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# Altair MotionView 2019 Tutorials

## MV-1030: Creating a System Definition Using the MotionView GUI

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# MV-1030: Creating a System Definition Using the MotionView GUI

In the earlier exercise, you learned about MDL and authoring a definition using the MDL language through a text editor. In general, many of the definitions (such as systems, datasets, and analyses) are created using the MotionView graphical user interface. This tutorial demonstrates how to create a system using the GUI and save its definition to a file, which is an alternate way of creating a definition other than using the text editor.

## Exercise: Creating a System Definition Using the GUI.

This exercise will help you learn to:

- Create systems using the MotionView graphical user interface
- Export a system definition to a file
- Reuse the saved definition by instantiating it in the model

### Step 1: Creating a system instance.

1. To create a system, right-click on ***Model*** in the **Project Browser** and select ***Add > System/Assembly***.

   OR

   – Right-click on the ***System/Assembly*** panel button  on the **Container Entity** toolbar.

   The **Add System/Assembly** dialog is displayed.

2. Select the **System** radio button and click ***Next***.

   The **Add System** dialog is displayed.

3. Specify `sys_pendu` as the ***Variable***, `Pendulum` as the ***Label***, and `def_sys_pendu` as the **Definition Name**.

4. Click ***OK***.

   The **Pendulum** system  is added to the model and its corresponding panel is displayed.

### Step 2: Adding attachments to the system.

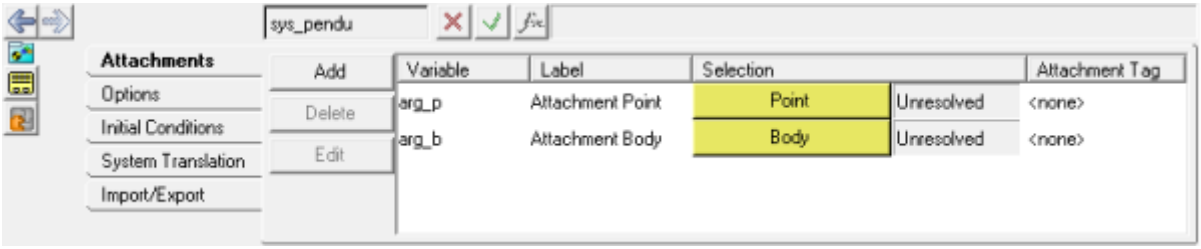
1. From the ***Attachments*** tab, click on the ***Add*** button (located in the middle of the panel).

   The **Add an Attachment** dialog is displayed.

2. Specify the **Label** as `Attachment Point` and `arg_p` for the **Variable**, select ***Point*** (from the drop-down menu), and verify that the **Type** is set to ***Single only***.

3. Click ***OK***.

4. Add another attachment with the **Label** as `Attachment Body` and **Variable** as `arg_b`, select ***Body*** from the drop-down menu, and specify the **Type** as ***Single only***.



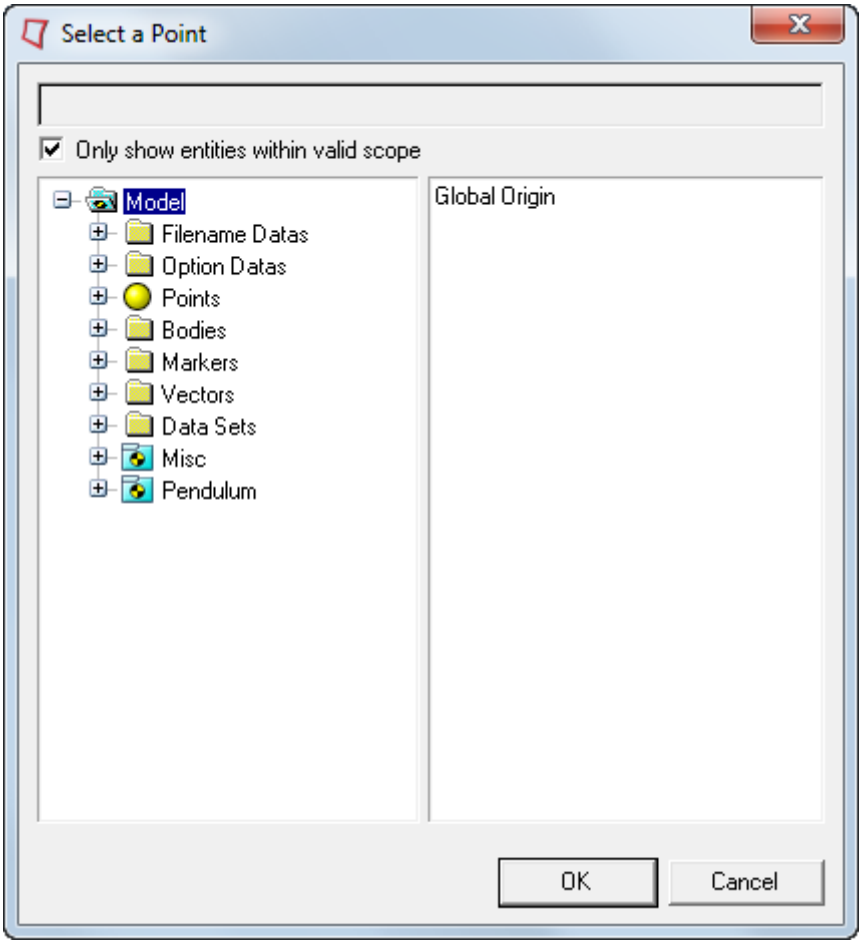

We have created two attachments to the **Pendulum** system which will be used to attach this system to other entities of a model.

Notice that the both of the newly created attachments are **Unresolved**, which means that the attachments are not yet referring to another entity in the model.

