Machinery Bearing Tutorial

This tutorial teaches you how the Adams/Machinery Bearing module can be used to create a model of a bearing using the detailed method of type deep groove ball bearing single row. This also demonstrates how bearing module is being incorporated into other Adams/Machinery modules with ease.

This chapter includes the following sections:

What You Will Create

During this tutorial, you will model a Planetary Gear Set (imported) consisting of Sun gear, Ring gear and Planetary gears mounted on the carrier. Bearing of method "Detailed" of type "Deep Groove Ball Bearing Single Row" is used to mount the Sun gear on the shaft. Impose motion is applied to the bearing. The bearing will transmit the motion to the Sun gear and to the shaft accordingly.

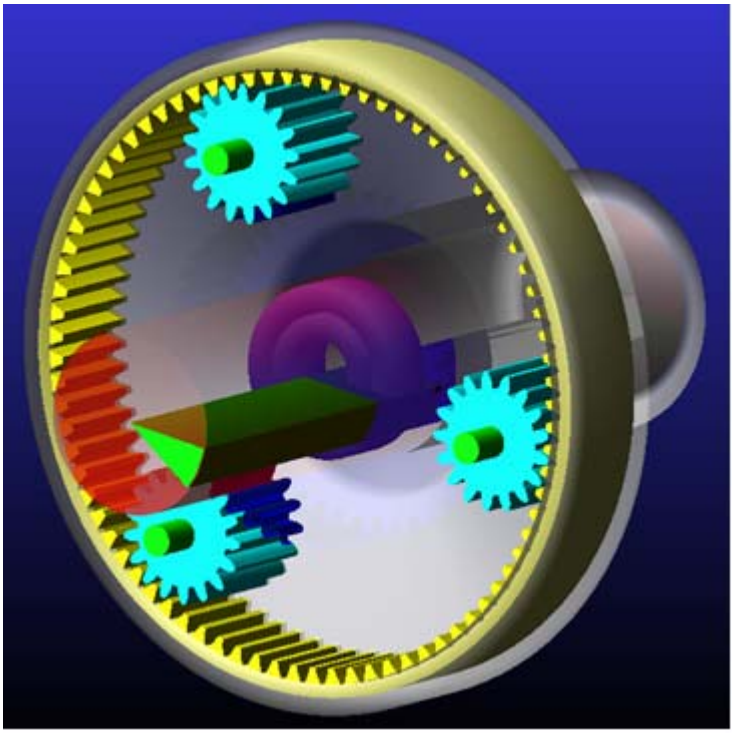
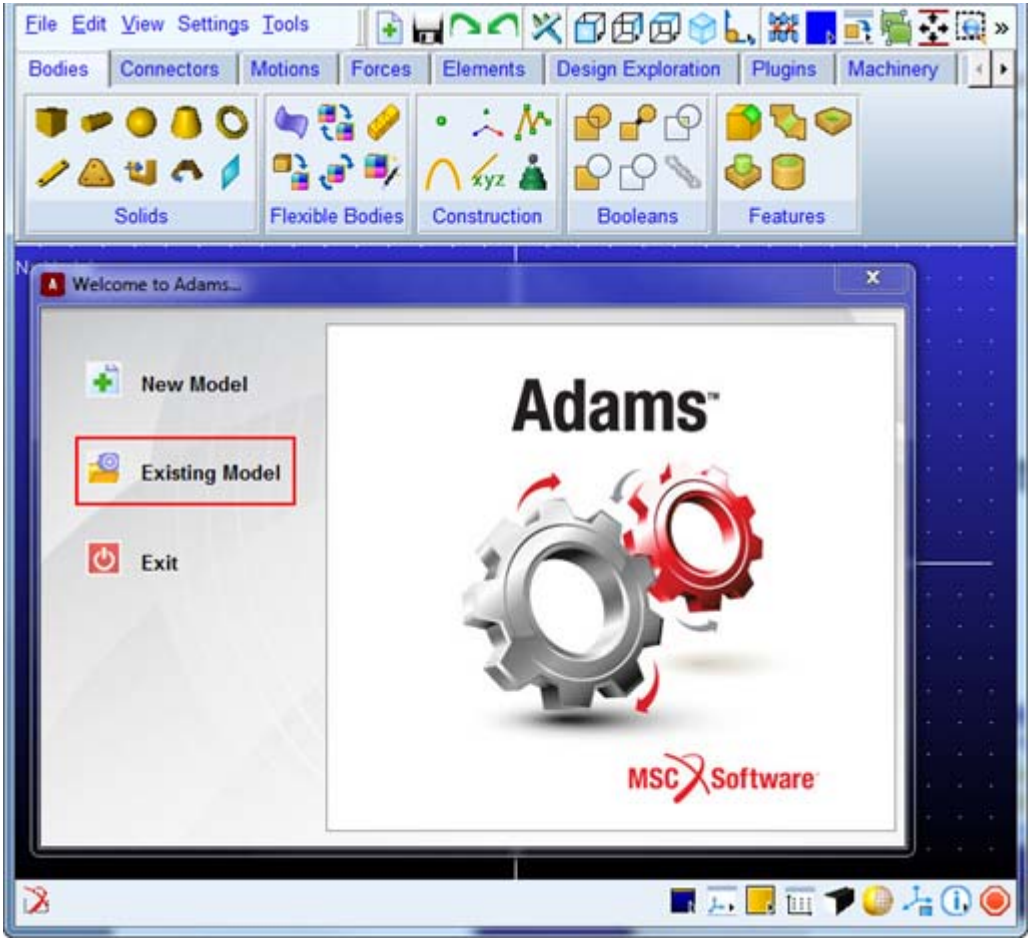


