Machinery Belt Tutorial

This tutorial teaches you how to create poly-v grooved belt system using the 2D links modeling method. The Adams/Machinery Belt module supports multiple combinations of belt system type and modeling methodology options.

This chapter includes the following sections:

What You Will Create

During this tutorial, you will model a ploy-v grooved belt system consisting of 2 grooved pulleys and one tensioning device which includes a smooth pulley. All 3 pulleys will be constrained via revolute joints. One of the grooved pulleys will be actuated with a motion. Contact forces including friction between the discrete belt segments and the pulleys convey the motion.

The figure shows the poly-v grooved belt system that you are going to create.

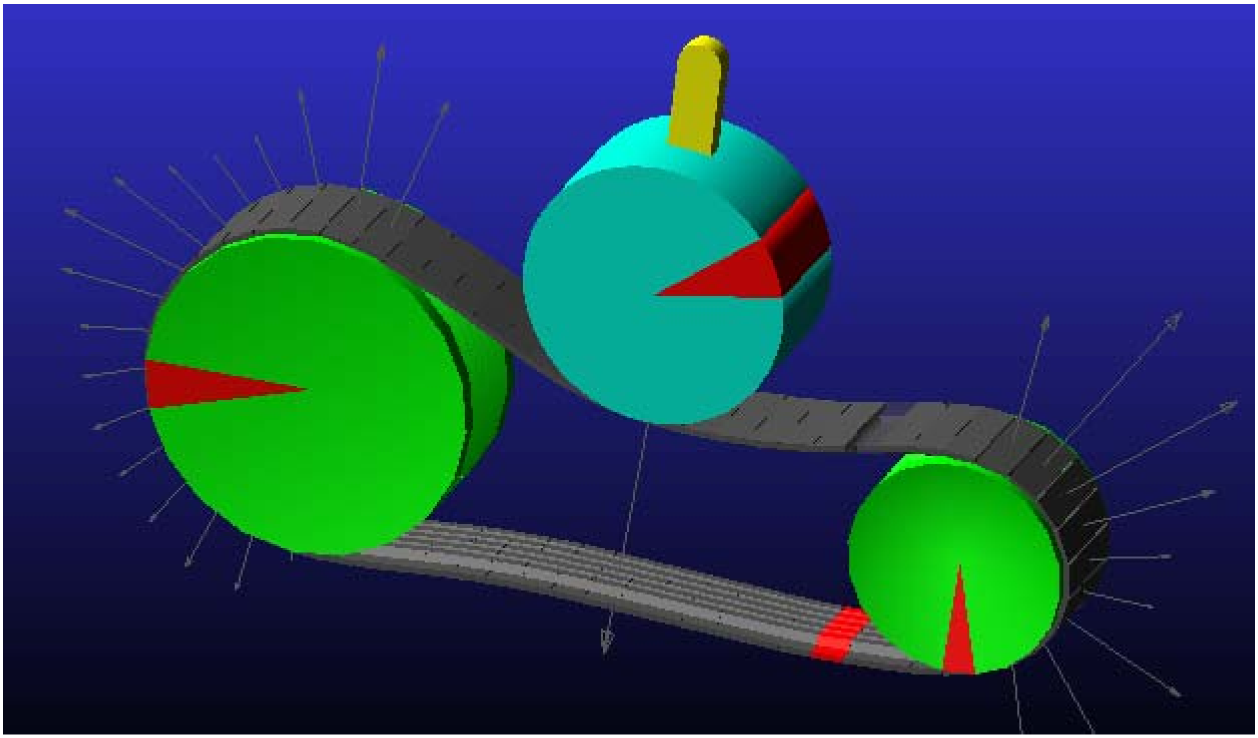


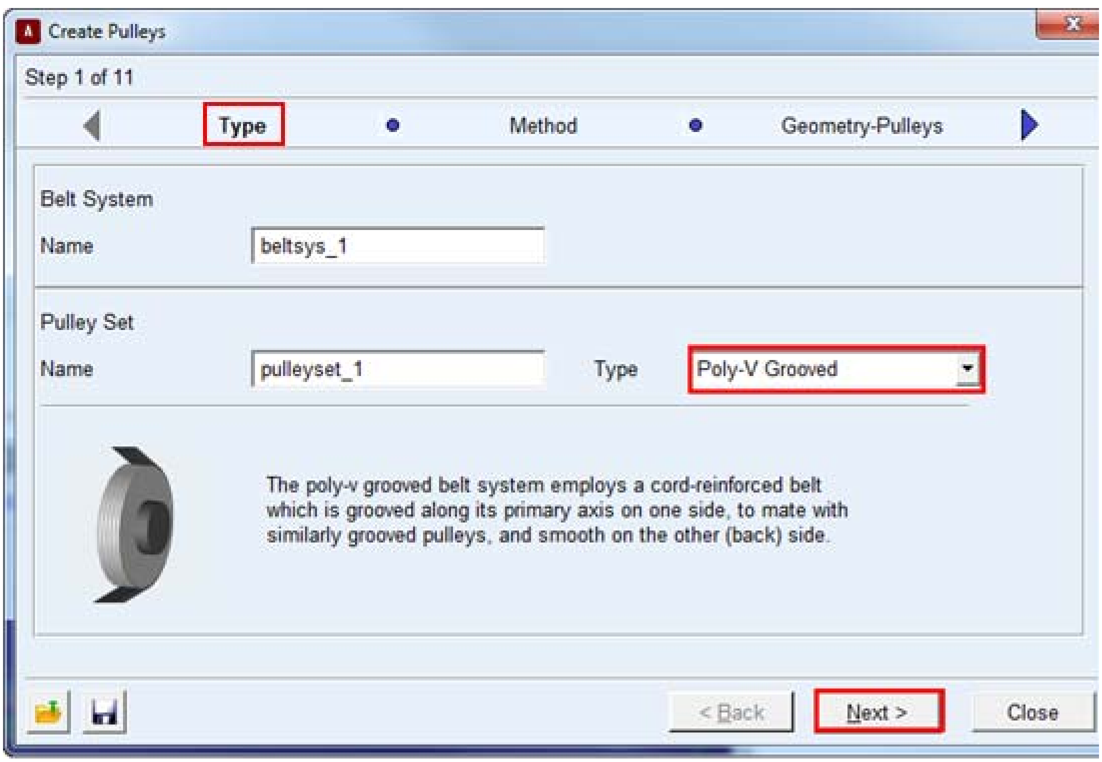
Figure 1 Poly-V Grooved Belt System

Creating Poly-V Grooved Belt System

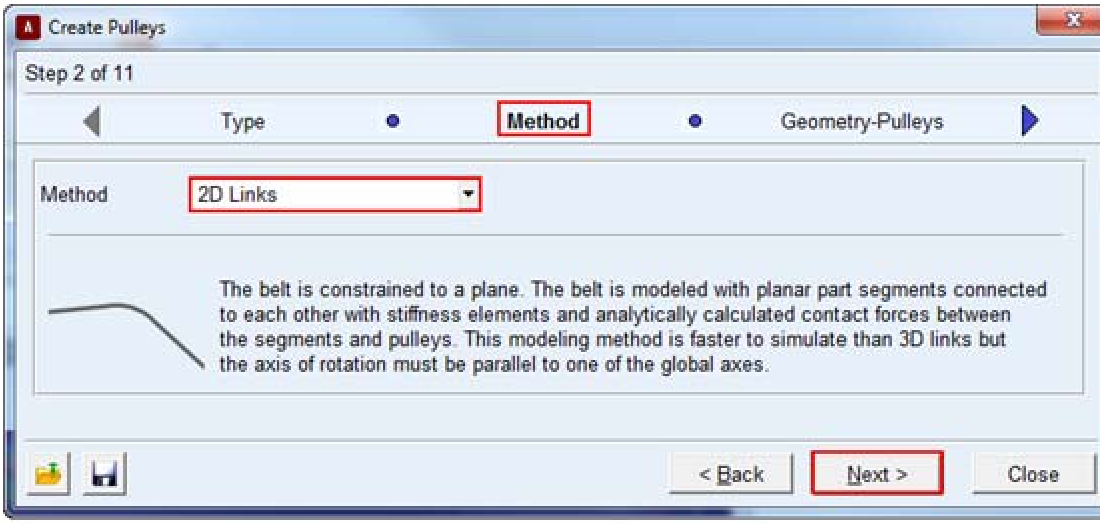
In this section, you will create a belt system.

1. Click the **Machinery** tab on the Adams/View ribbon.
2. From the **Belt** container, click the icon for **Create Pulley.**

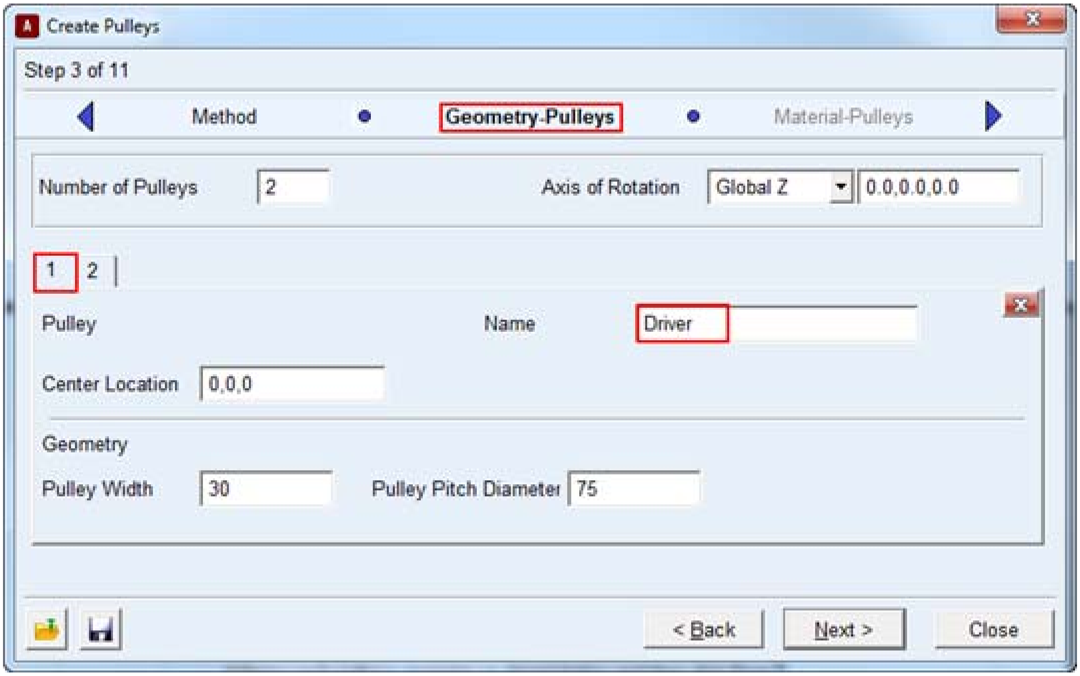
3. The pulley creation wizard will launch. On the first page (Type) select **Poly-V Grooved** from the **Type** option menu and click **Next.**