5. Double click on the 

collector.

The **Select a Point** dialog is displayed.




6. Select ***Global Origin*** from the list on the right side of the dialog and click ***OK***.

7. Similarly, click the Body collector, select ***Ground Body*** from the model tree, and click ***OK***.

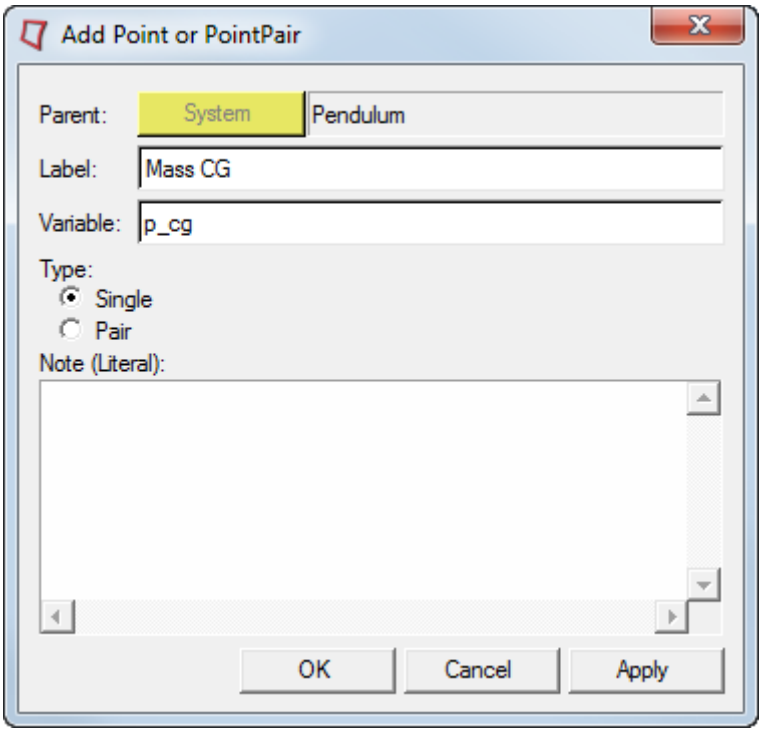
## Step 3: Adding entities to the system.

1. Select ***Pendulum*** in the **Project Browser**.
2. Right-click and select ***Add > Reference Entity >*** ***Point***.

   OR

   – Right-click on the ***Points*** panel button on the **Reference Entity** toolbar).

   The **Add Point or PointPair dialog** is displayed.
3. Specify the **Label** as `Mass CG`, **Variable** as `p_cg`, and the **Type** as ***Single***.