Figure 1 Bearing Module

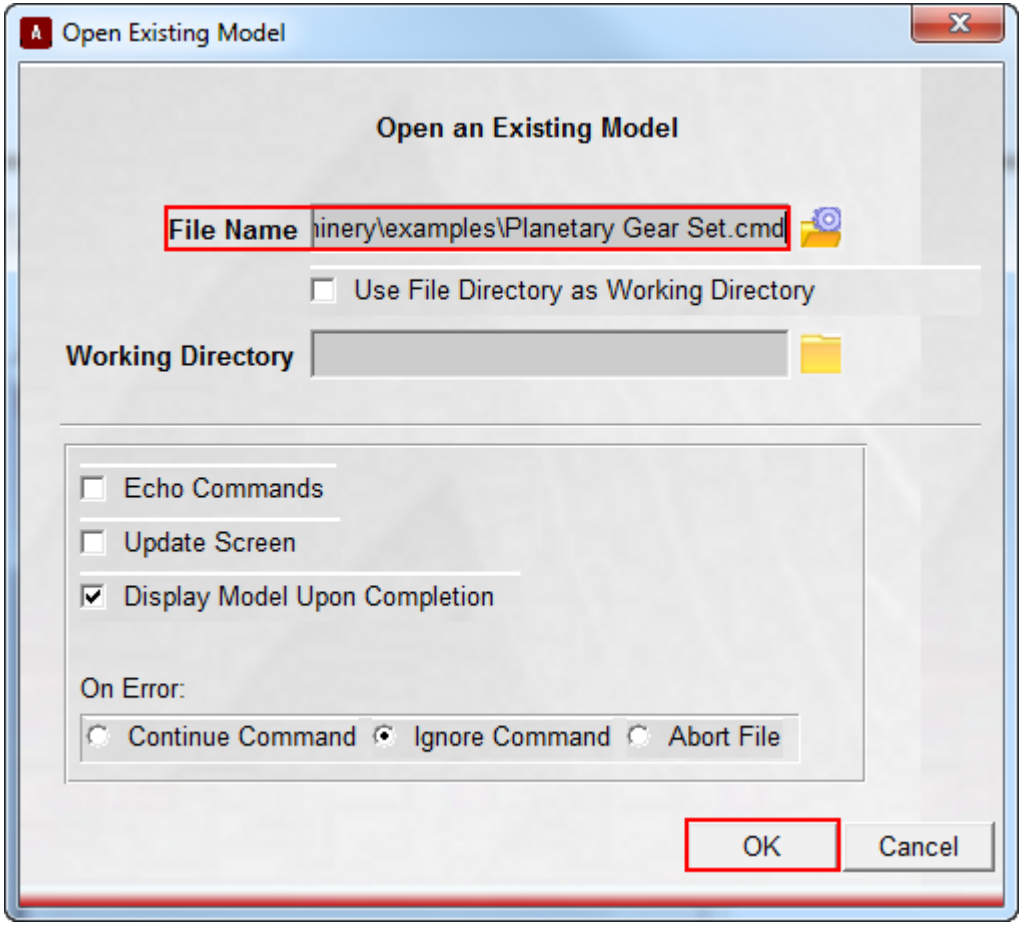
Creating Bearing Module

In this section, you will create a Planetary Gear Set (imported) consisting of Sun gear, Ring gear and Planetary gears mounted on the carrier.

