Machinery Motor Tutorial

The Adams/Machinery Motor module provides for the modeling of motor systems within the Adams/View environment.

Three modeling methods are available:

- Curve Based
- Analytical
- External

Curve Based

The Adams/Machinery Motor module provides for the modeling of motor systems within the Adams/View environment. It supports multiple modeling methodology options. This example shows how to create motor using the curve-based method from the minimal set of input parameters.

This chapter includes the following sections:

What You Will Create

You will model a motor consisting of two parts (Stator and Rotor) with simple geometry. The stator and rotor will be attached to the ground and crank (Input) respectively. The crank is connected with a revolute joint and a spherical joint to the ground and connecting rod respectively. The connecting rod is connected to the rocker via a universal joint. The rocker is connected to ground via a revolute joint. The crank will be driven by the motor whose torque is defined by the user-input torque-speed curve.

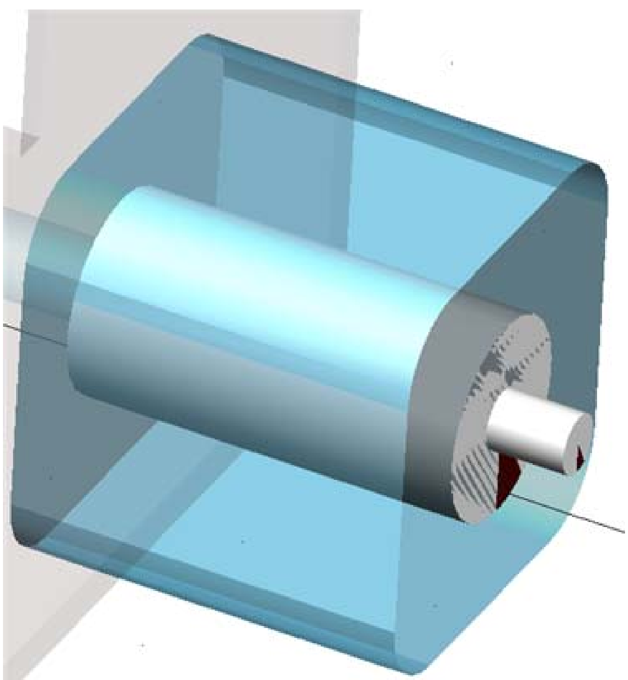
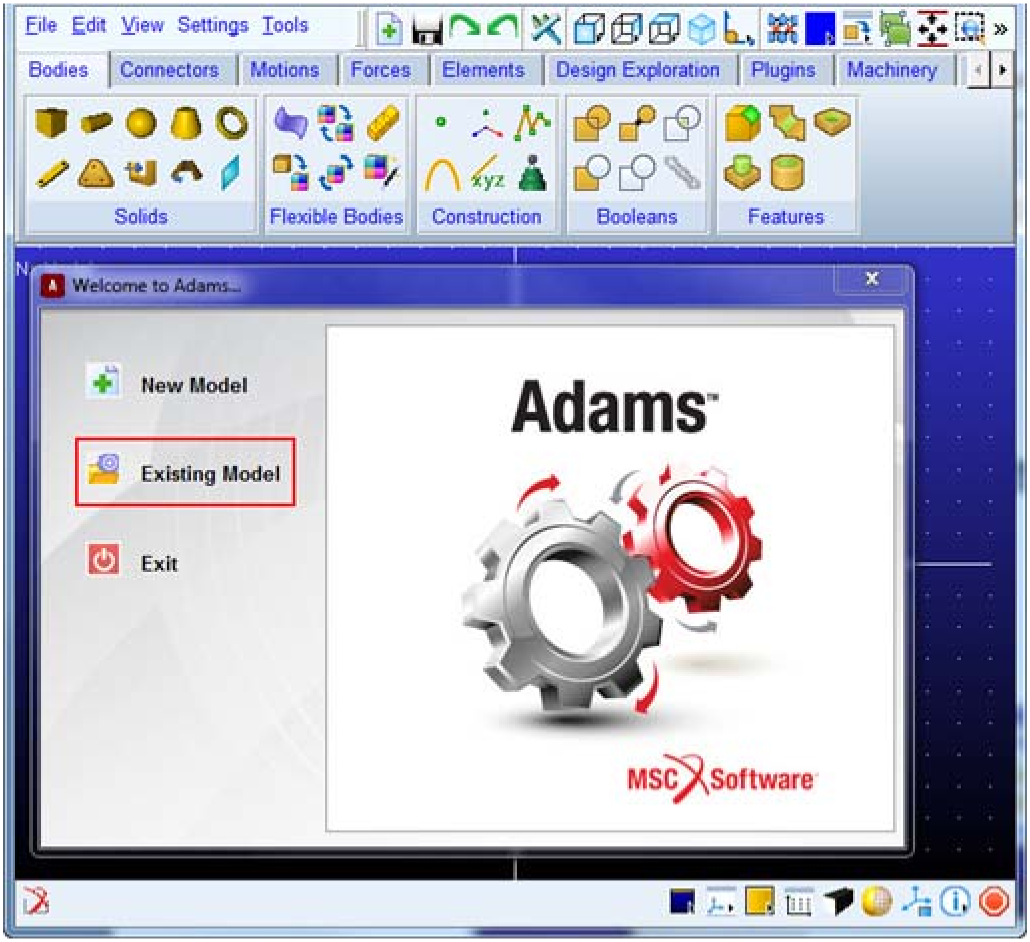