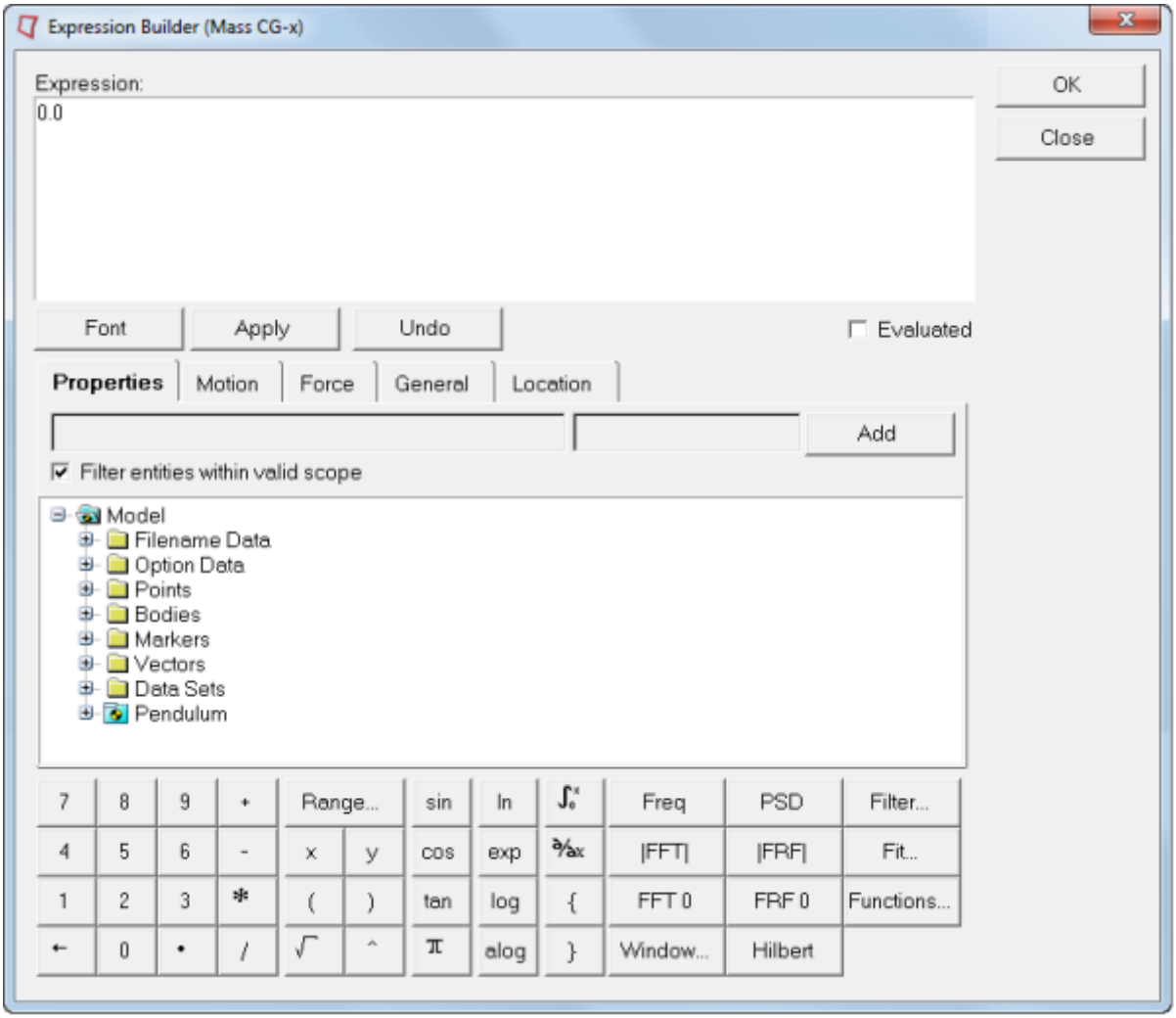



4. Click ***OK***.

   The **Points** panel is displayed with the properties of **Mass CG**.

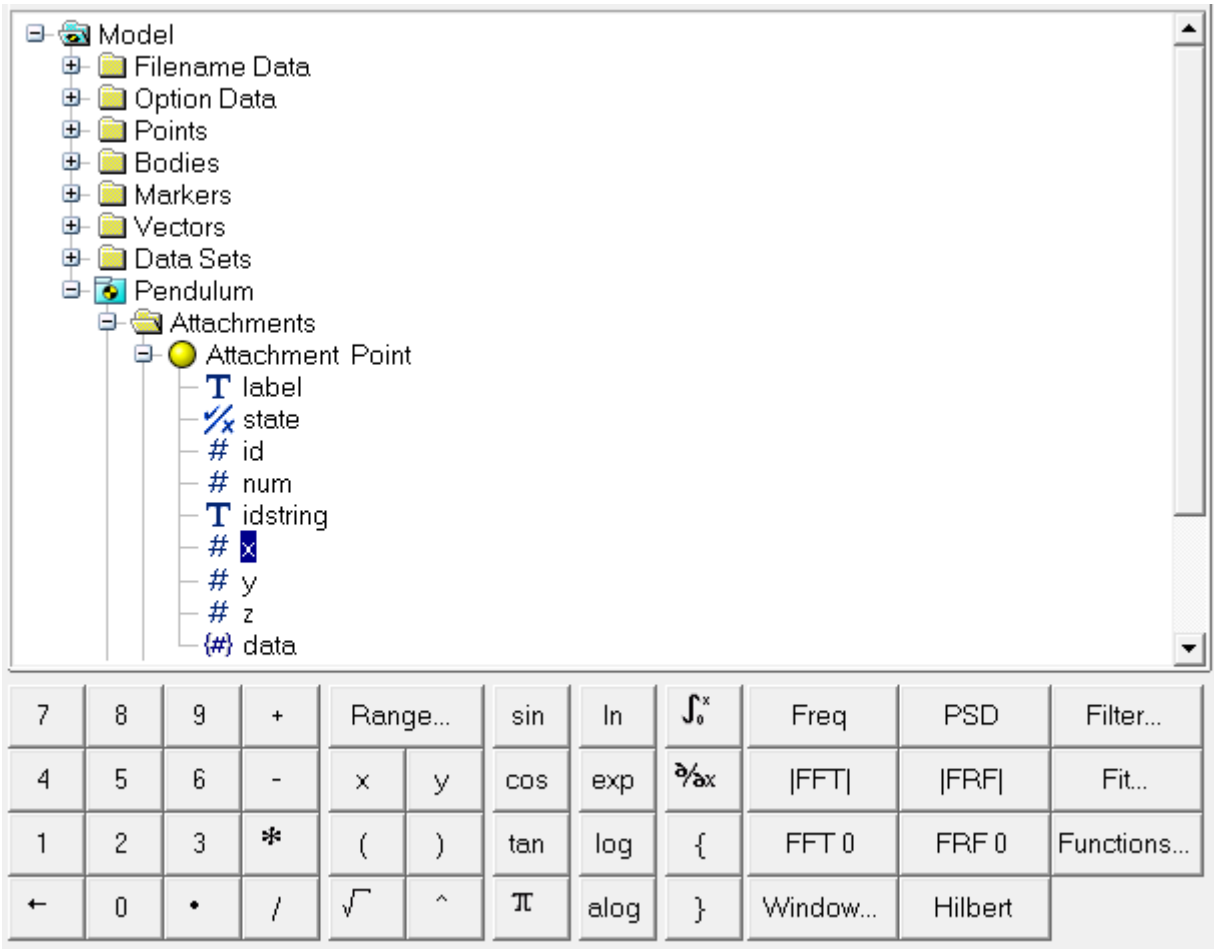
5. From the ***Properties*** tab, click in the ***X Coordinate*** field and click on the $f_x$ button on the **Expression** bar.

   The ***Expression Builder*** is displayed.




6. Delete `0.0` from the **Expression** area (located at the top of the dialog).

7. From the model tree, expand the ***Pendulum > Attachments > Attachment Point*** folders and select ***x*** (**x** is one of the property attributes of the point entity **Attachment point**).