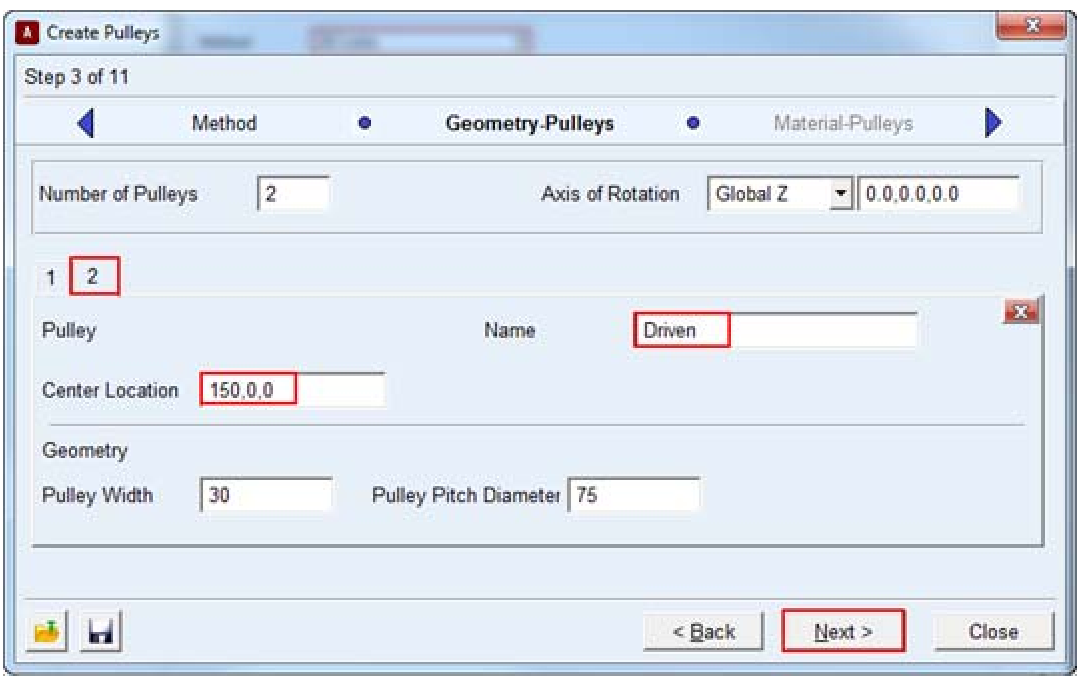


4. On the next page (Method) select **2D Links** from the Method option menu and click **Next**.

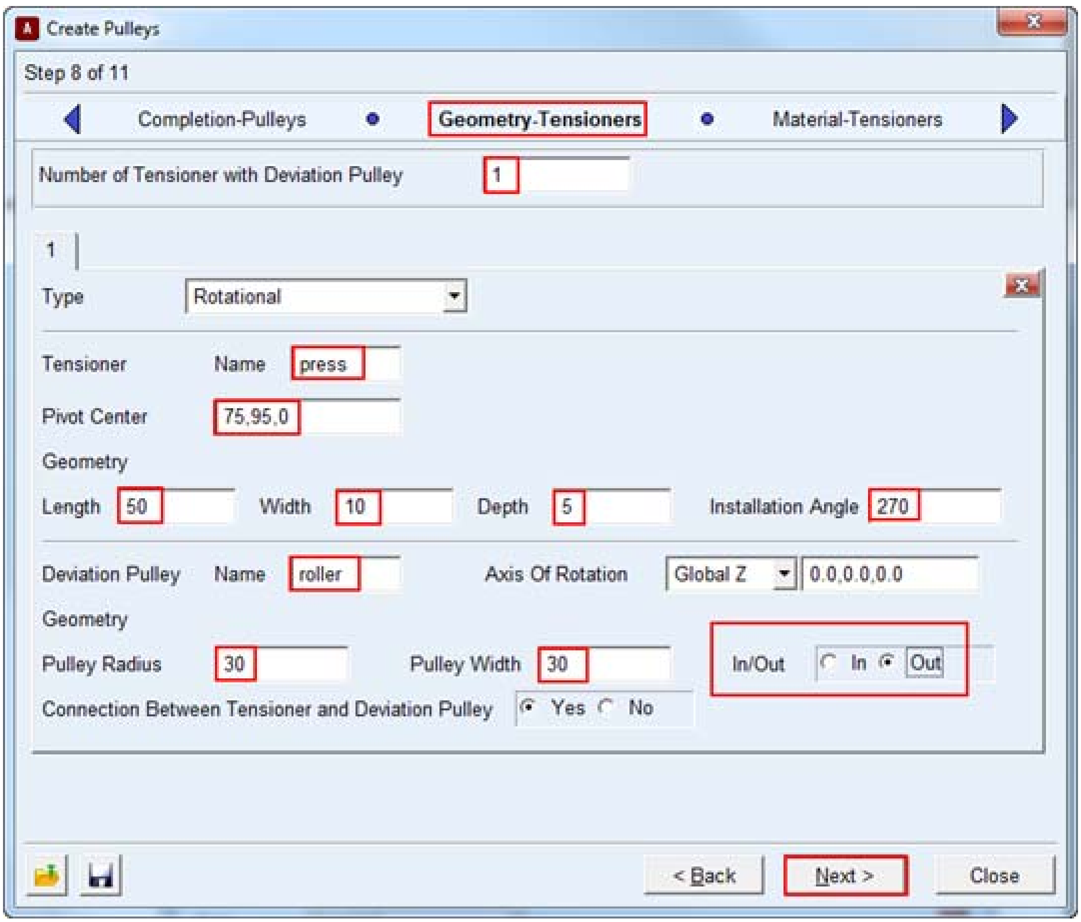


5. On the next page (**Geometry**) fill out the two tabs defining each pulley's geometry as shown below and then click **Next**:
   a. Pulley1 name as **Driver** and Pulley2 name as **Driven**.
   b. Pulley1 center location as **0,0,0** and Pulley2 center location as **150,0,0**.

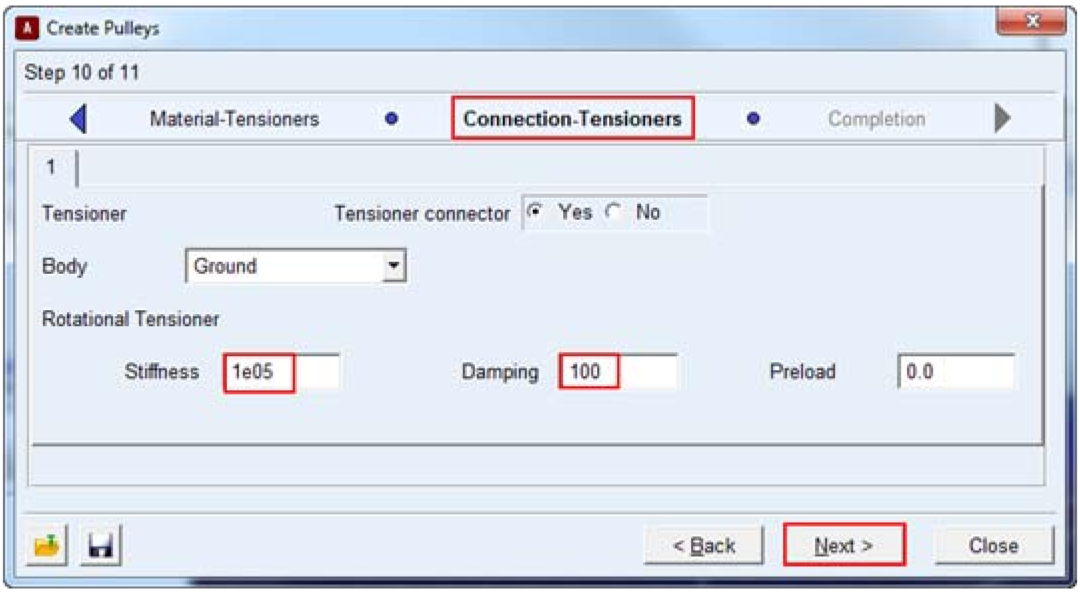

Create Pulleys
Step 3 of 11
Method
Geometry-Pulleys
Material-Pulleys
Number of Pulleys
2
Axis of Rotation
Global Z
0.0,0.0,0.0
1
2
Pulley
Name
Driver
Center Location
0,0,0
Geometry
Pulley Width
30
Pulley Pitch Diameter
75
< Back
Next >
Close


Create Pulleys
Step 3 of 11
Method
Geometry-Pulleys
Material-Pulleys
Number of Pulleys
2
Axis of Rotation
Global Z
0.0,0.0,0.0
1
2
Pulley
Name
Driven
Center Location
150,0,0
Geometry
Pulley Width
30
Pulley Pitch Diameter
75
< Back
Next >
Close