1. Start **Adams 2013.2** → **AView** → **Adams - View**.
2. From the welcome screen click **Existing Model**.

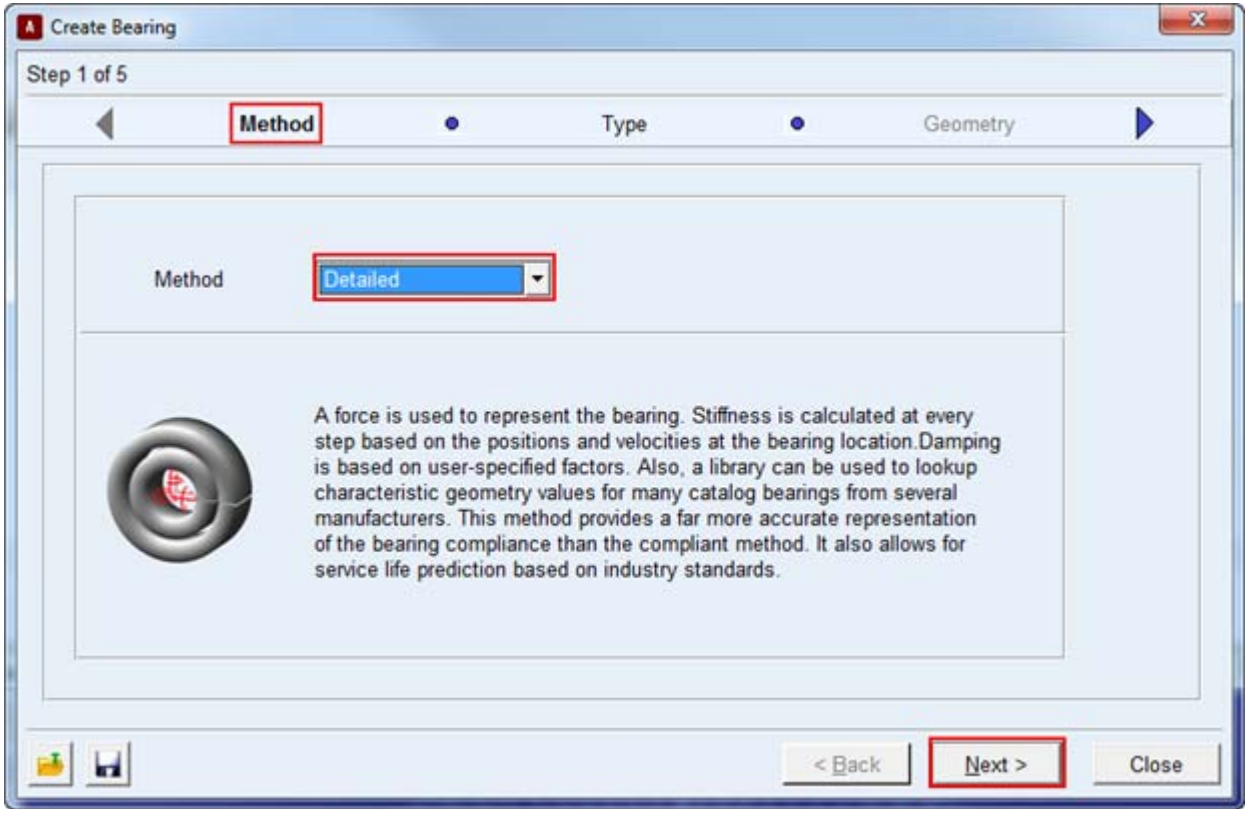


3. For the **File Name** browse and select the **Planetary Gear set.cmd** and click **OK**.

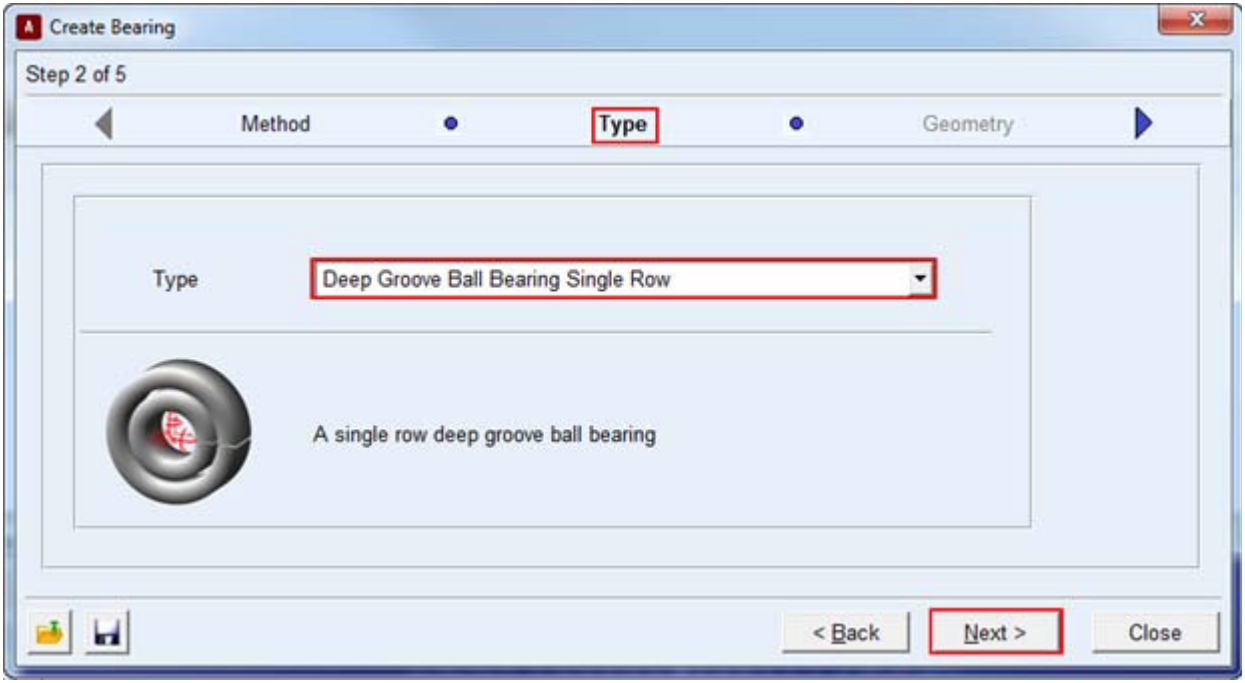


4. Click the **Machinery** tab on the Adams/View ribbon.
5. From the **Bearing** container, click the **Create Bearing** icon.

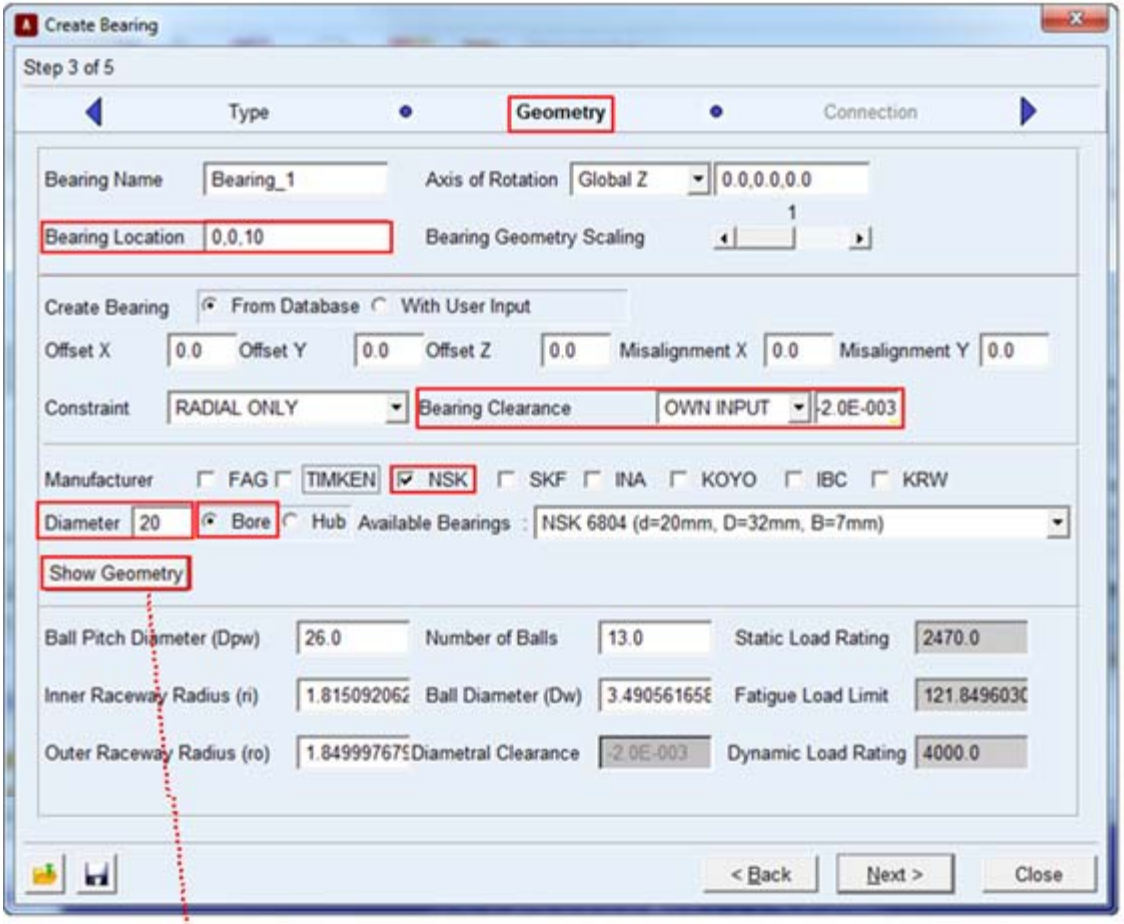
6. The bearing creation wizard will launch. On the first page (**Method**) select **Detailed** from the **Method** option menu and click **Next.**

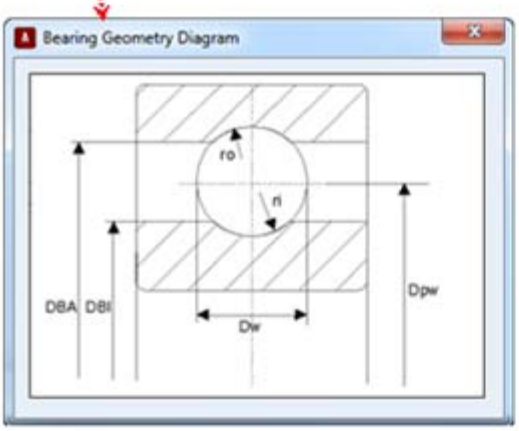


7. On the next page (**Type**) select **Deep Groove Ball Bearing Single Row** from the **Type** option menu and click **Next**.