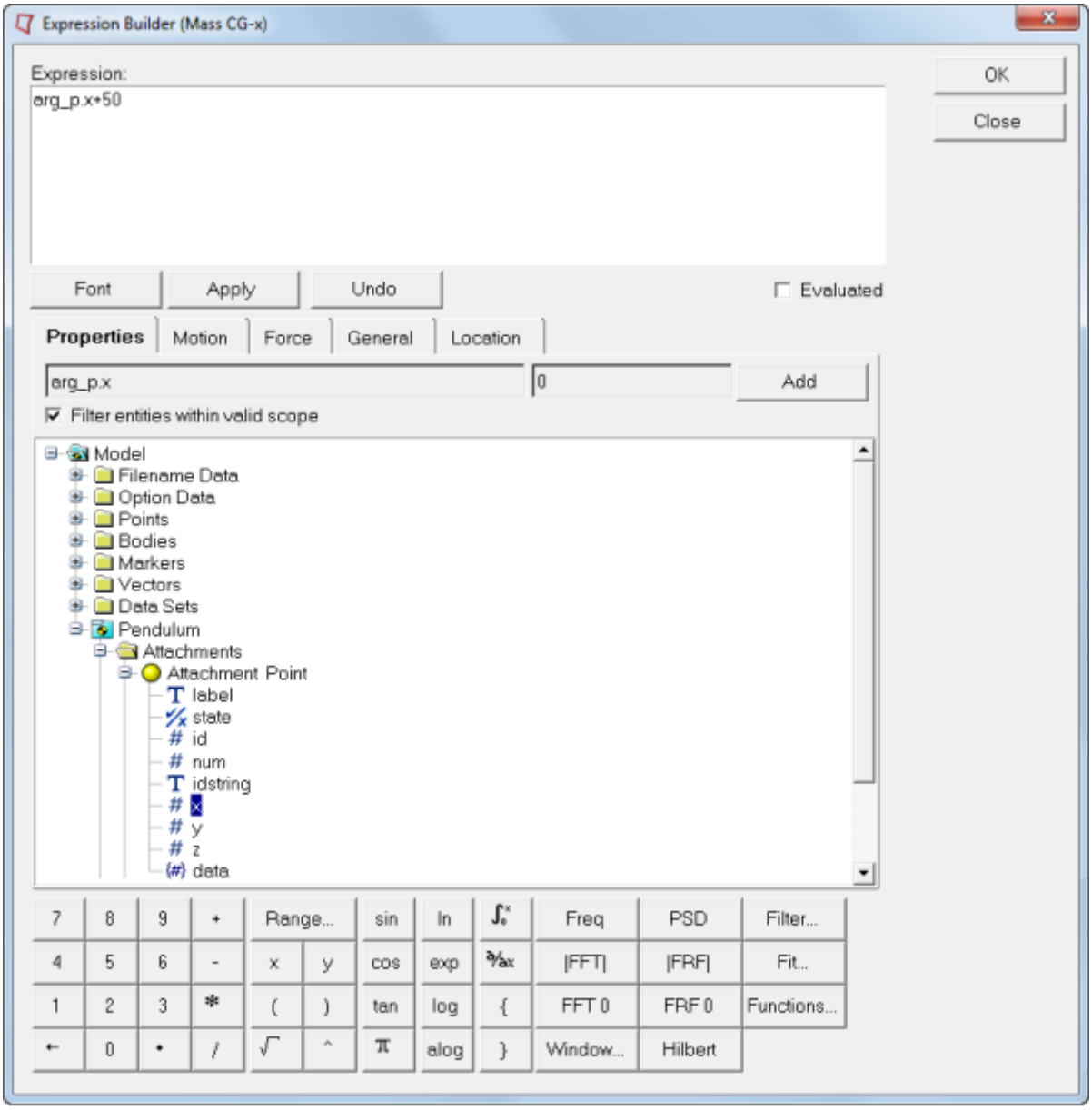



8. Click the ***Add*** button (located in the middle of the dialog).

   `arg_p.x` is automatically filled in the **Expression** area.

9. Append `+50` to this expression.

   The complete expression should now read: `arg_p.x+50`.

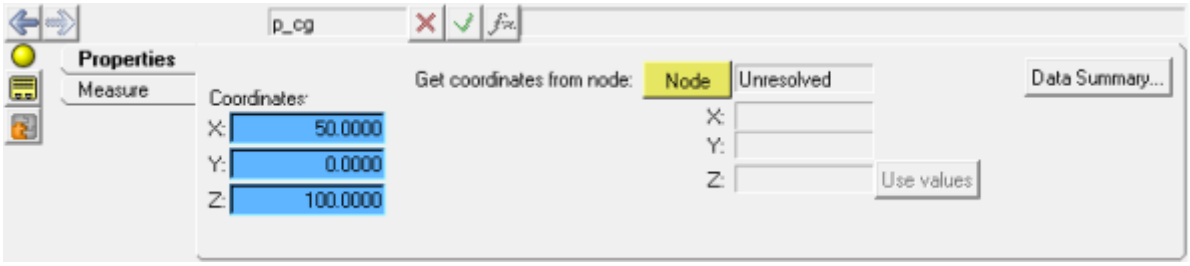



10. Click ***OK*** to close the dialog.

    Through the above steps the point **Mass CG** is parameterized with regard to the **X coordinate** of the point **Attachment Point** and is placed at a distance of 50 length units in the X direction.

11. Repeat the above steps for the **Y** and **Z Coordinates**, by selecting attribute y and z respectively in the expression bar. Specify the expression for the **Y Coordinate** as `arg_p.y` and `arg_p.z+100` for the **Z Coordinate**.

    Alternatively, the expressions in **Y** and **Z** can be filled by copying the `arg_p.x+50` expression from **X Coordinate** and editing it.