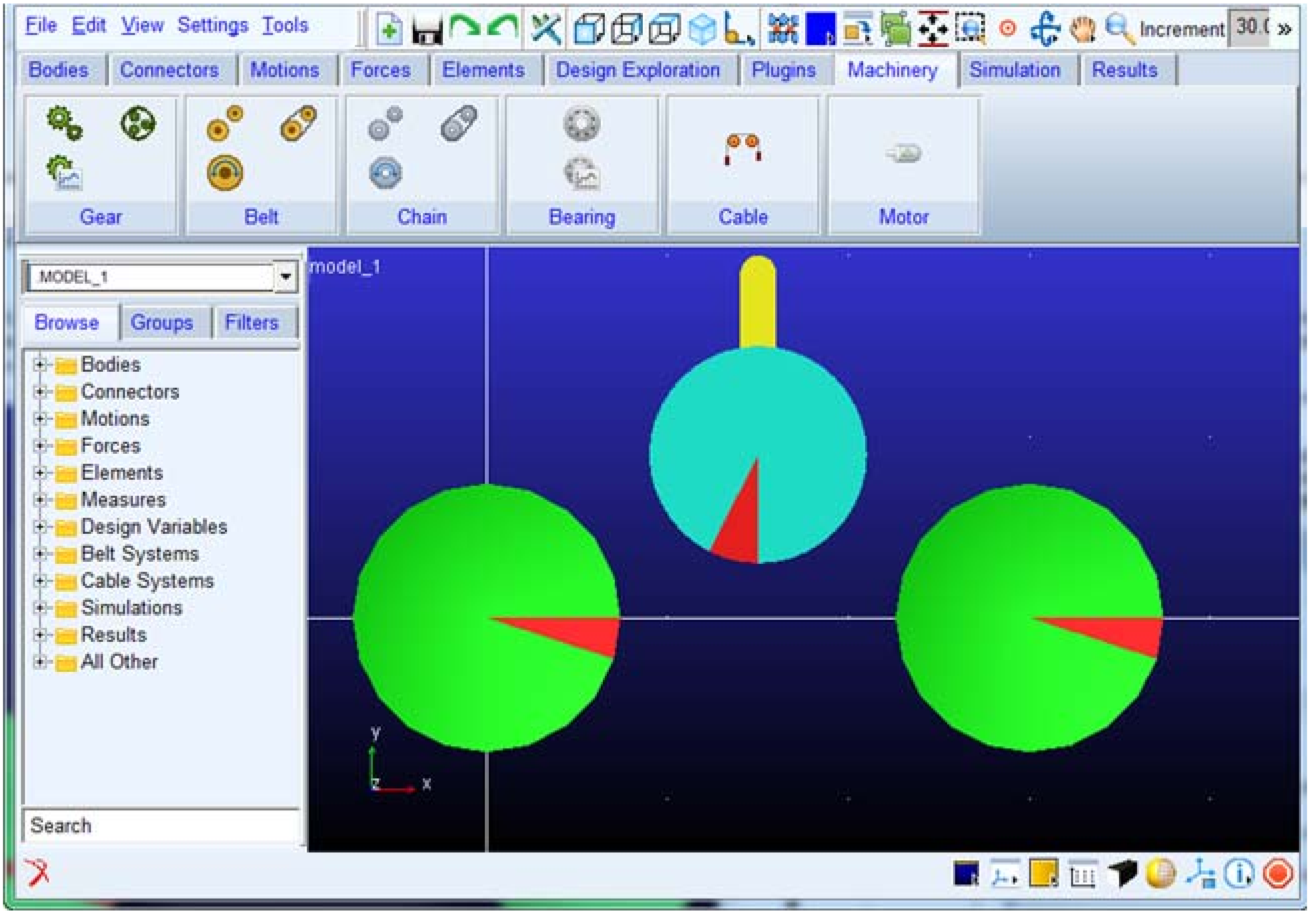
6. The next page (**Material-Pulleys**) defines the material properties to be used for the mass property calculations for each pulley. Accept the defaults and move on by clicking **Next**.
7. On the next page (**Connection-Pulleys**) you define how each pulley is to be connected to the rest of the model. For this example, accept the defaults which mount each pulley to ground via revolute joints and click **Next**.
8. On the next page (**Output-Pulleys**) you can optionally reduce the amount of post-processing information about the pulleys to be made available as Adams Requests. For this example, accept the defaults (to get all information) and click **Next**.
9. The next page (**Completion-Pulleys**) informs you that all the information required for the grooved pulleys has been entered. Click **Next** to proceed to tensioner definition.
10. On this page (**Geometry - Tensioners**) enter **1** in the **Number of Tensioner with Deviation Pulley** field and fill out the tabs defining the tensioner arm and deviation pulley geometry as shown below and then click **Next**:



11. The next page (**Material-Tensioners**) defines the material properties to be used for the mass property calculations for the tensioner arm and deviation pulley. Accept the defaults and move on by clicking **Next**.
12. On the next page (**Connection-Tensioners**) you define how the tensioner arm is to be connected to the rest of the model. Since we selected a rotational type of tensioner earlier in the wizard, the tensioner arm will be mounted via a revolute joint and a rotational spring-damper will be applied to the remaining rotational degree of freedom. Here we define to which body in the model the tensioner arm is mounted and specify the spring damper coefficients.