Figure 1 Motor Model

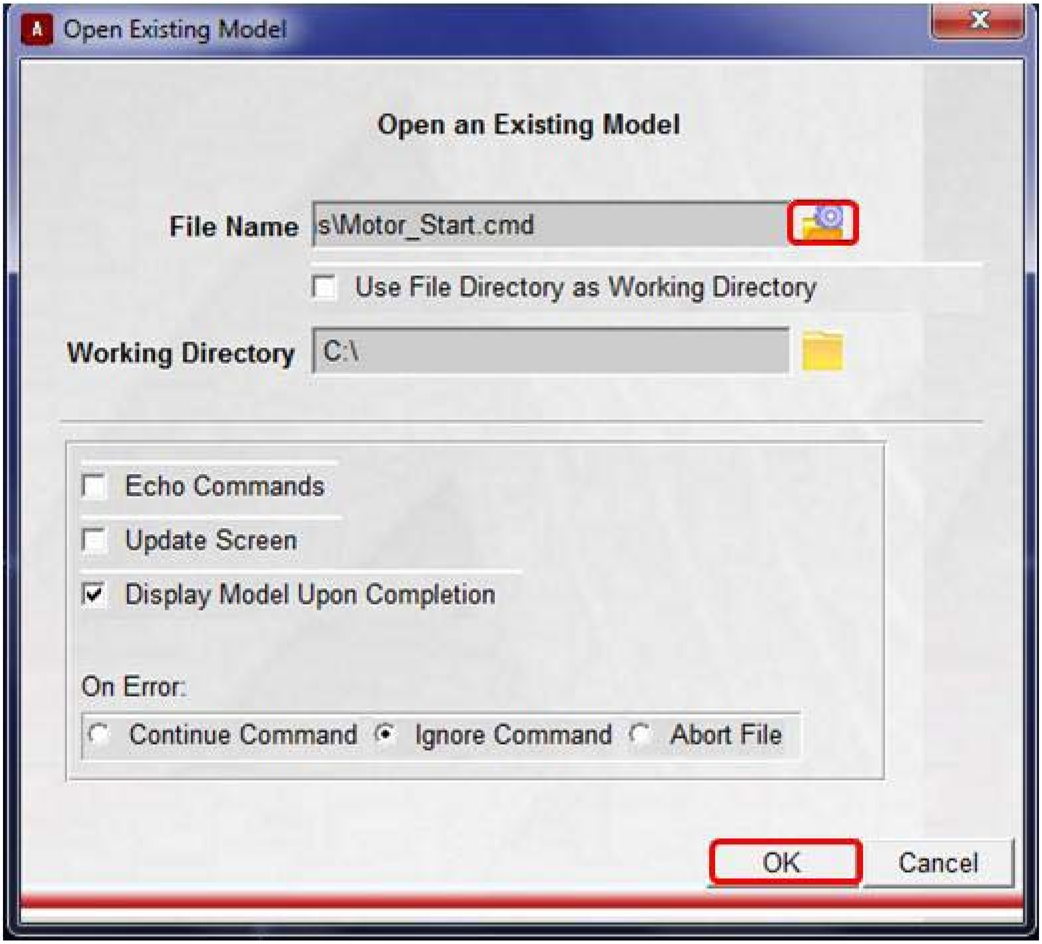
Curve Based Method Motor Model

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

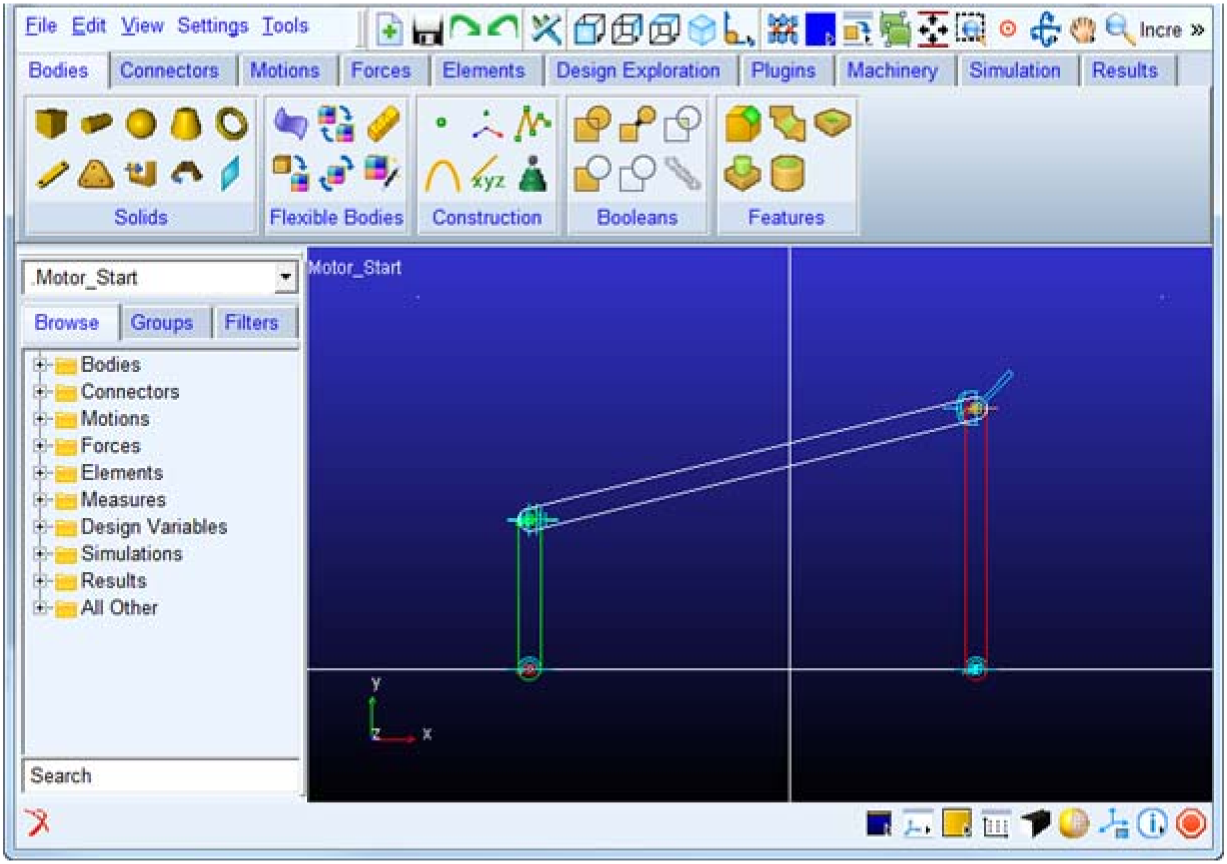


3. Open the model **Motor_Start.cmd** from the installation directory. For example, Windows 64 examples files placed in the below location: **C:\MSC.Software\Adams_x64\2013.2\amachinery\example\motor\Motor_Start.cmd**.