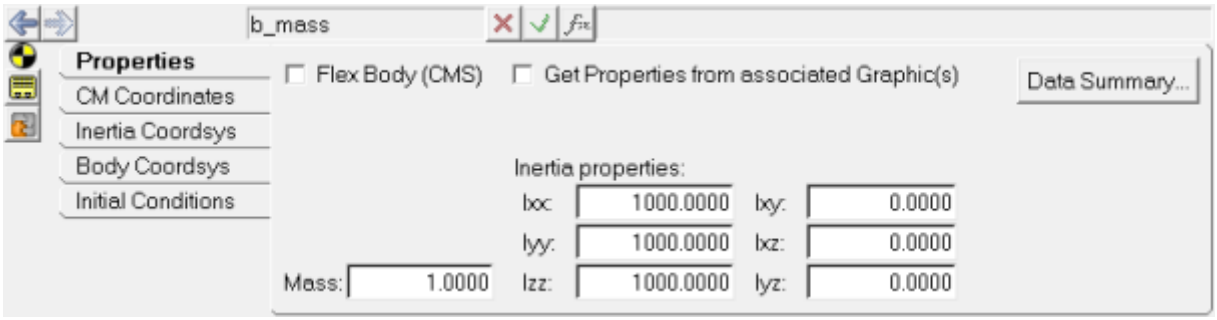

**Note** The background color of the field changes for parametric expressions.

12. Right-click on the ***Pendulum*** system in the **Project Browser** and select ***Add > Reference Entity >*** ***Body***.

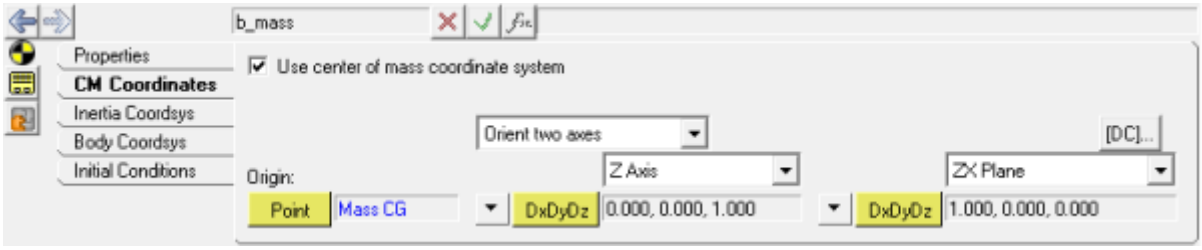
    The **Add Body or BodyPair** dialog is displayed.

13. Enter `Mass` for the ***Label*** and `b_mass` for the ***Variable***, and click ***OK***.

14. From the ***Properties*** tab specify the ***Mass*** as `1` and the ***Inertia properties*** as `1000` for ***Ixx***, ***Iyy*** and ***Izz*** respectively.




15. Click on the ***CM Coordinates*** tab and check the ***Use center of mass coordinate system*** option. Pick the point ***Mass CG*** as the **Origin**.



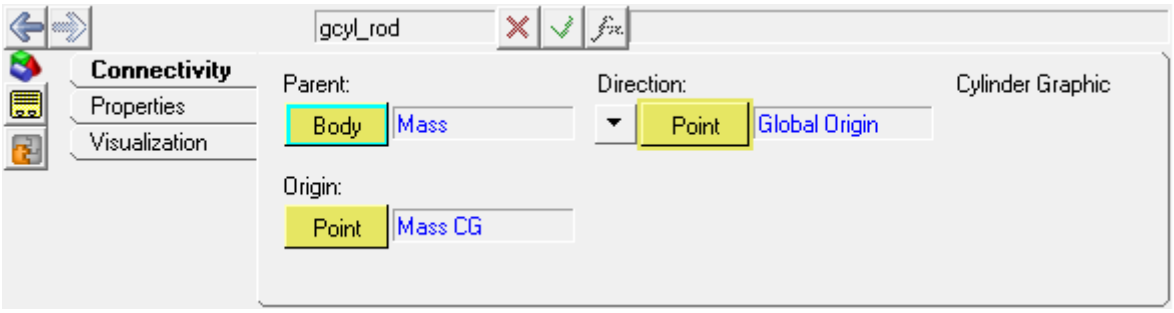

16. Right-click on the ***Pendulum*** system in the **Project Browser** and select ***Add > Reference Entity > Graphic***.

    The **Add "Graphic"** dialog is displayed.

17. Specify the **Label** as `Rod`, the **Variable** as `gcyl_rod`, the **Type** as ***Cylinder***, and click ***OK***.

    The **Graphics** panel is displayed.

18. From the ***Connectivity*** tab; double click on the ***Body*** collector for **Parent** and pick ***Mass*** in the ***Pendulum*** system, click on the ***Point*** collector and pick ***Mass CG*** as ***Origin,*** and for **Direction** double click the ***Point*** collector and select the attachment to the system ***Attachment Point***.