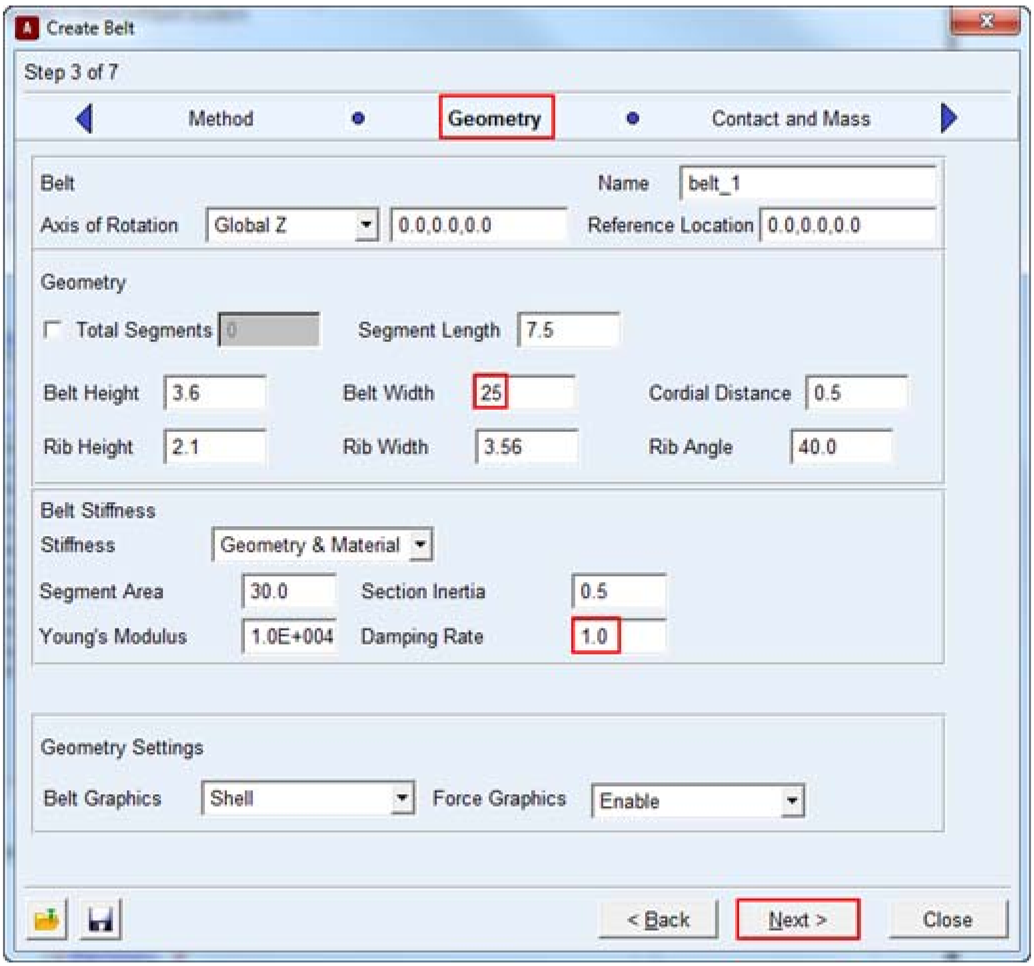


13. The next page (**Completion**) informs you that all the information required for the pulley set has been entered. Optionally save the content of the entire wizard to a file for re-use later by clicking the **Save** icon. Click **Finish** to create the pulley set.



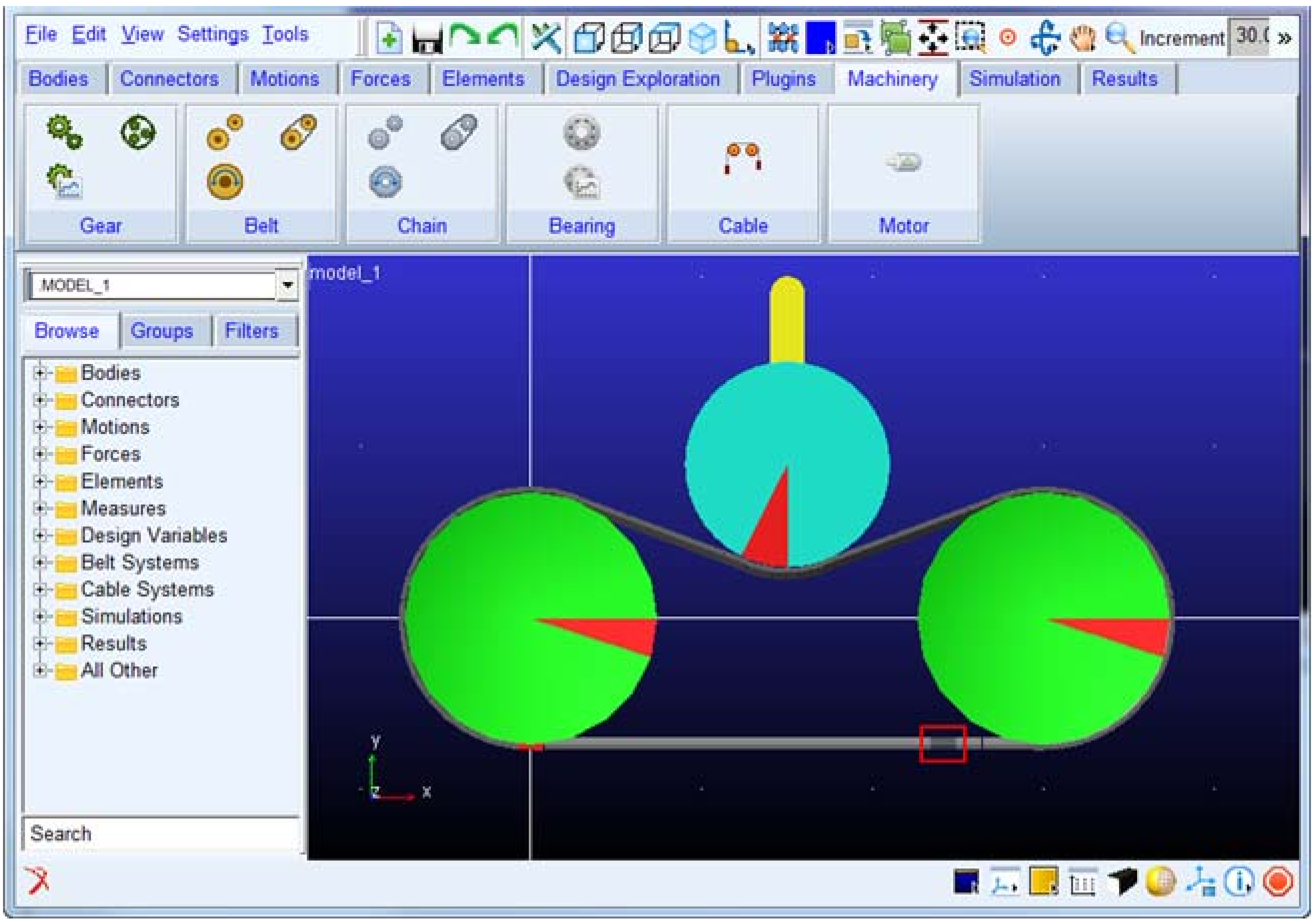
16. From the Ribbon go to the **Machinery** tab's **Belt** container and click the icon for **Create Belt**.