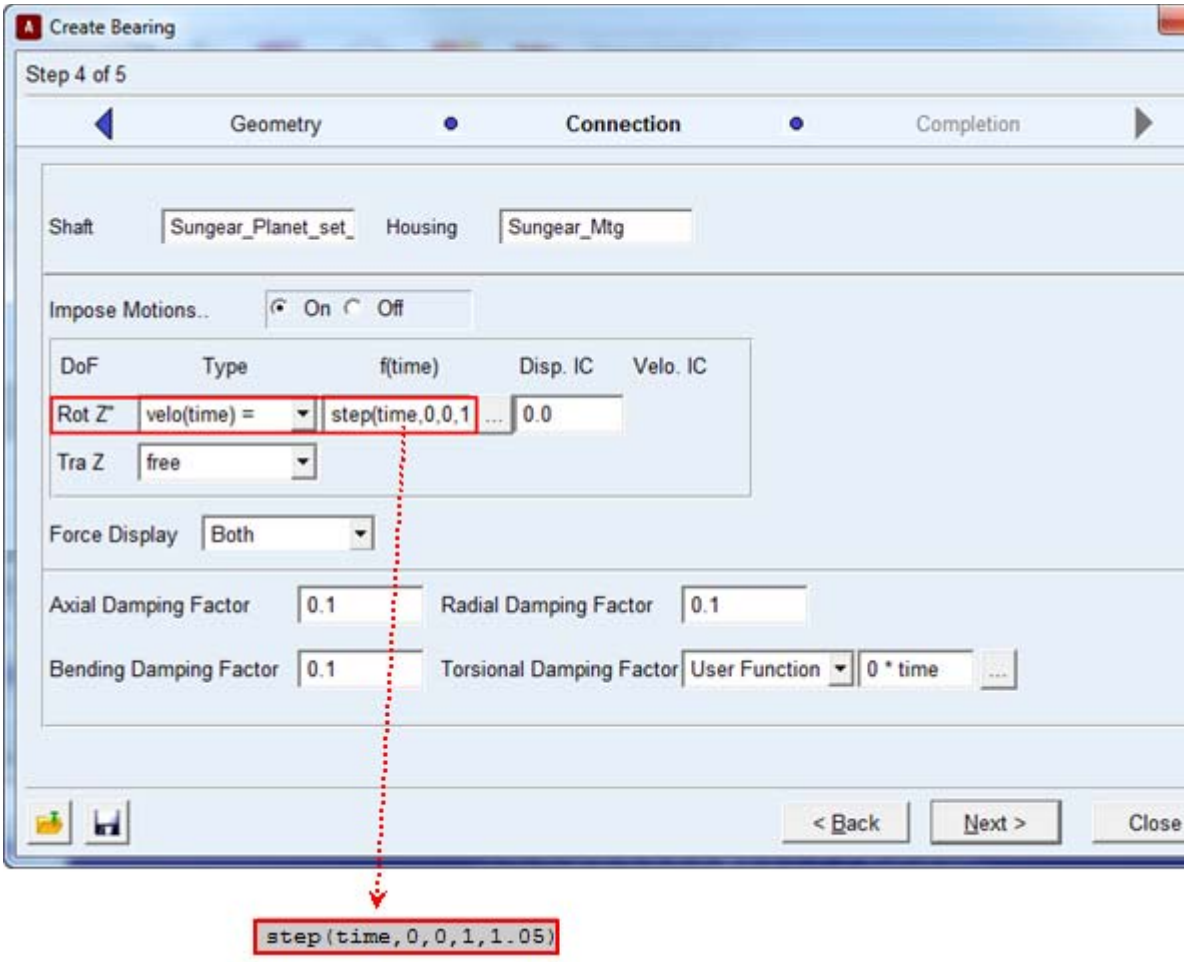


8. On the next page (**Geometry**) enter values for Bearing Location field as mentioned below. Select the bearing of your choice from the available manufacturer catalog by entering the diameter for **Bore** or **Hub**. For this example select **NSK** from the manufacturer list and enter the value **20** for bore diameter. Select **OWN INPUT** for bearing clearance and enter **-2um**. Accept the default values for the remaining fields and click **Next.**

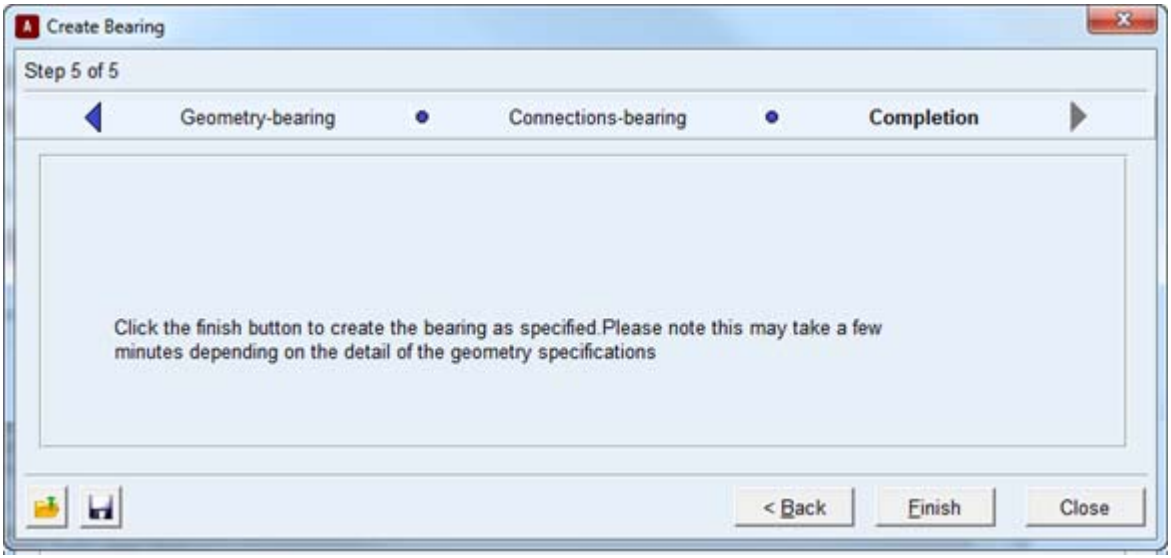

Create Bearing
Step 3 of 5
Type
Geometry
Connection
Bearing Name
Bearing_1
Axis of Rotation
Global Z
0.0,0.0,0.0
Bearing Location
0.0,10
Bearing Geometry Scaling
1
Create Bearing
From Database
With User Input
Offset X
0.0
Offset Y
0.0
Offset Z
0.0
Misalignment X
0.0
Misalignment Y
0.0
Constraint
RADIAL ONLY
Bearing Clearance
OWN INPUT
-2.0E-003
Manufacturer
FAG
TIMKEN
NSK
SKF
INA
KOYO
IBC
KRW
Diameter
20
Bore
Hub
Available Bearings
NSK 6804 (d=20mm, D=32mm, B=7mm)
Show Geometry
Ball Pitch Diameter (Dpw)
26.0
Number of Balls
13.0
Static Load Rating
2470.0
Inner Raceway Radius (ri)
1.815092062
Ball Diameter (Dw)
3.490561658
Fatigue Load Limit
121.849603(
Outer Raceway Radius (ro)
1.849997675
Diametral Clearance
-2.0E-003
Dynamic Load Rating
4000.0
< Back
Next >
Close


Bearing Geometry Diagram
ro
ri
DBA
DBI
Dw
Dpw

9. On the next page (**Connection**) you define how the bearing is to be connected to the rest of the model. For this example, pick "Sungear" for shaft and "sun_gear_mtg" for housing which mount sungear to shaft. Provide angular velocity around the rotational axis as input for the motion using a step function via function builder as shown below by clicking the radio button **On** from the impose motion field. Choose **Both** for force display field. Accept the default values for the remaining fields and click **Next**:

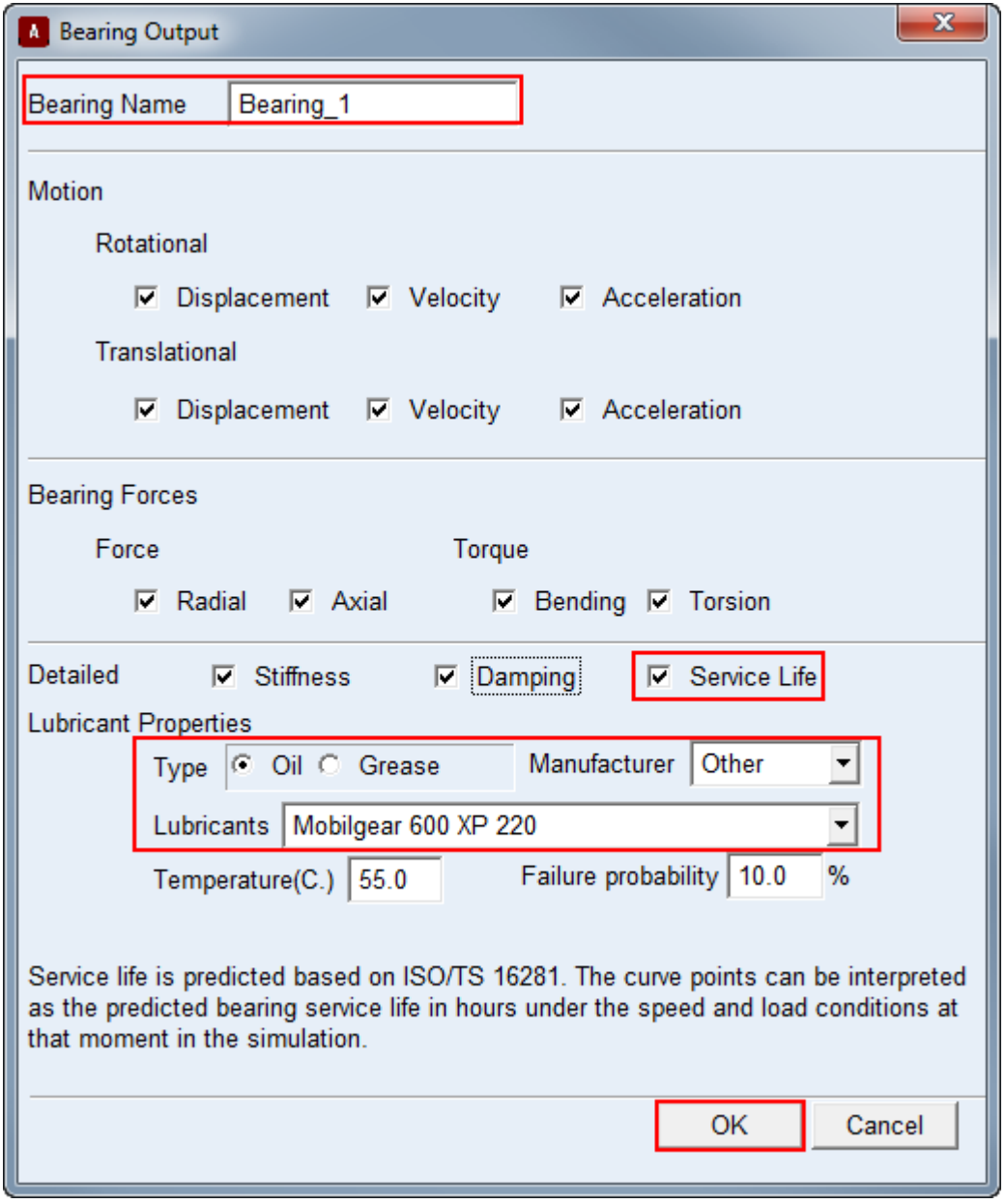


10. The next page (**Completion**) informs you that all the information required for the bearing creation has been entered. Here, optionally save the content of the entire wizard to a file for re-use later by clicking the **Save** icon. Click **Finish** to create the bearing.



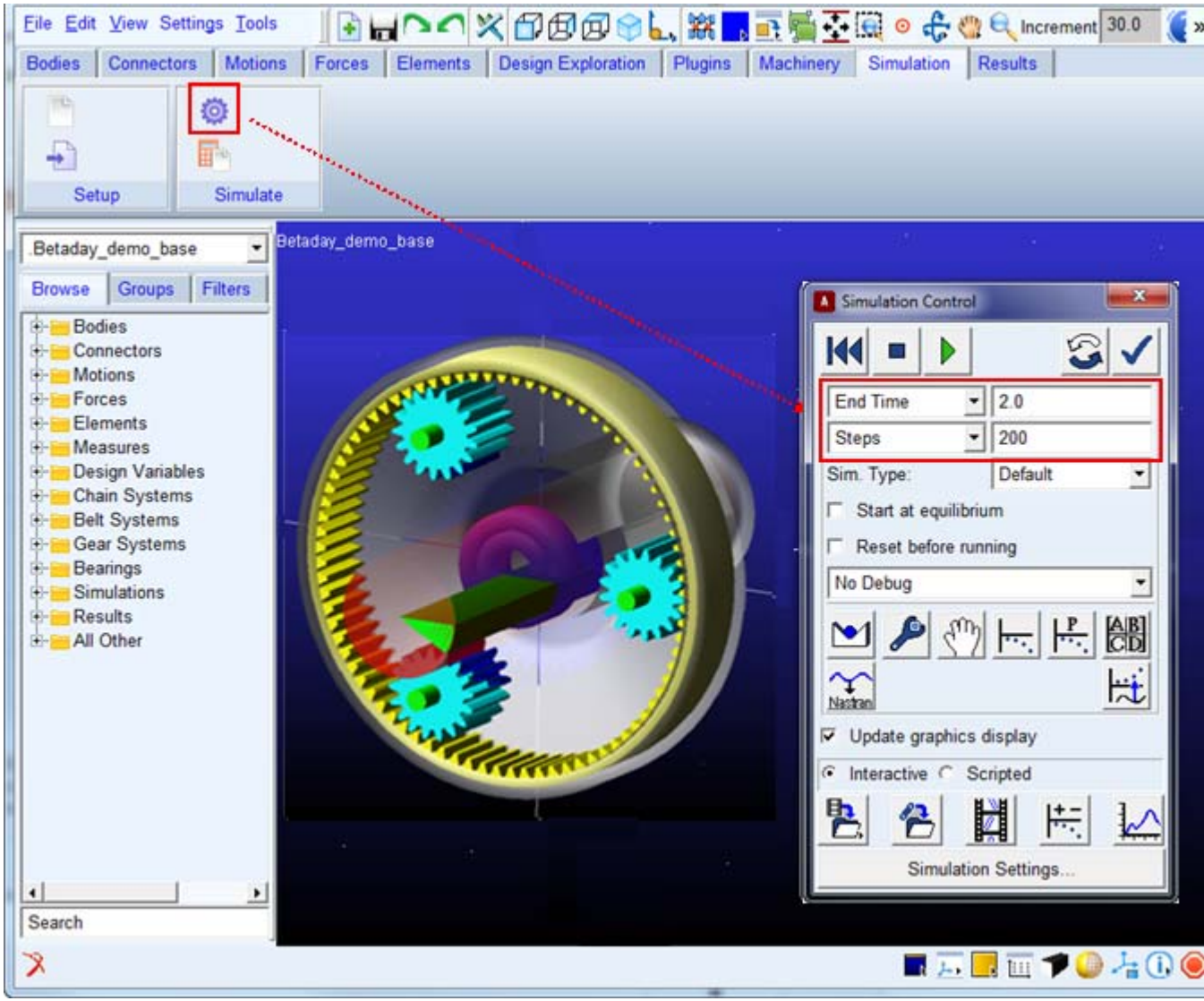
11. From the Bearing container, click the **Bearing output** icon.