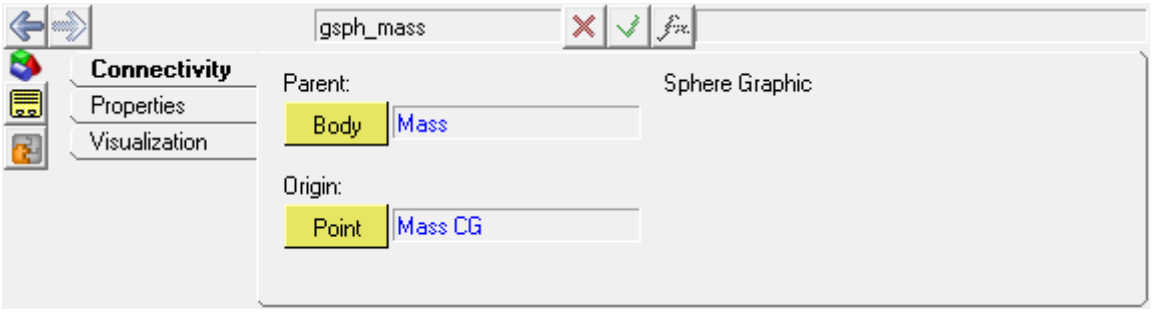



19. Go to the ***Properties*** tab and change the value of **Radius 1** to `2`.

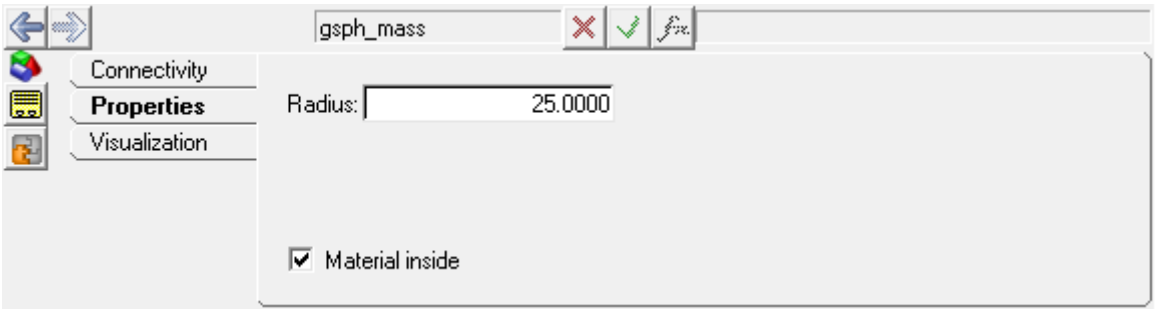
20. Next, add a ***Sphere*** graphic by right-clicking on the ***Pendulum*** system in the **Project Browser** and selecting ***Add > Reference Entity > Graphic***.

21. Specify the **Label** as `Mass`, the **Variable** as `gsph_mass`, the **Type** as ***Sphere***, and click ***OK***.

22. Pick ***Mass*** for the **Parent** body and ***Mass CG*** as the **Origin**.




23. From the ***Properties*** tab, specify `25` for the ***Radius***.



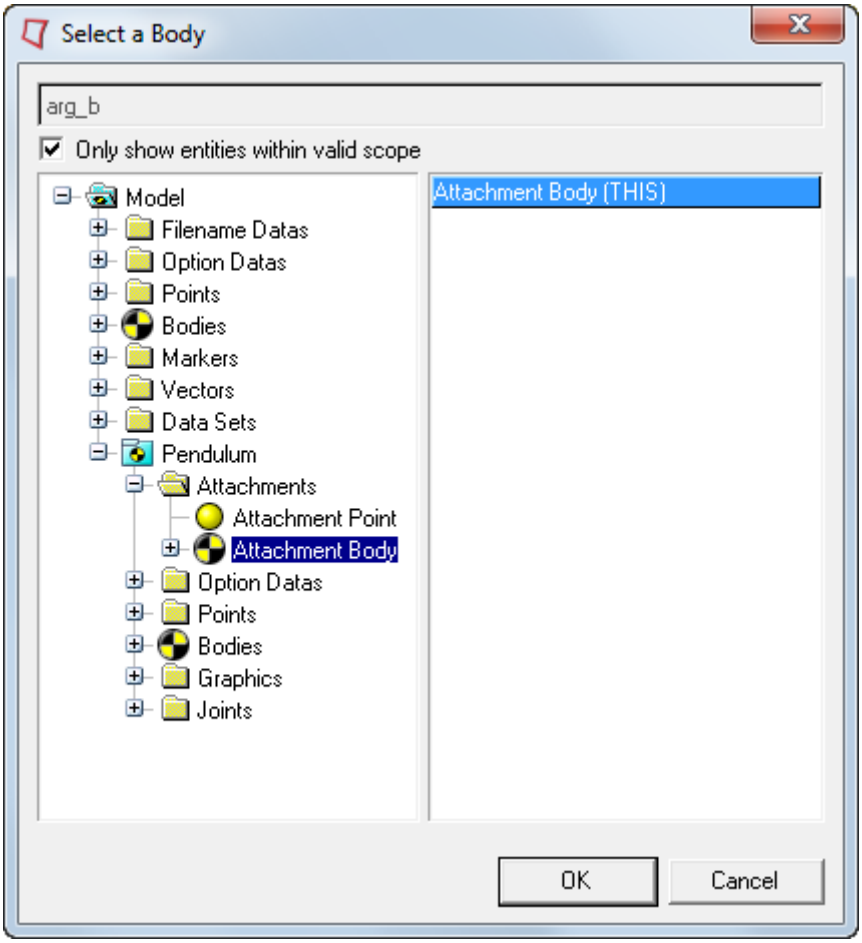

24. Right-click on the ***Pendulum*** system in the **Project Browser** and select ***Add > Constraint > Joint***.

    The **Add Joint or JointPair** dialog is displayed.

25. Select **Revolute Joint** from the drop-down menu, specify the **Label** as `Pivot`, the **Variable** as `j_pivot`, the **Type** as ***Single***, and click ***OK***.

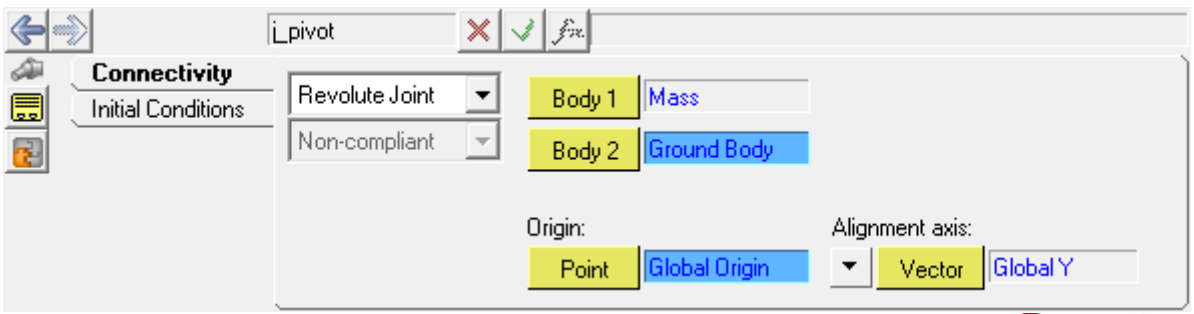
    The **Joints** panel is displayed.