Tip:	Copy the example files folder and place it outside the working directory. Doing this, you can avoid having the working directory inside the Adams install folders.


Open Existing Model
Open an Existing Model
File Name
s\Motor_Start.cmd
Use File Directory as Working Directory
Working Directory
C:\
Echo Commands
Update Screen
Display Model Upon Completion
On Error:
Continue Command
Ignore Command
Abort File
OK
Cancel

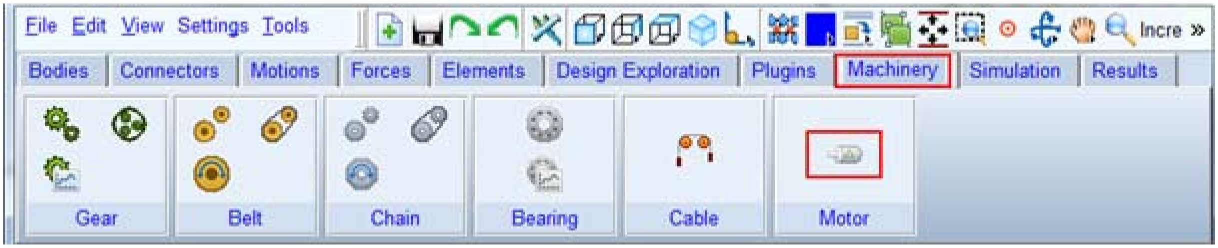
4. The imported model will look like the one shown below.



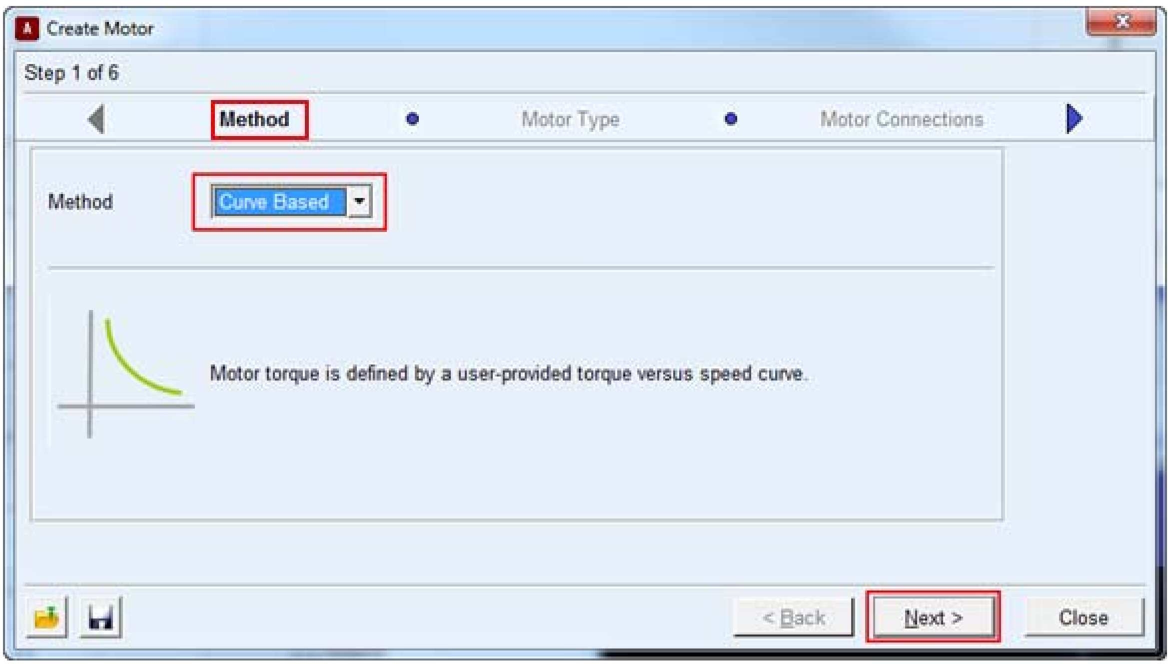
   a. It has:
      - Crank geometry connected with revolute and spherical joint with ground and connecting rod
      - Connecting rod is connected to rocker with universal joint
      - Rocker is connected to ground with revolute joint