12. Pick the recently created bearing "Bearing_1" for the bearing name. Make sure **Service Life** from the detailed section is selected as it is available by default. Choose your lubricant properties from the available options in the **Lubricant Properties** section. For this example, choose **Oil** for lubricant type, **Other** for manufacturer, **Mobilgear 600 XP 220** for lubricants and click **OK.**


Bearing Output
Bearing Name
Bearing_1
Motion
Rotational
Displacement
Velocity
Acceleration
Translational
Displacement
Velocity
Acceleration
Bearing Forces
Force
Radial
Axial
Torque
Bending
Torsion
Detailed
Stiffness
Damping
Service Life
Lubricant Properties
Type
Oil
Grease
Manufacturer
Other
Lubricants
Mobilgear 600 XP 220
Temperature(C.)
55.0
Failure probability
10.0
%
Service life is predicted based on ISO/TS 16281. The curve points can be interpreted as the predicted bearing service life in hours under the speed and load conditions at that moment in the simulation.
OK
Cancel

Simulation

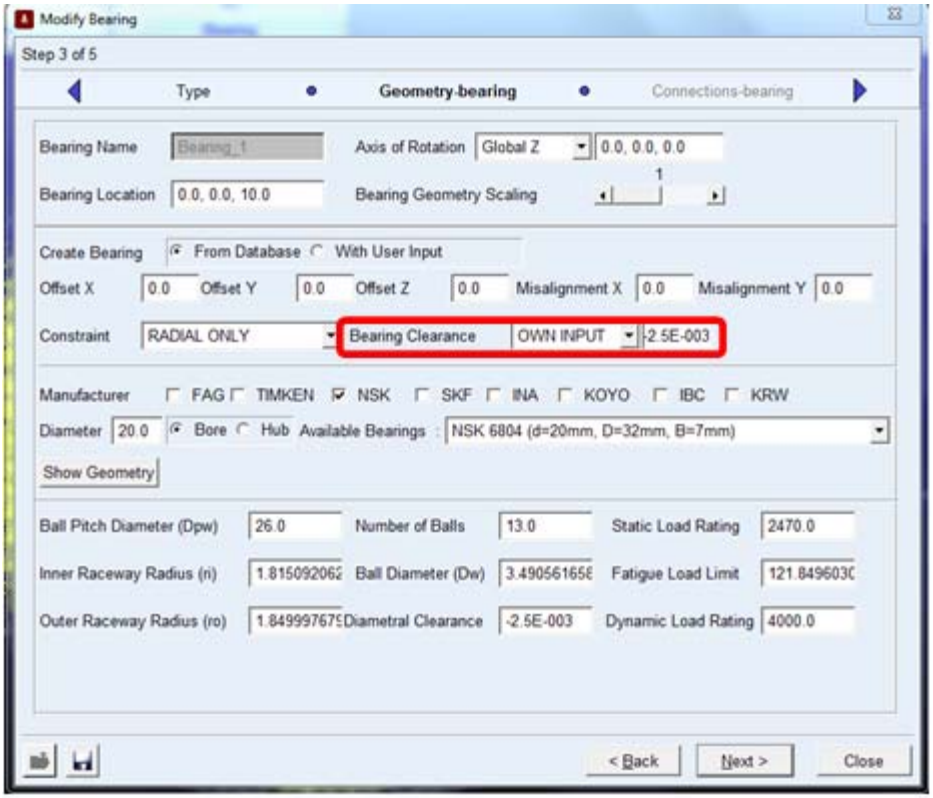
Simulate your model for 2 seconds at 200 steps by clicking the **Interactive Simulation** icon from the **Simulate** container on the **Simulation** tab, entering the values shown below and clicking the **Start Simulation** button.



1. Modify the Bearing clearance (operating condition) value as follows:
   a. From the graphics window right-click the Bearing ("Bearing_1") and select **Modify.**

b. Accept the default options and values for **Method** and **Type** Page.