26. From the **Connectivity** tab, double click on Body 1 and select **Mass** from the **Select a Body** dialog (model tree). For the second body, click on the Body 2 collector and browse through the model tree (***Model > Pendulum > Attachments***) and select ***Attachment Body***.




**Note** Alternatively, you can click on the ***Global Triad*** (at the bottom left of the triad) to pick ***Ground Body*** via the **Attachment Body**.

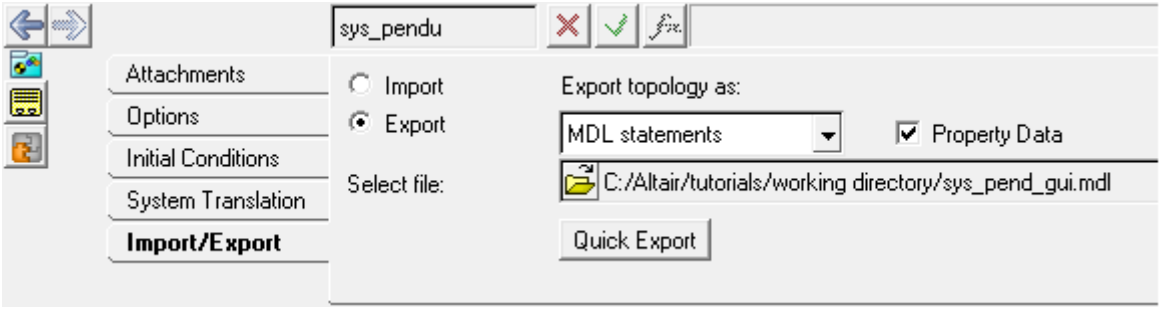
27. Similarly, for **Origin** select ***Attachment Point*** (located under ***Model > Pendulum > Attachments***). Use the **Alignment axis** drop-down menu to change from **Point** to ***Vector*** and select ***Global Y*** for the **Alignment axis**.



28. Save the model to your <working directory> as `pend_gui.mdl`.

## Step 4: Exporting the system definition.

1. Select the ***Pendulum*** system in the **Project Browser** and click on the ***Import/Export*** tab in the ***Systems/Assembly*** panel.
2. Select the ***Export*** option.




3. Click on the **Select file** file browser and browse to your <working directory>.
4. Specify the name of the file as `sys_pend_gui.mdl` by clicking on the folder icon and clicking on ***Save***.
5. Open the above file in a text editor.

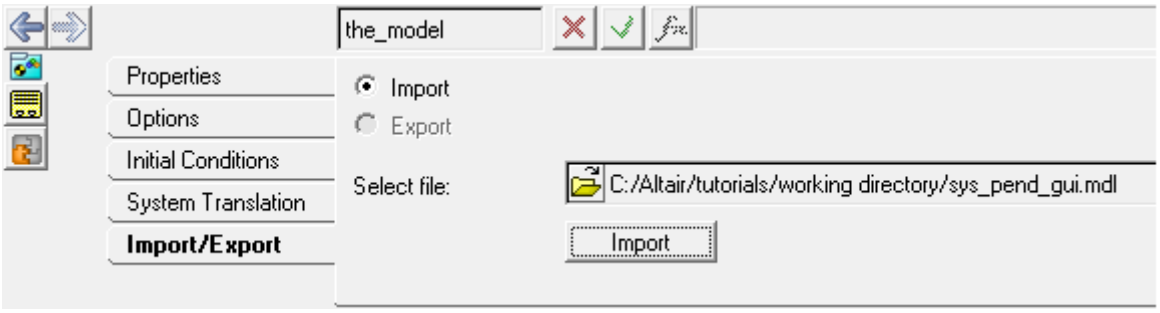
   The system definition content will look as displayed below:

```
*DefineSystem( def_sys_pendu, arg_p, arg_b )
  *Attachment( arg_p, "Attachment Point", Point, "Select attachment.",
P_Global_Origin,  )
  *Attachment( arg_b, "Attachment Body", Body, "Select attachment.",
B_Ground,  )
  *SetDefaultSystemInstance( sys_pendu, "Pendulum" )
  *Point( p_cg, "Mass CG" )
  *Body( b_mass, "Mass", p_cg, , , ,  )
  *Graphic( gcyl_rod, "Rod", CYLINDER, b_mass, p_cg, POINT, arg_p, 2.0,
gcyl_rod.r1, , 0.0, CAPBOTH )
  *Graphic( gsph_mass, "Mass", SPHERE, b_mass, p_cg, 25.0 )
  *RevJoint( j_pivot, "Pivot", b_mass, arg_b, arg_p, VECTOR, V_Global_Y
)
  *SetPoint( p_cg,                        arg_p.x+50, arg_p.y,
arg_p.z+100 )
  *SetBodyInertia( b_mass,                          1.0, 1000.0, 1000.0,
1000.0, 0.0, 0.0, 0.0 )
  *Set( b_mass.usecm, true )
*EndDefine()
```

**Note** The **Export** option is only available for Systems and Analyses. For other definitions like Datasets or Templates, the definition can be copied from the model .mdl file.