5. Click the **Machinery** tab on the Adams/View ribbon.

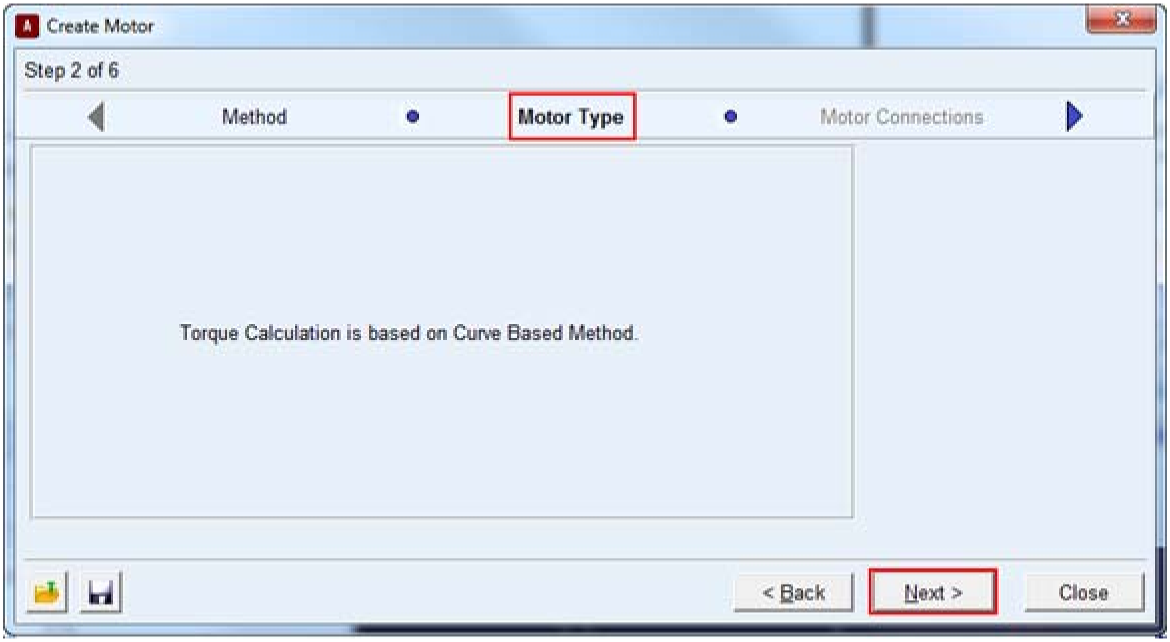
6. From the **Motor** container, click the icon for **Create Motor** icon.



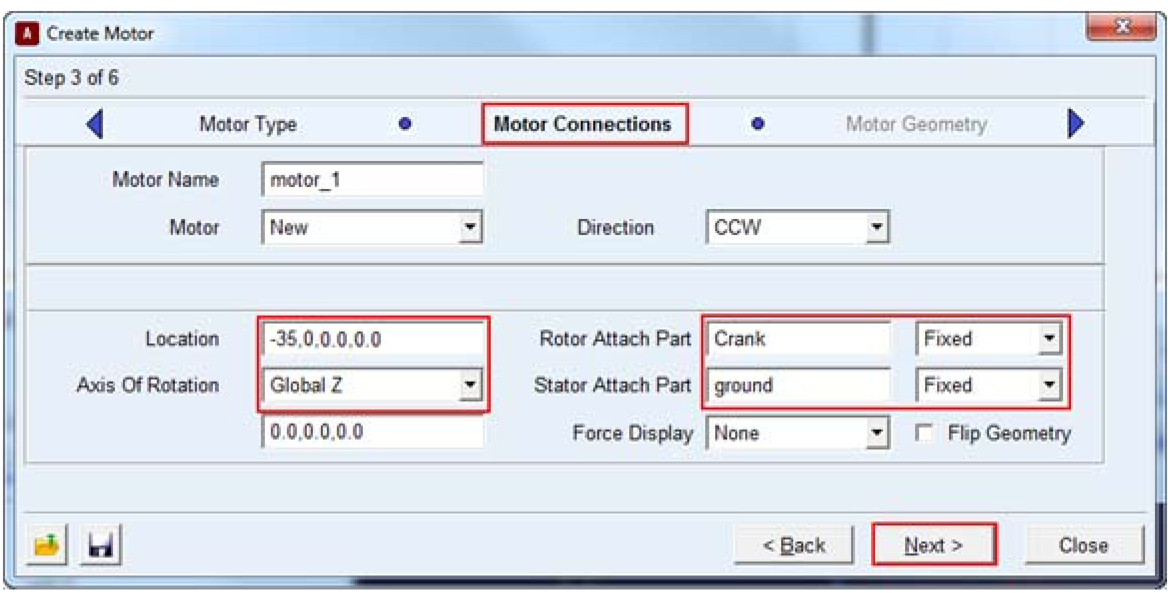
7. The motor creation wizard will launch. On the first page (**Method**) select **Curve_Based** from the **Method** option menu and click **Next**.



8. On the next page click **Next** to proceed (the curve-based method is not type-specific).



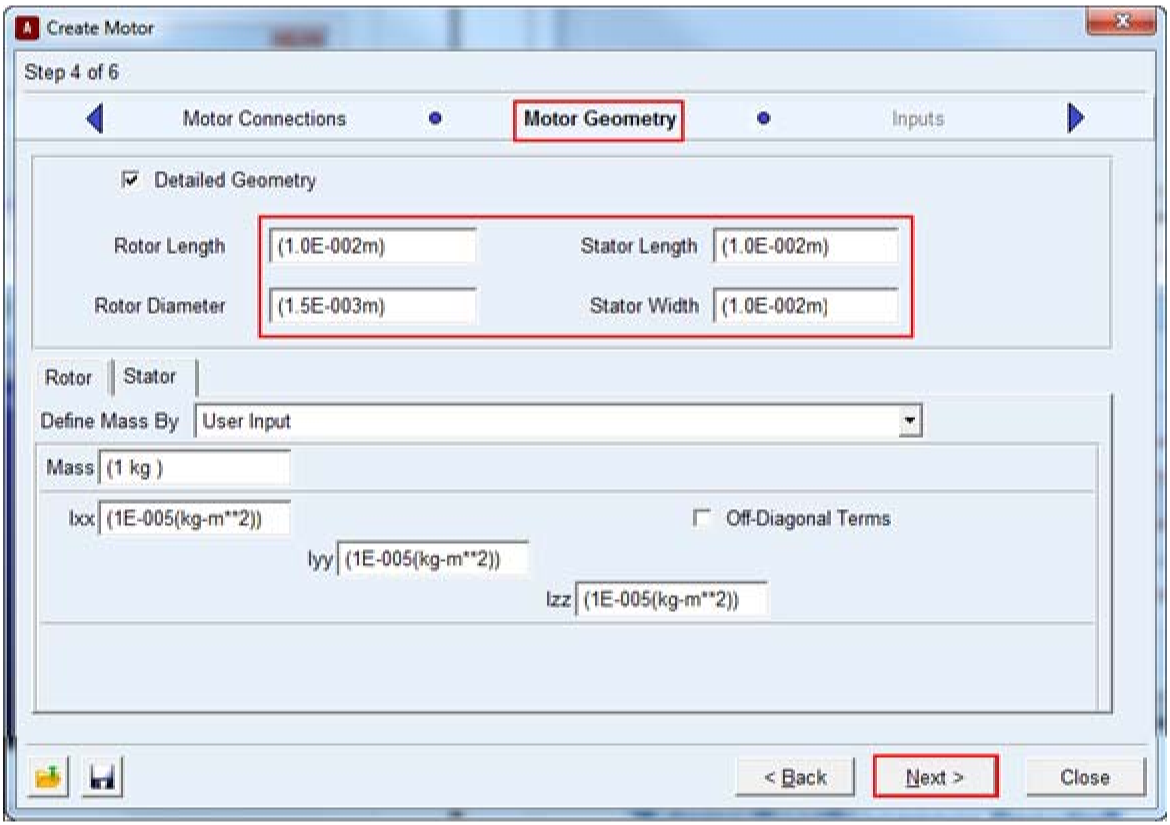
9. On the next page (**Motor Connection**) enter values for as given below (circled in Red) and click **Next**.



