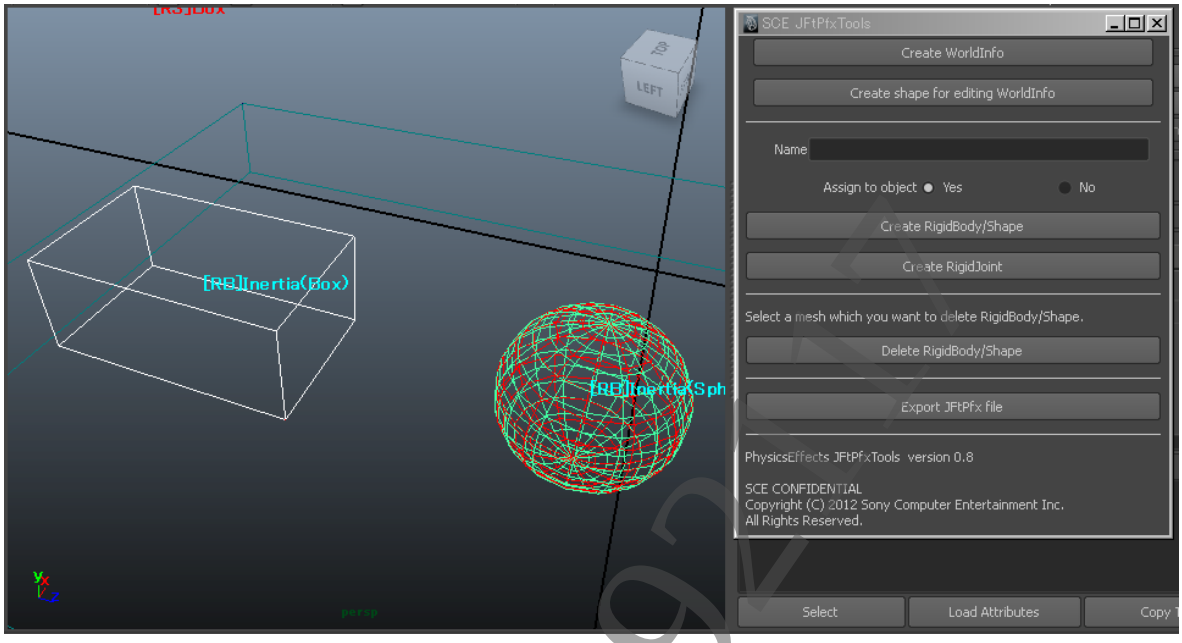


Figure 12 After Creating RigidJoint between Box and Sphere

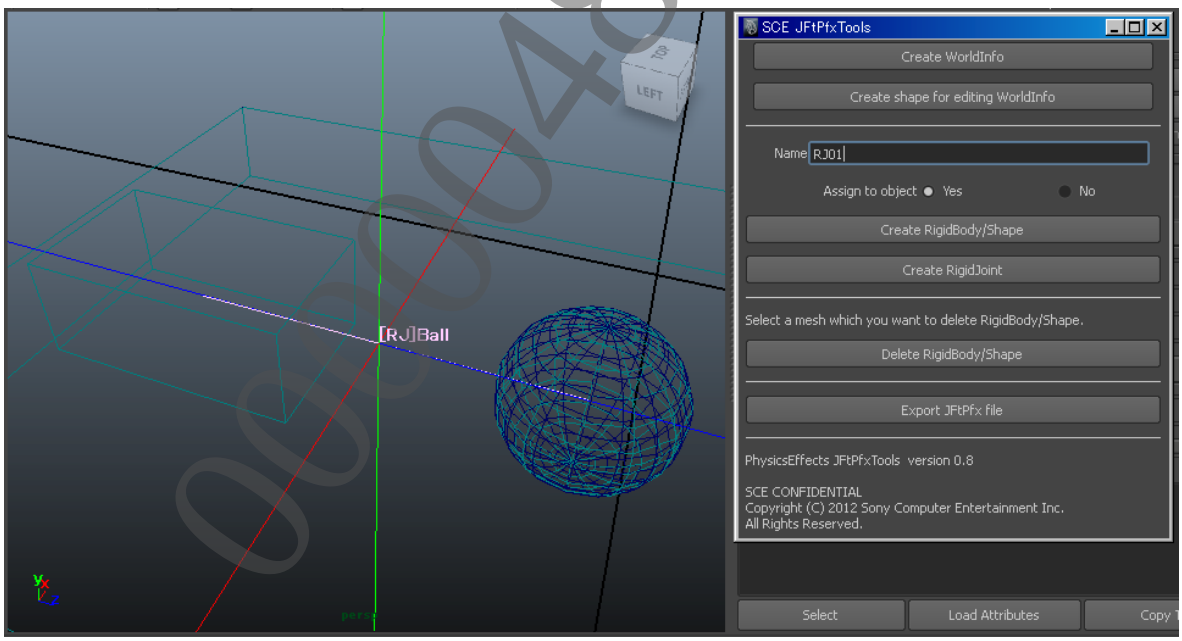


Figure 12 shows the state where RigidJoint has been created for the selected parent and child RigidBodies.

The joint types (**Ball**, **Fix**, **Hinge**, **Slider**, **SwingTwist**, and **Universal**) can be selected from the **JointType** attribute of RigidJoint.

(4) Create WorldInfo