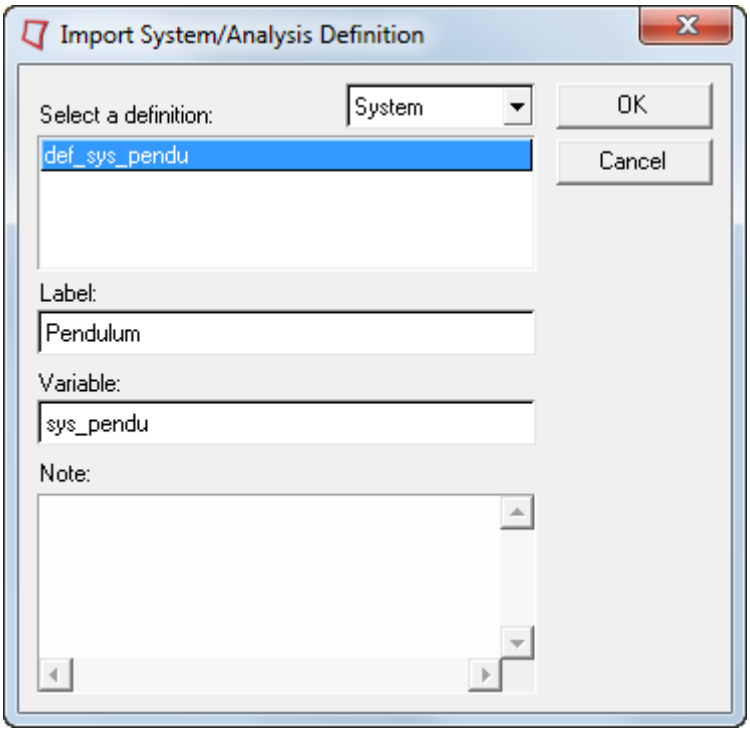
## Step 5: Instantiating the system definition.

1. Select the ***Model*** system in the **Project Browser**.
2. Click the ***Import/Export*** tab in the **Systems/Assembly** panel.
3. Click on the **Select file** file browser and browse to your <working directory>.
4. Select the `sys_pend_gui.mdl` file and click ***Open***.




5. Click the ***Import*** button.

   The **Import System/Analysis Definition** dialog is displayed.

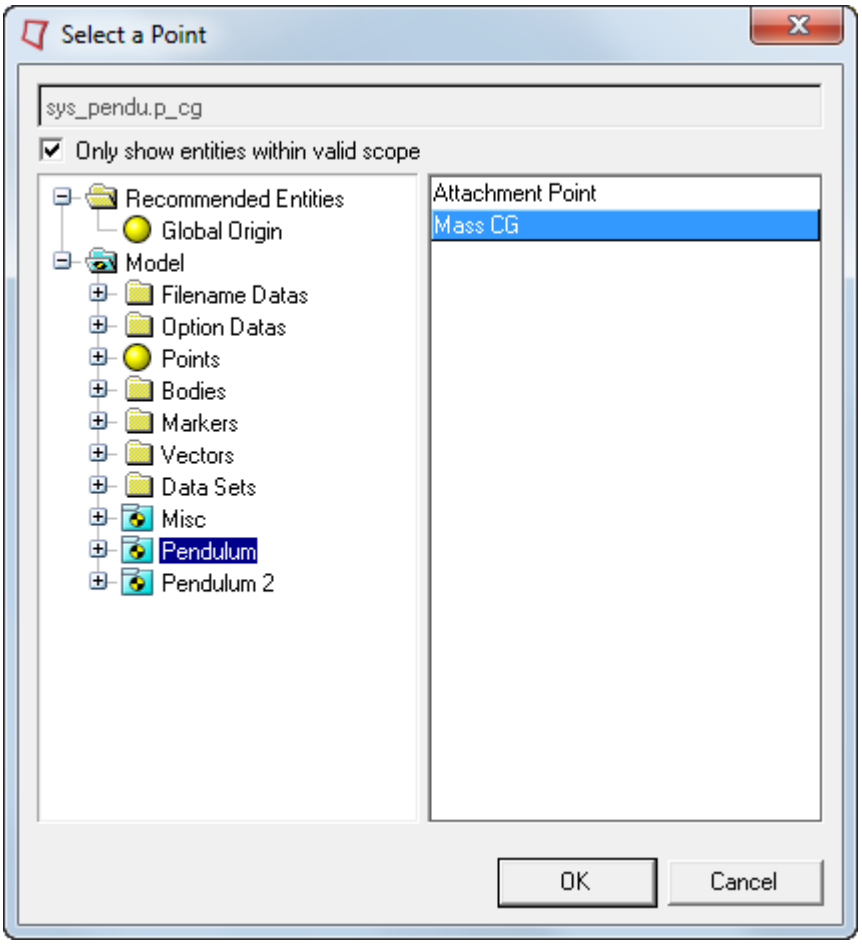



6. Select `def_sys_pendu`.
7. Change the **Label** to `Pendulum 2` and the **Variable** to `sys_pendu_2`.
8. Click ***OK***.

   The system definition is instantiated.
9. Select the ***Pendulum 2*** system in the **Project Browser**.

10. Go to the **Attachments** tab and resolve the attachments in the following manner:

   – Double click on the Point collector. In the model tree that appears, click on the ***Pendulum*** system, select ***Mass CG*** from the list on the right, and click ***OK***.




   – Click on the Body collector. In the model tree that appears, click on the ***Pendulum*** system, select ***Mass*** from the list on the right, and click ***OK***.

11. Save the model to your `<working directory>` as `pend_2_gui.mdl`.

    The same system definition can be reused to instantiate several times either within the same model or in a different model.