14. The Belt Creation wizard is launched. In the **Name** field enter the name of the pulley set you just created (right-mouse-click in the field and use **Pick** or **Guesses** to quickly select) and then click **Next**.
15. The next page (**Method**) defaults to the method you chose when creating the pulley set. Accept this default by clicking **Next**.
16. The next page (**Geometry**) is for specification of the Belt geometry. Make the modification as shown below and click **Next** to move on.



17. The next page (**Mass**) defines the material properties to be used for the mass property calculations for the belt segments. Accept the defaults and move on by clicking **Next**.
18. On the next page (**Wrapping Order**) the belt routing is defined. Right-click in the field and use the **Guesses** menu to first pick the Driver, then the roller and finally the Dirven so that the field is populated as such: "**pulleyset_1_Driver, pulleyset_1dev_roller, pulleyset_1_Driven**", then click **Next.**

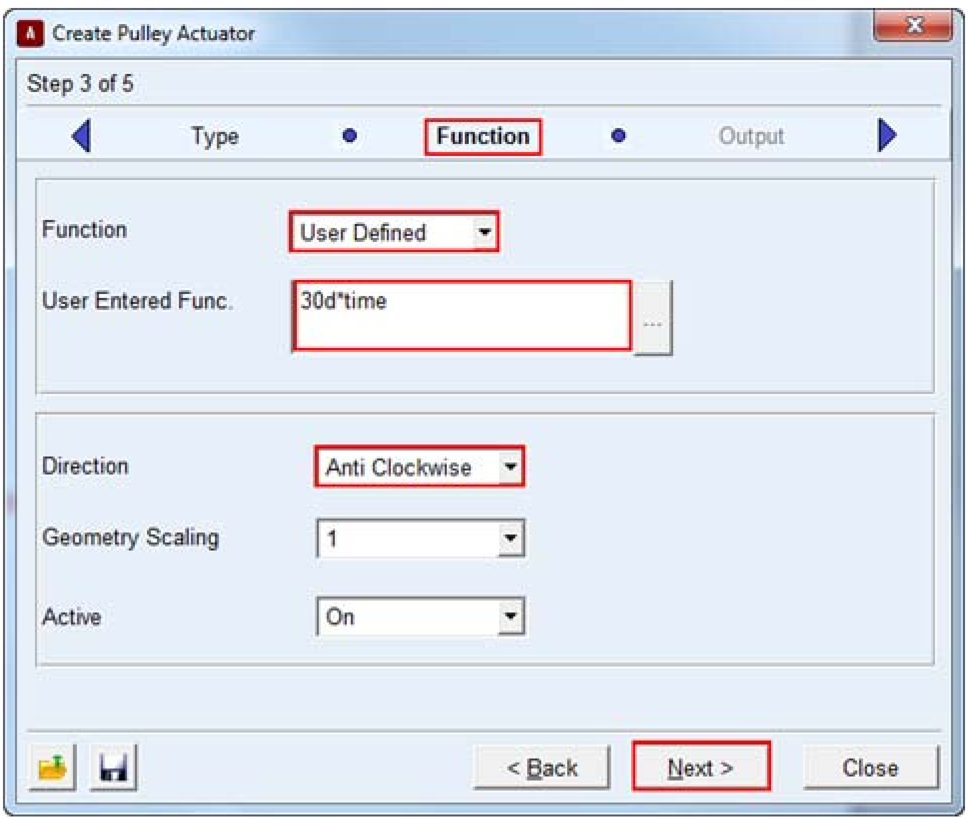
19. When prompted about the belt number of segments, tension and strain; click **OK** to continue. A warning message will be displayed informing you that the 2D parts for the belt segments are unique to the Adams/Solver C++ executable (the default mode).
20. Now you will be on the Output Request page. Create a request of type **Segment Request** and populate the **Link Part(s)** field (for example, via right-click **Pick**) with a belt segment (57) near the bottom of the follower pulley. This will create output requests to track the forces on that segment as the belt runs around the pulleys. You may want to toggle the icon display off to better see the belt (one way to do this is to click inside the graphics window and press the "**v**" key on your keyboard). Click **Next.**



21. The next page (**Completion**) informs you that all the information required for the belt has been entered. Optionally save the content of the entire wizard to a file for re-use later by clicking the **Save** icon. Click **Finish** to create the belt.