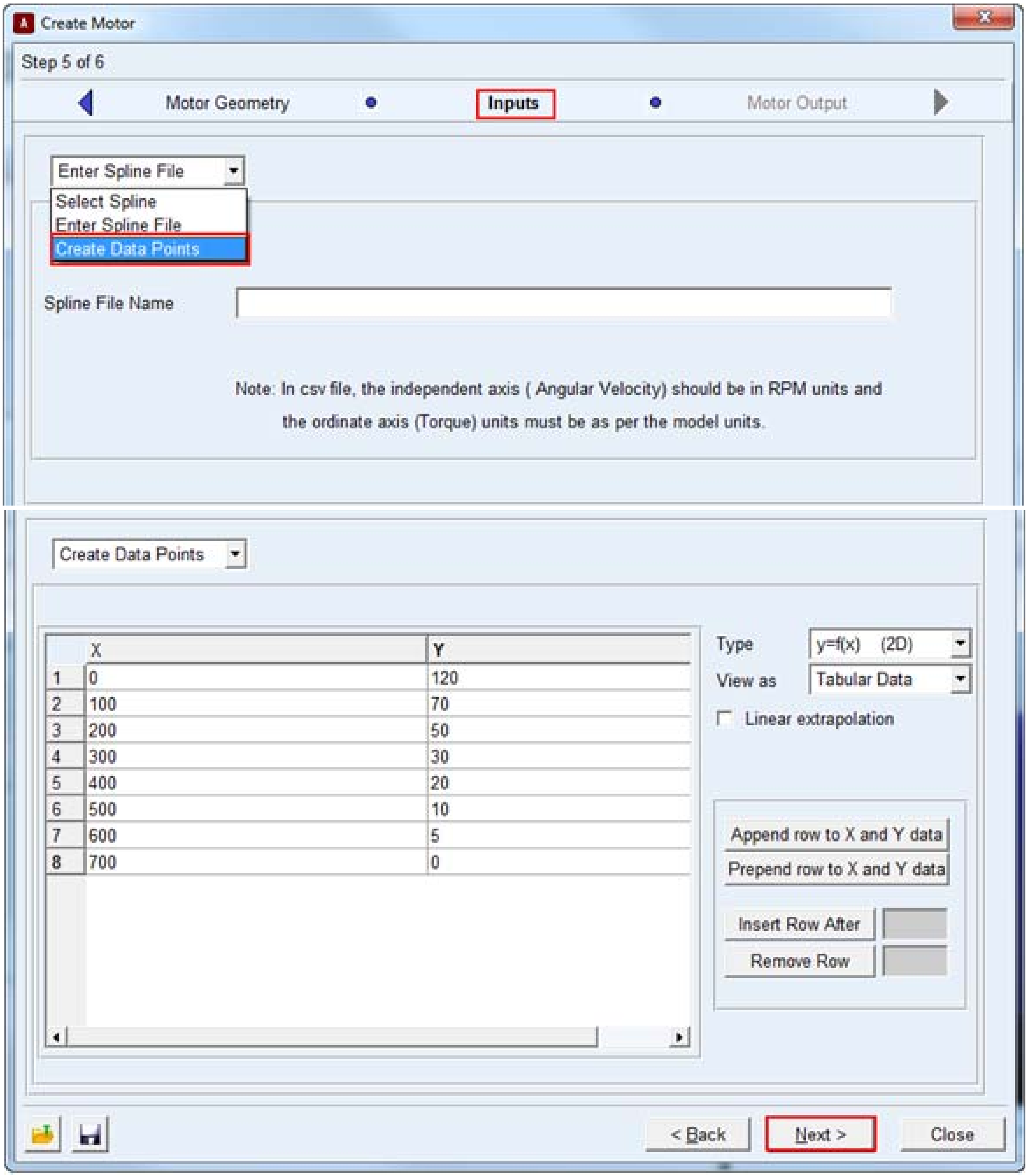
a. Enter the values for the following fields and accept the defaults for others as shown below

- Axis of Rotation as “Global Z”.
- Enter the values “-35.0,0.0,0.0” in mm for location.
- Rotor attach part as “Crank” from right-mouse-button option Guesses.
- Stator attach part as “ground” from right-mouse-button option Guesses.