WorldInfo is used for specifying the calculation range of the physics simulation. Note that WorldInfo must be created before outputting the JFtPfx files. By clicking the **Create WorldInfo** button first, and then the **Create shape for editing WorldInfo** button, Shape used to visually edit both Center and Extent of WorldInfo can be created.

Figure 13 Before Creating WorldInfo

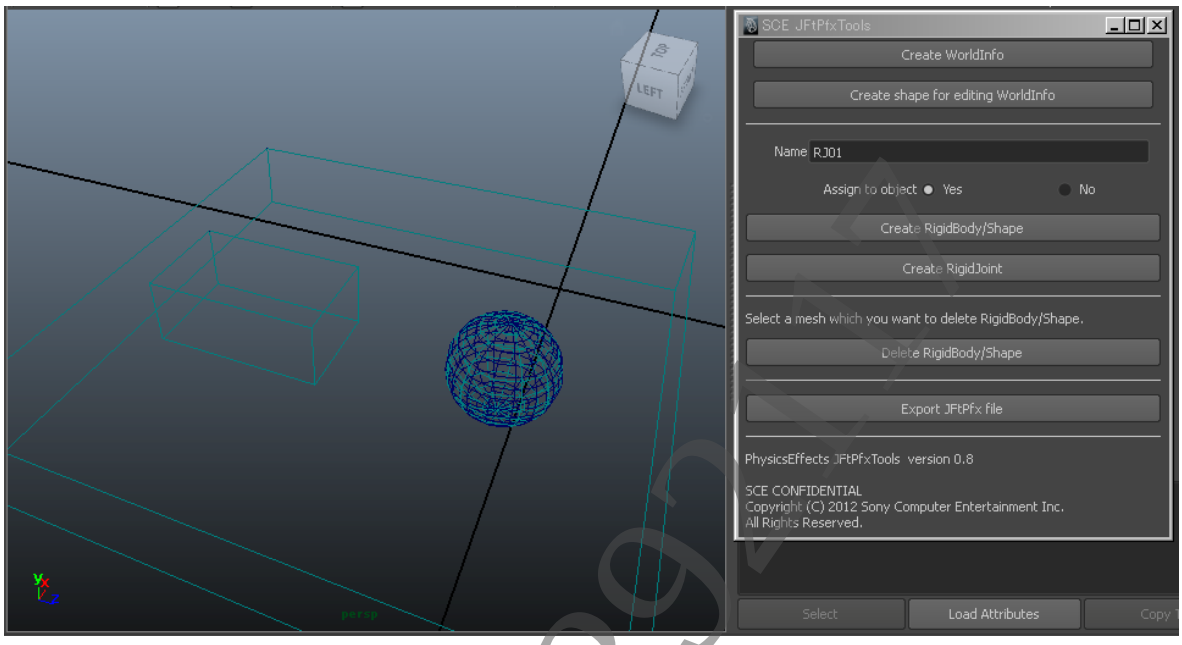
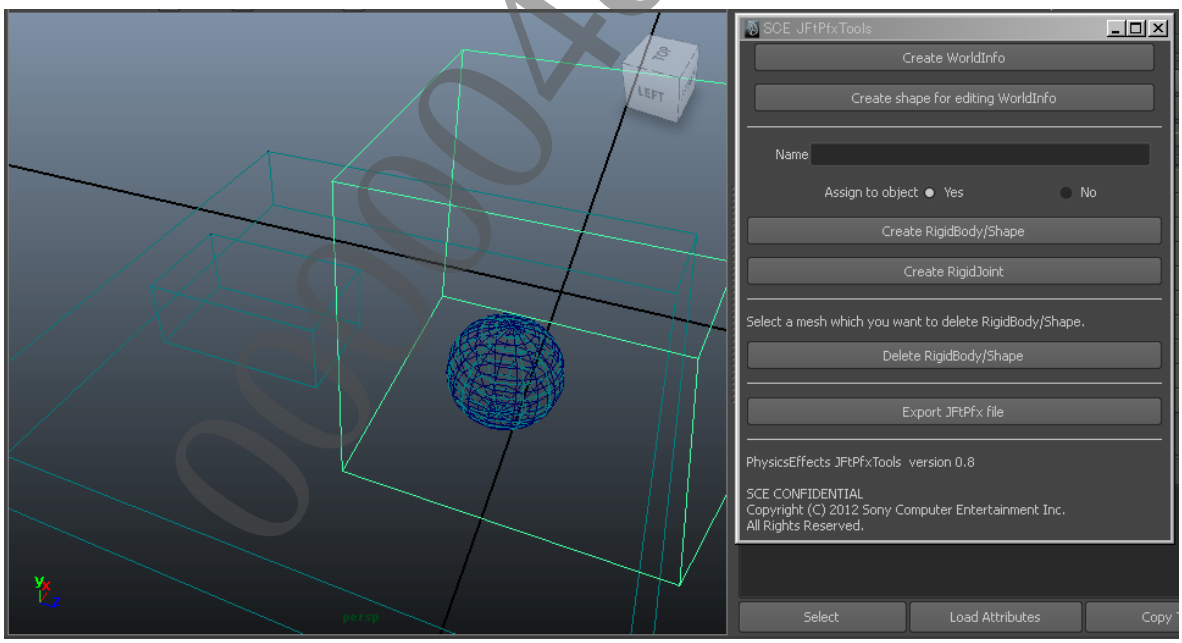