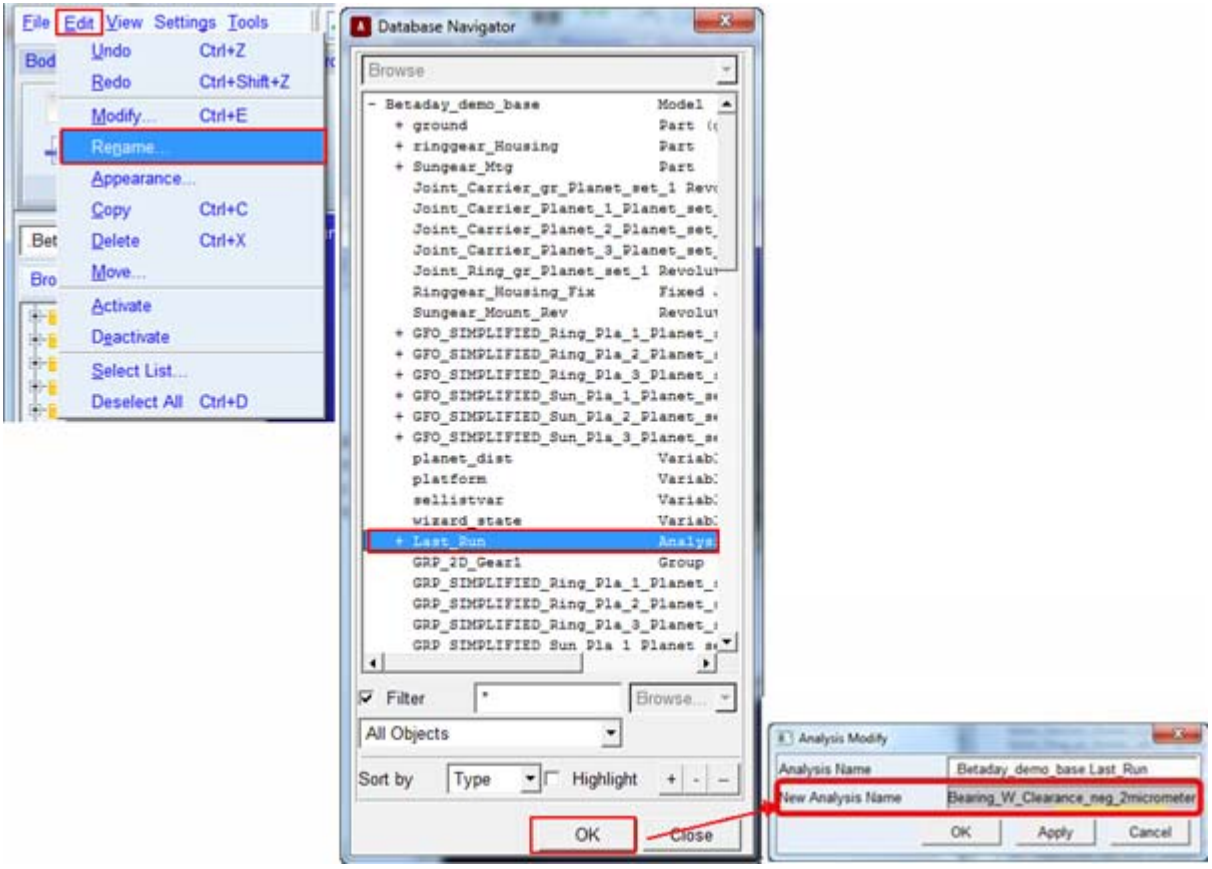
c. In the **Geometry** page, modify the bearing clearance value from **-2um** to **-2.5um** as shown below.



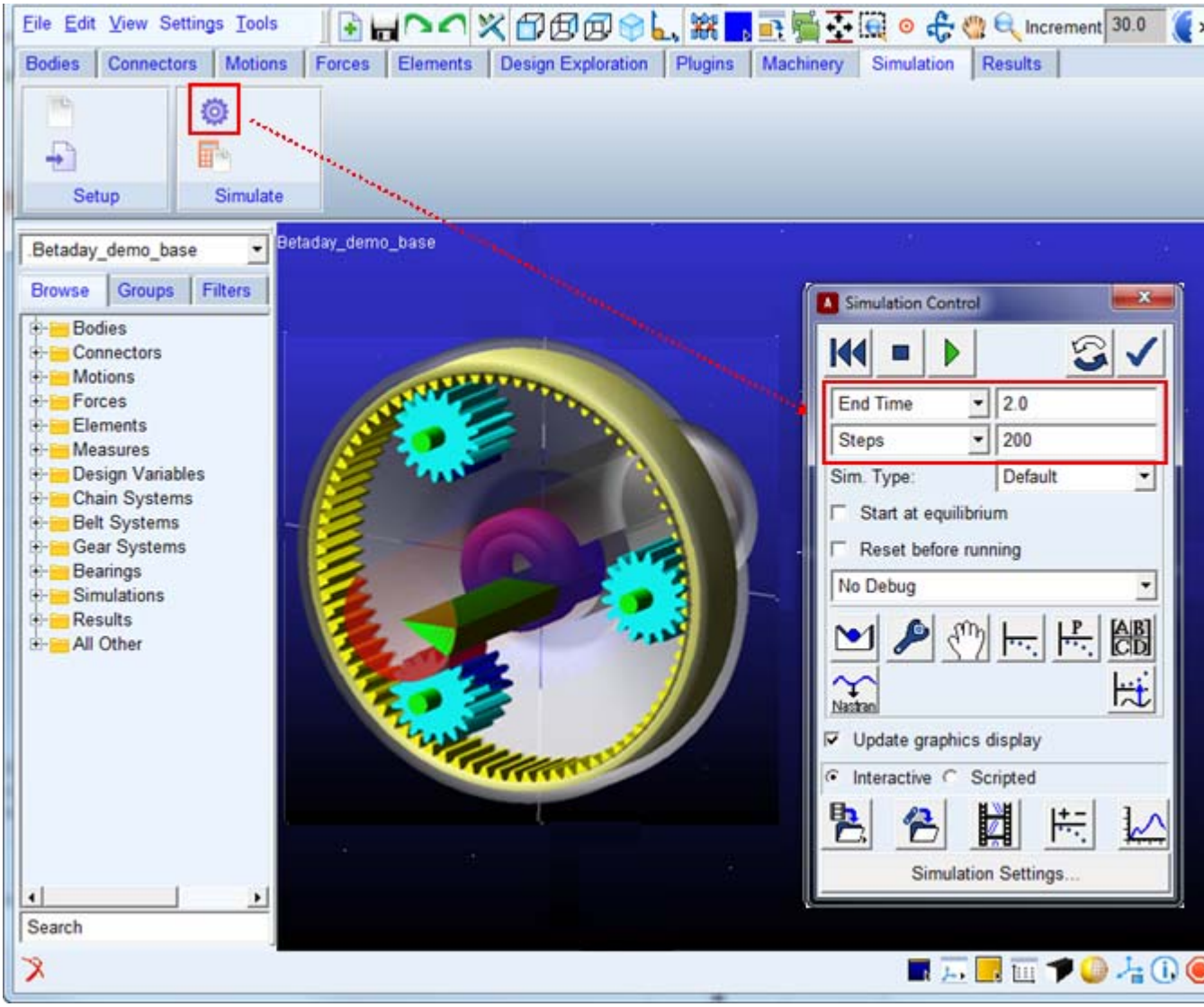
d. Accept the default options in the **Connection** page.

e. In the next page (**Completion**) click **Finish** to complete the bearing modification.