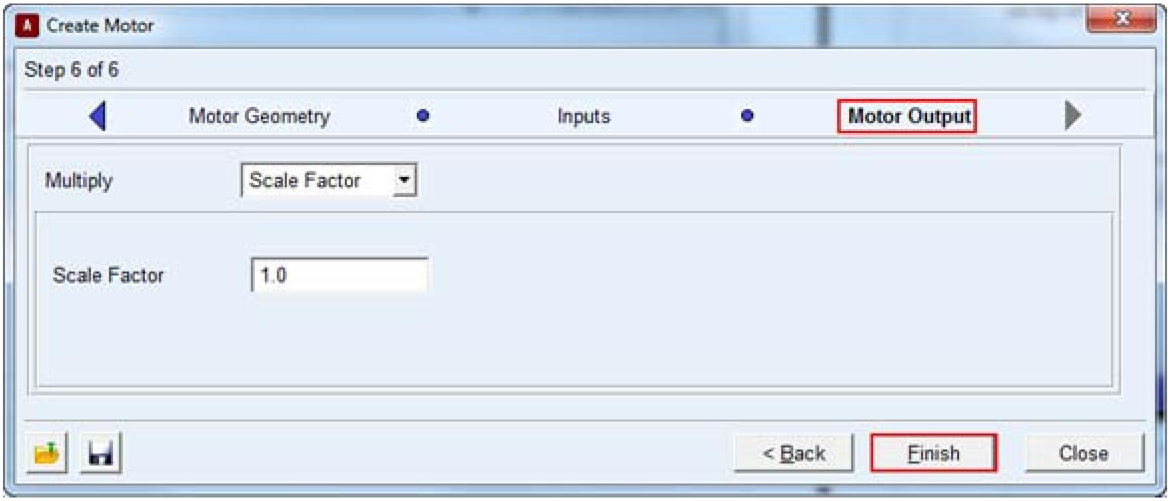
10. In the **Motor Geometry**, enter the values (circled in red) as shown below and accept the default values for others and click **Next**.