Figure 14 After Creating Shape for Editing WorldInfo



(5) Output JFtPfx file

After setting RigidBody and other attributes, press the **Export JFtPfx file** button of the **SCE JFtPfxTools** window. Next, select **Files of Types > XML** of the **Export JFtPfx file** dialog and then save the files. Note that WorldInfo must be created before outputting the JFtPfx files.

Other Processing

Delete RigidBody, RigidShape, and RigidJoint

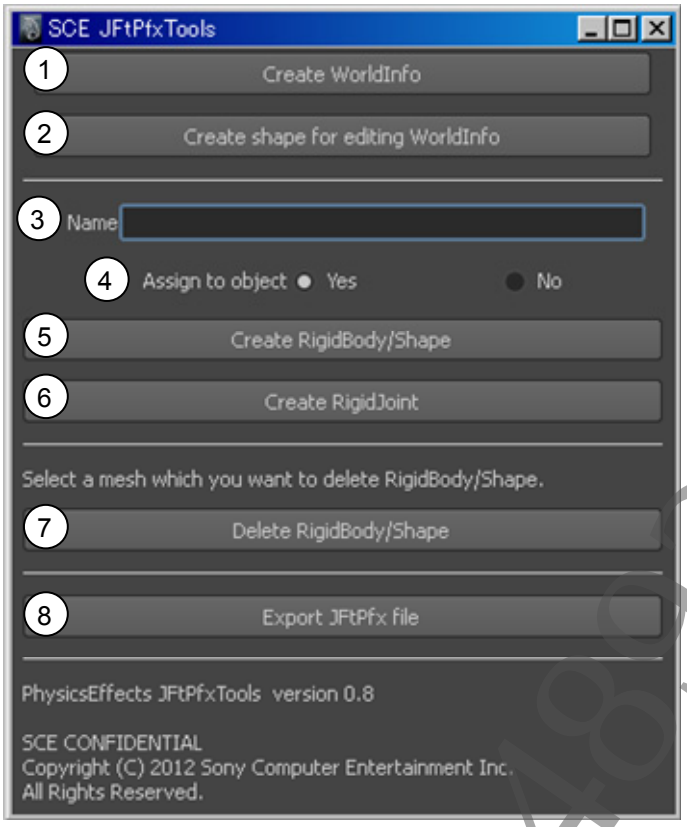
By selecting the target object and then clicking the **Delete RigidBody/Shape** button of the UI, RigidBody and RigidShape assigned to the object can be deleted. To delete RigidJoint, press the Delete key of the key board after selecting the target object.