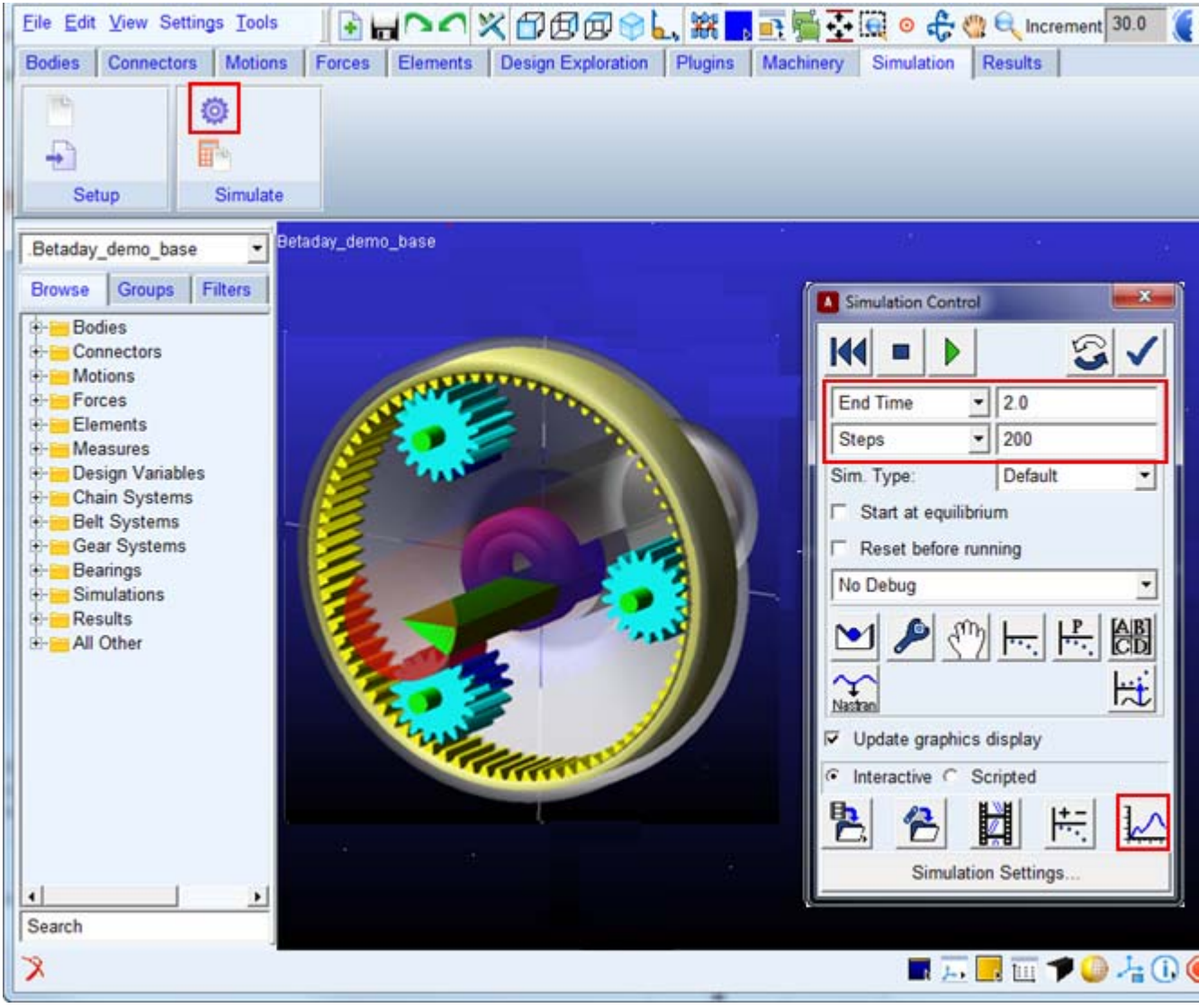
2. Before running the simulation, rename the "Last_Run" to "**XXXX.Bearing_W_Clearance_neg_2micrometer**".



3. Now simulate your model for 2 seconds at 200 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.

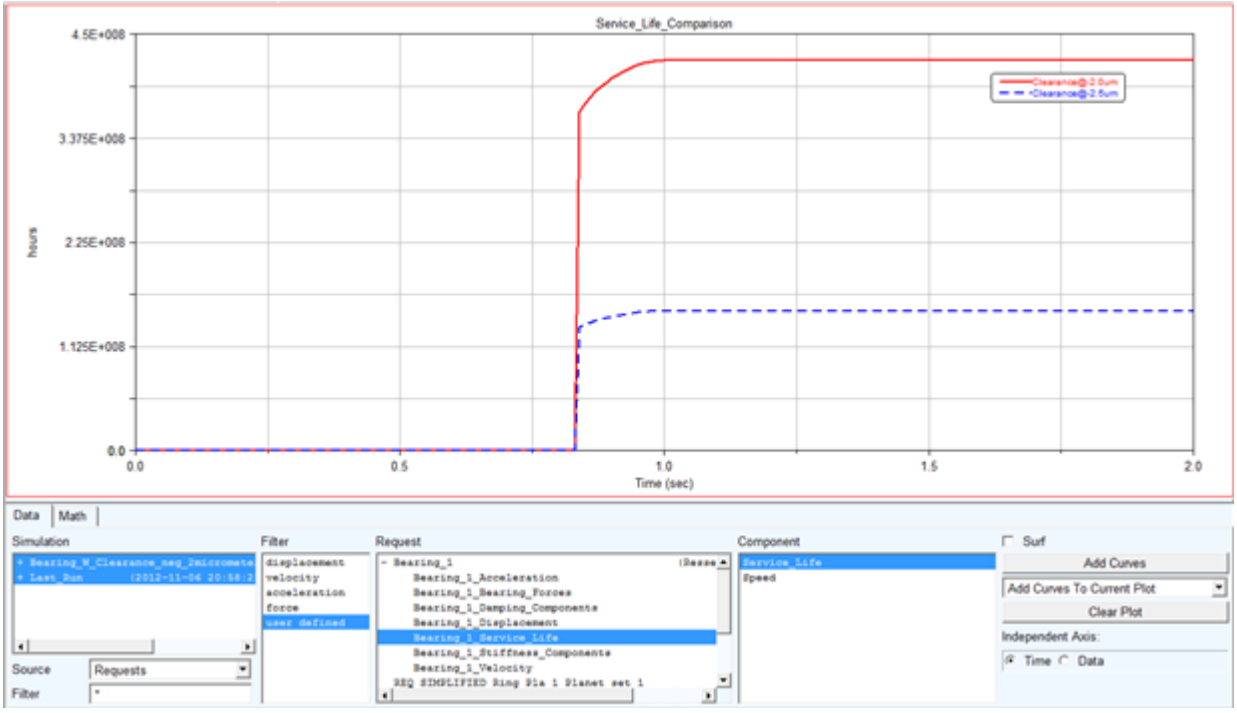


4. Switch to PostProcessor by clicking plotting icon from the Simulation Control.


File Edit View Settings Tools
Increment 30.0
Bodies Connectors Motions Forces Elements Design Exploration Plugins Machinery Simulation Results
Setup
Simulate
Betaday_demo_base
Browse Groups Filters
Bodies
Connectors
Motions
Forces
Elements
Measures
Design Variables
Chain Systems
Belt Systems
Gear Systems
Bearings
Simulations
Results
All Other
Search
Betaday_demo_base
Simulation Control
End Time 2.0
Steps 200
Sim. Type: Default
Start at equilibrium
Reset before running
No Debug
Nastran
Update graphics display
Interactive Scripted
Simulation Settings...

Adams/PostProcessor Results

Explore the results in Adams/PostProcessor. Compare the results of the predicted bearing service life before and after modification as shown below by selecting the items highlighted in blue and then by clicking "**Add Curves**" button under various loading conditions.



The plot shows that the bearing operating condition (Input) is having significant influence on the bearing service life (output).