11. In the **Inputs** page select **Create_Data_Points** options and accept the default values. Click **Next**.

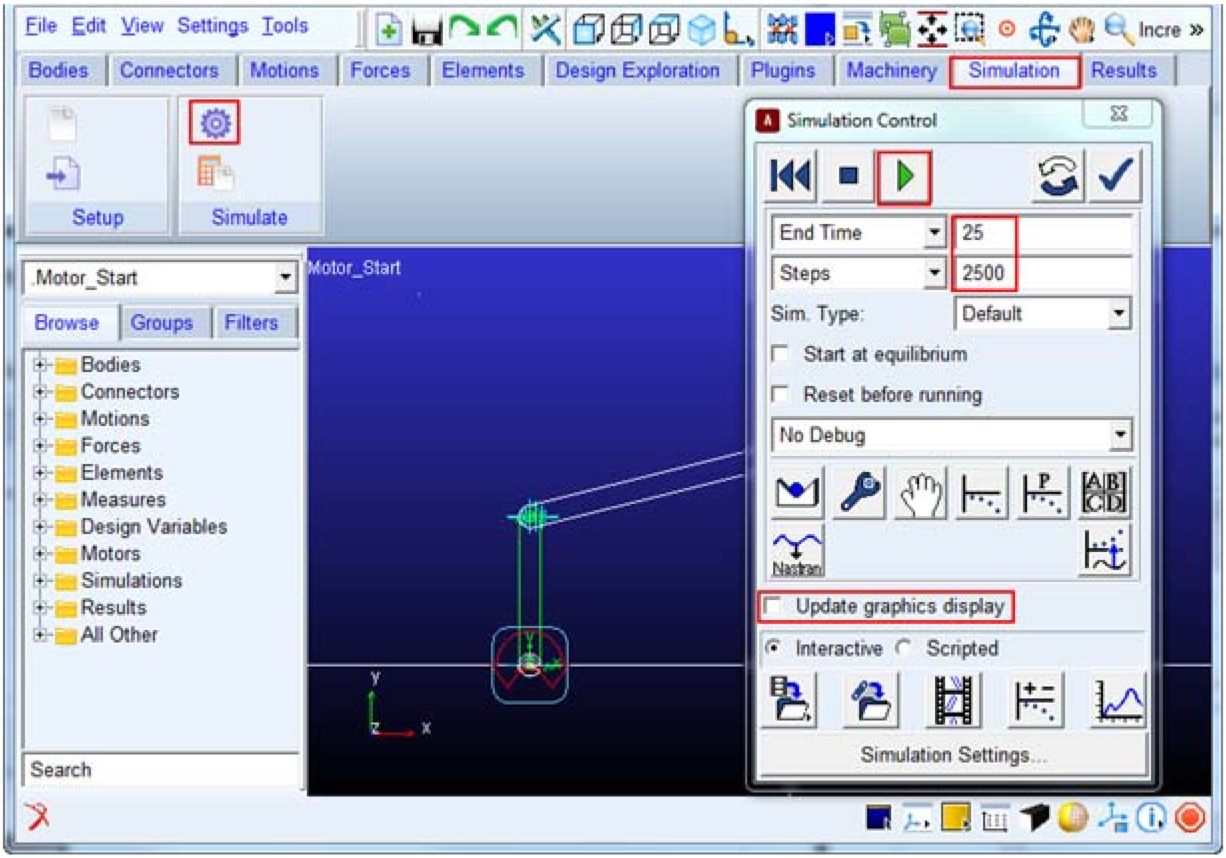


12. Accept the default values in the next page (**Motor Output**) and click **Finish**.



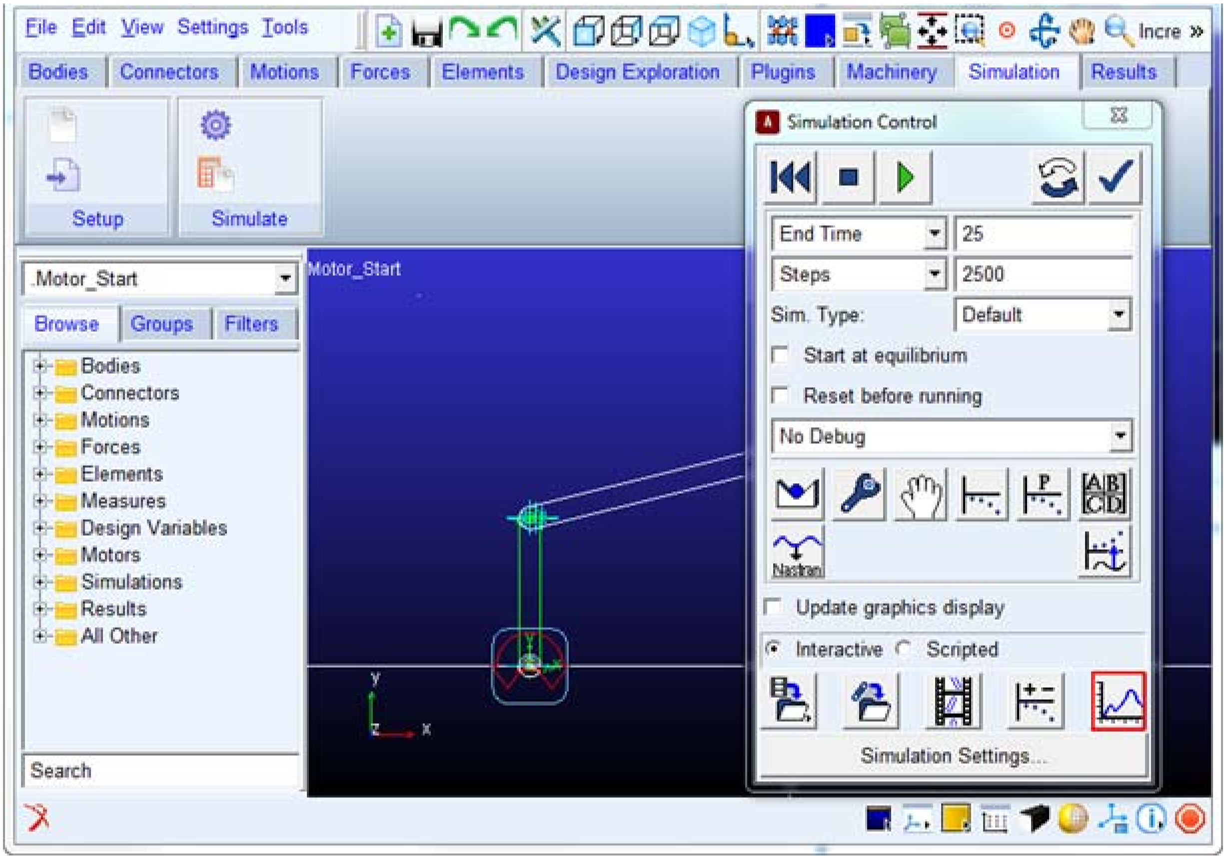
Simulation

Simulate your model for 25 seconds at 2500 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.