Create Compound Shape

It is possible to create a compound shape by adding multiple RigidShape nodes to a RigidBody node with Maya's Hypergraph Hierarchy. Using the compound shape enables the multiple shapes to be simulated as a single RigidBody.

5 Explanation of Maya Version UI and Usage Methods

SCE JFtPfxTools



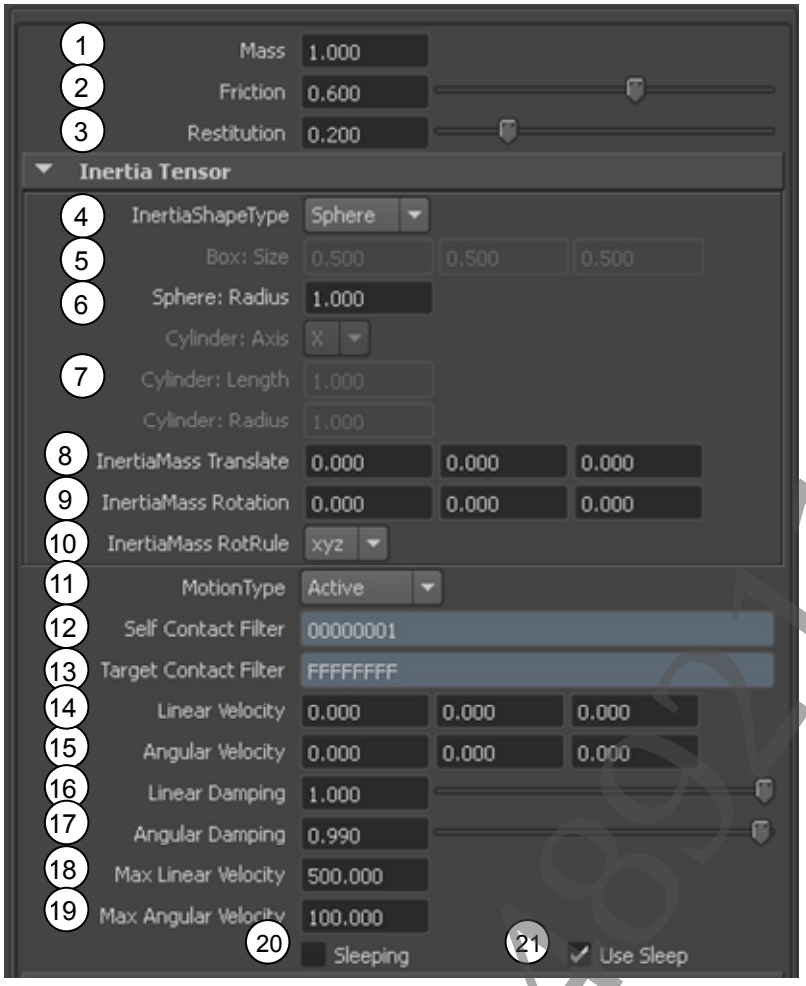
1	**Create WorldInfo**	- Creates WorldInfo By clicking the button in the state in which objects are selected, WorldInfo having sufficient size to include all the selected objects is created.
2	**Create shape for editing WorldInfo**	- Creates shape for editing WorldInfo Shape is created for editing both WorldCenter and WorldExtent of WorldInfo.
3	**Name**	- Specifies the name of RigidBody/RigidShape or RigidJoint at the time of the creation The name for each attribute can be specified.
4	**Assign to object**	- Specifies whether to assign RigidBody and RigidShape to the object when creating the attributes If **Yes** is selected, the attributes are created and assigned to the object. On the other hand, if **No** is selected, the attributes are created with no assignment.
5	**Create RigidBody/Shape**	- Creates RigidBody/RigidShape By clicking the button in the state in which an object is selected, RigidBody and RigidShape are created in the center of the selected object.
6	**Create RigidJoint**	- Creates RigidJoint By clicking the button in the state in which two RigidBodies are selected (select the parent first and then the child), RigidJoint is created between the selected RigidBodies.
7	**Delete RigidBody/Shape**	- Deletes RigidBody/RigidShape By clicking the button in the state in which an object with RigidBody assigned is selected, RigidBody and RigidShape are deleted.