22. From the Ribbon go to the **Machinery** tab's **Belt** container and click the icon for **Belt Actuation Input**.

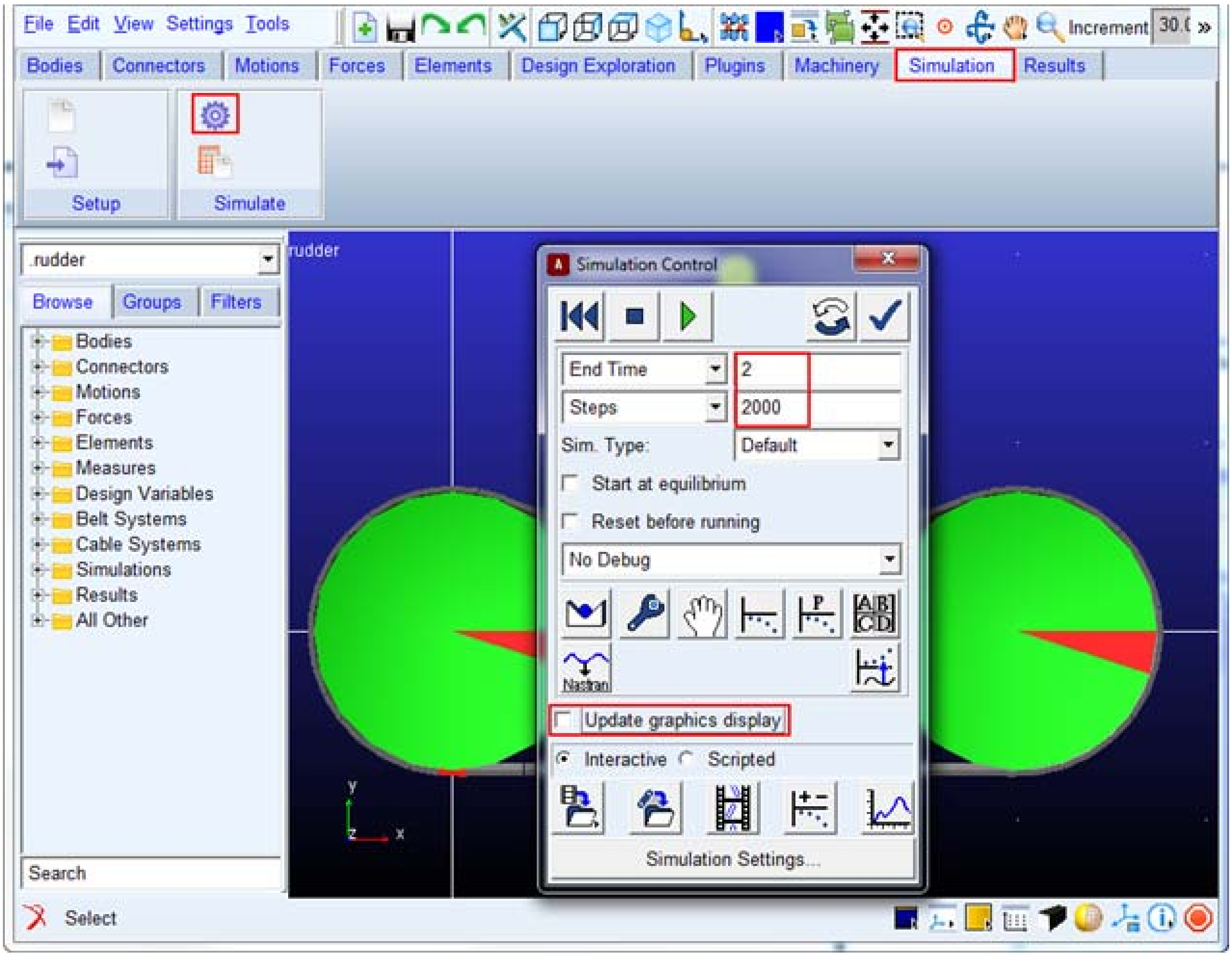
23. The **Actuate Belt** wizard is launched. In the Pulley Set **Name** field enter the name of the pulley set you just created (right-mouse-click in the field and use **Pick** or **Guesses** to quickly select). In the Actuator Pulley field enter the name of the driver pulley (right-mouse-click in the field and use **Pick** or **Guesses** to quickly select). Then click **Next**.
24. On the next page (**Type**) select **Motion** and click **Next.**
25. Complete the next page (**Function**) as shown below and click **Next**.



26. On the next page (**Output**) you can optionally reduce the amount of post-processing information about the actuator to be made available as Adams Requests. For this example, accept the defaults (to get all information) and click **Next**.
27. The next page (**Completion**) informs you that all the information required for the actuation has been entered. Optionally save the content of the entire wizard to a file for re-use later by clicking the **Save** icon. Click **Finish** to create the actuator.

Simulation

Simulate your model for 2 seconds at 2000 steps by clicking the **Interactive Simulation** icon from the **Simulate** container on the **Simulation** tab, entering the values shown below and clicking the **Start Simulation** button.



Adams/PostProcessor Results

Explore the results in Adams/PostProcessor