8	**Export JFtPfx file**	- Outputs JFtPfx file (in XML format) After setting RigidBody and other attributes, press the **Export JFtPfx file** button to output the Export JFtPfx files.

WorldInfo

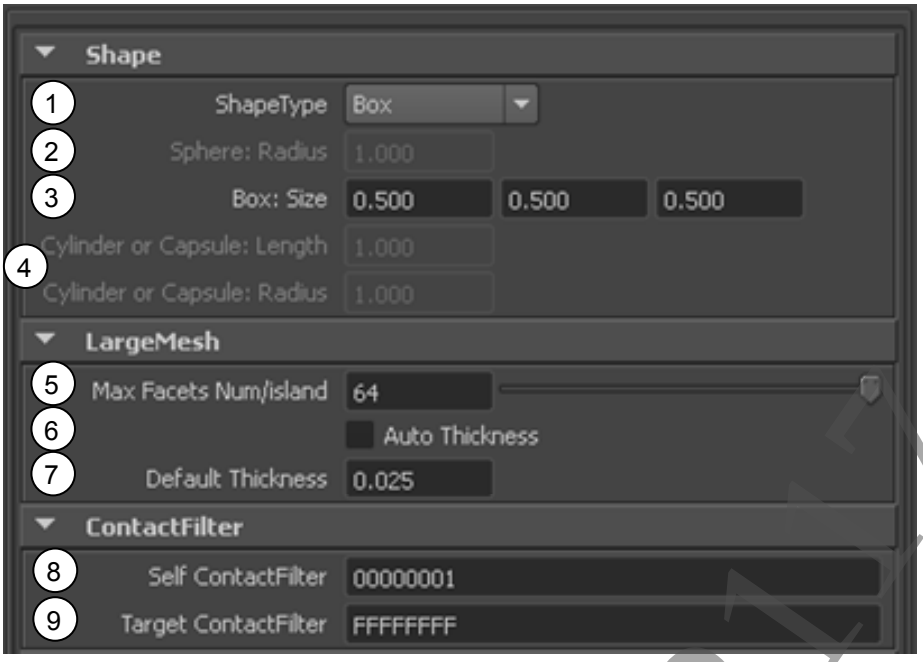
1	**Max RigidBodies**	Maximum number of rigid bodies
2	**Max Shapes**	Maximum number of shapes
3	**Max Joints**	Maximum number of joints
4	**Max ContactPairs**	Maximum number of contacts
5	**World Center**	Center position of World
6	**World Extent**	Size of World
7	**World Gravity**	Amount of gravity
8	**Sub Step Count**	Number of substeps
9	**Iteration**	Number of iterations for the solver calculation
10	**Separate Bias**	Bias value used for preventing penetration when a collision occurs
11	**Sleep**	ON/OFF of the sleep function
12	**Sleep Count**	Count of the sleep function
13	**Sleep Interval**	Interval of sleep checks
14	**Sleep Linear Velocity**	The linear velocity to enter sleep
15	**Sleep Angular Velocity**	The angular velocity to enter sleep
16	**Wake Linear Velocity**	The linear velocity to wake from sleep
17	**Wake Angular Velocity**	The angular velocity to wake from sleep

RigidBody



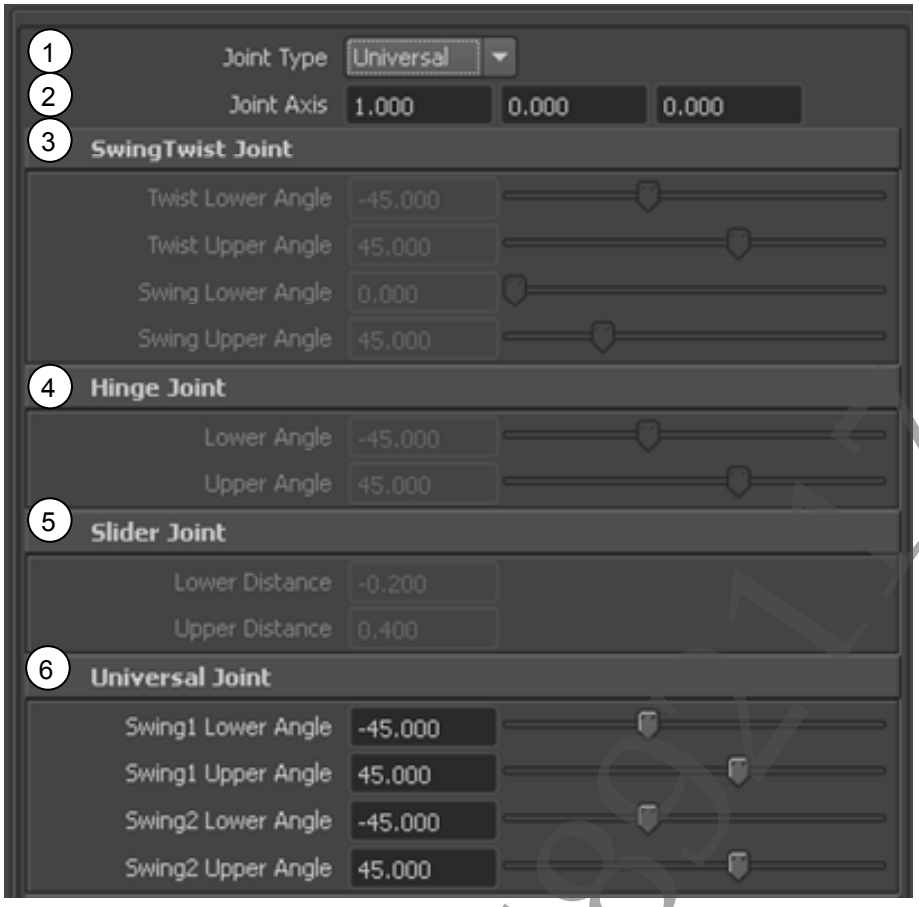
1	**Mass**	Mass
2	**Friction**	The friction coefficient
3	**Restitution**	The restitution coefficient
4	**InertiaShapeType**	Type of inertia tensor shape
5	**Box: Size**	Size of inertia tensor box
6	**Sphere: Radius**	Radius of inertia tensor sphere
7	**Cylinder**	Length, radius and axis of inertia tensor cylinder
8	**InertiaMass Translate**	Parallel translation of the inertia tensor
9	**InertiaMass Rotation**	Rotation of the inertia tensor
10	**InertiaMass RotRule**	Rotation order of the inertia tensor
11	**MotionType**	Type of motion
12	**Self Contact Filter**	Contact filter of the rigid body itself
13	**Target Contact Filter**	Contact filter of collision target
14	**Linear Velocity**	The linear velocity
15	**Angular Velocity**	The angular velocity
16	**Linear Damping**	The linear damping
17	**Angular Damping**	The angular damping
18	**Max Linear Velocity**	Maximum value of the linear velocity
19	**Max Angular Velocity**	Maximum value of the angular velocity
20	**Sleeping**	Whether the rigid body is in sleep mode
21	**Use Sleep**	Whether or not to use the sleep function

RigidShape



1	**ShapeType**	Type of shape
2	**Sphere: Radius**	Radius of sphere
3	**Box: Size**	Size of box
4	**Cylinder or Capsule**	Length and radius of capsule and cylinder
5	**Max Facets Num/island**	Maximum number of triangles that can be held in one island mesh of large mesh
6	**Auto Thickness**	Automatic calculation of large mesh thickness
7	**Default Thickness**	Thickness of large mesh
8	**Self ContactFilter**	Contact filter of the rigid body itself
9	**Target ContactFilter**	Contact filter of collision target

RigidJoint



1	**Joint Type**	Type of joint
2	**Joint Axis**	Settings of joint axes
3	**SwingTwist Joint**	The motion range of SwingTwist Joint
4	**Hinge Joint**	The motion range of Hinge Joint
5	**Slider Joint**	The motion range of Slider Joint
6	**Universal Joint**	The motion range of Universal Joint