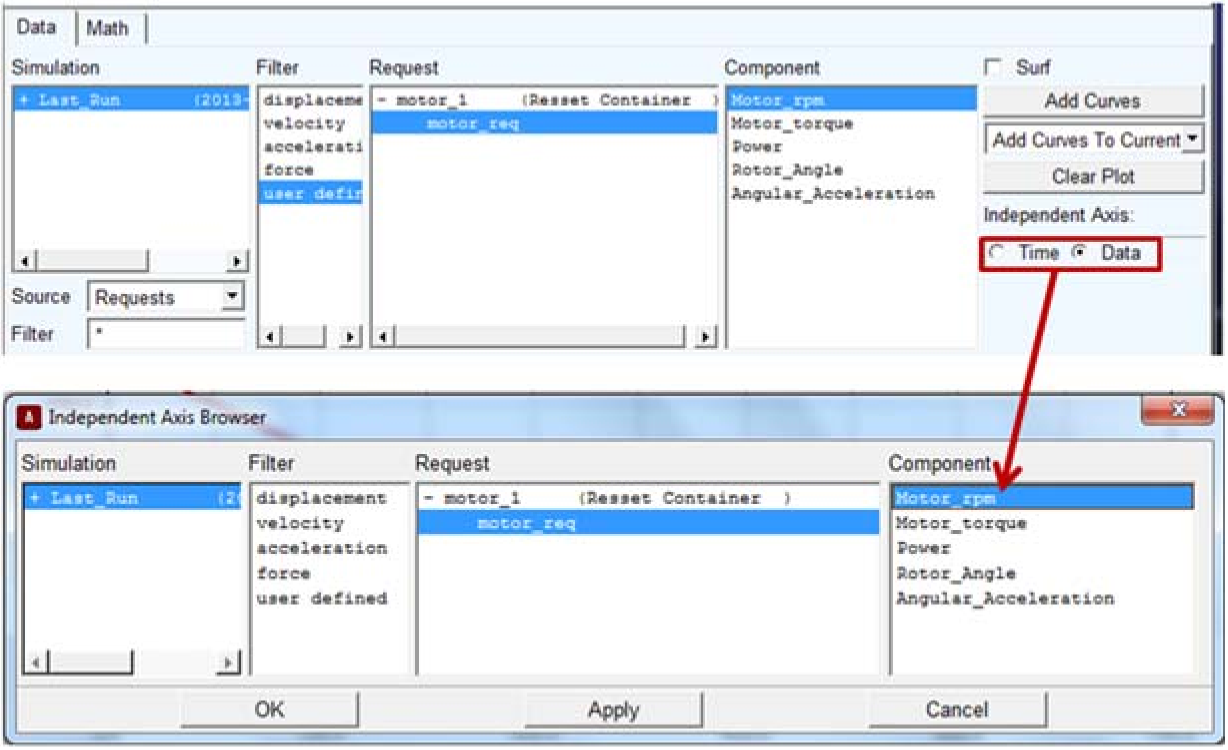


Adams/PostProcessor Results

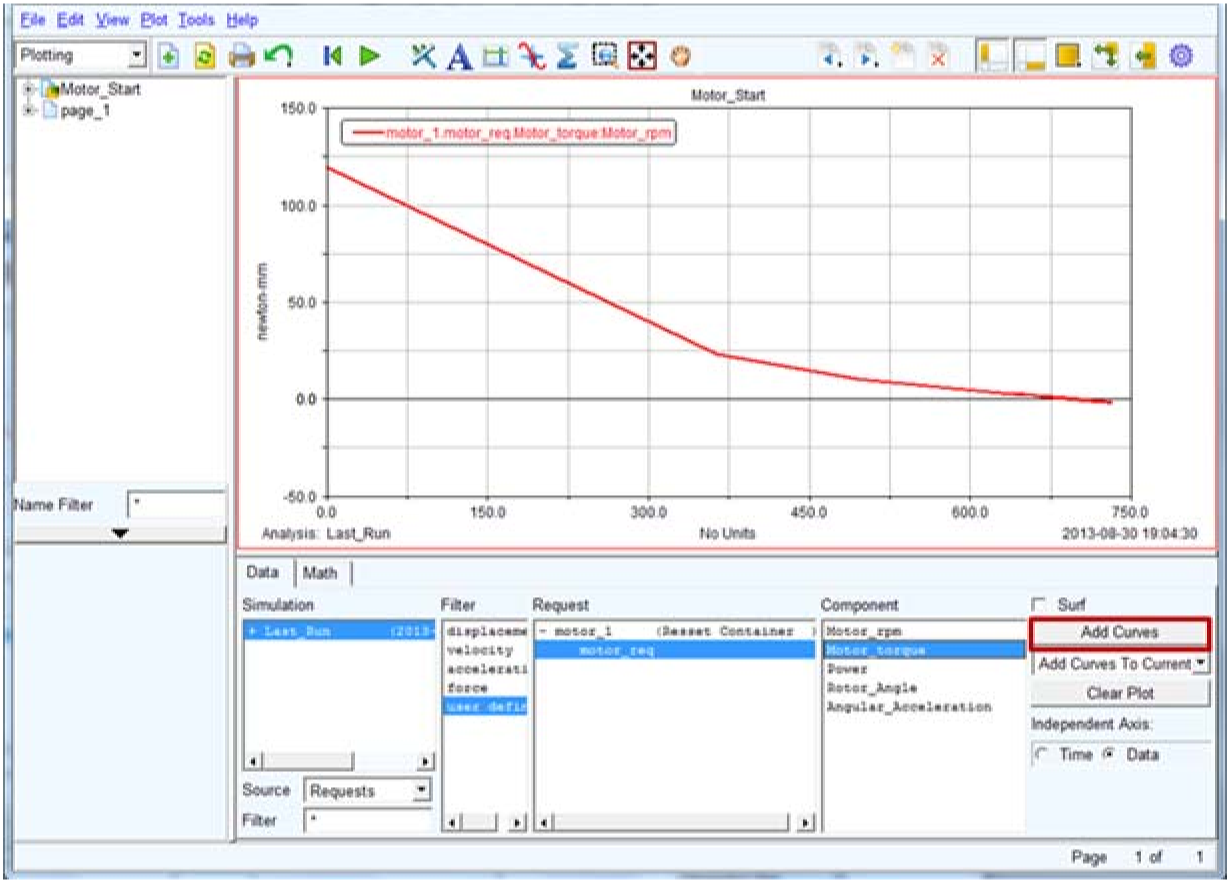
1. Switch to PostProcessor by clicking plotting icon from the Simulation Control.



2. In the Post Processor, Select the **Motor_rpm** as data for independent axis as shown below.



3. Select the items highlighted in blue below and then by clicking **Add Curves** button to plot the motor rpm vs torque.


File Edit View Plot Tools Help
Plotting
Motor_Start
page_1
Name Filter
Motor_Start
motor_1.motor_req.Motor_torque:Motor_rpm
newton-mm
150.0
100.0
50.0
0.0
-50.0
0.0
150.0
300.0
450.0
600.0
750.0
Analysis: Last_Run
No Units
2013-08-30 19:04:30
Data
Math
Simulation
Filter
Request
Component
Surf
Last_Run
displaceme
velocity
accelerati
force
user defin
motor_1
(Beeset Container
motor_req
Motor_rpm
Motor_torque
Power
Rotor_Angle
Angular_Acceleration
Add Curves
Add Curves To Current
Clear Plot
Independent Axis:
Time
Data
Source
Requests
Filter
Page 1 of 1

Analytical

The Adams/Machinery Motor module provides for the modeling of motor systems within the Adams/View environment. It supports multiple modeling methodology options including an analytical modeling method which supports multiple motor types: DC, AC Synchronous, DC Brushless and Stepper. This example shows how to create a motor of type DC of method analytical from the minimal set of input parameters.

This chapter includes the following sections:

What You Will Create

You will model a motor consisting of two parts (Stator and Rotor) with simple geometry. The stator and rotor will be attached to the ground and crank (Input) respectively. The crank is connected with a revolute joint and a spherical joint to the ground and connecting rod respectively. The connecting rod is connected to the rocker via a universal joint. The rocker is connected to ground via a revolute joint. The crank will be driven by the motor whose torque is defined by an analytical, equation-based calculation.

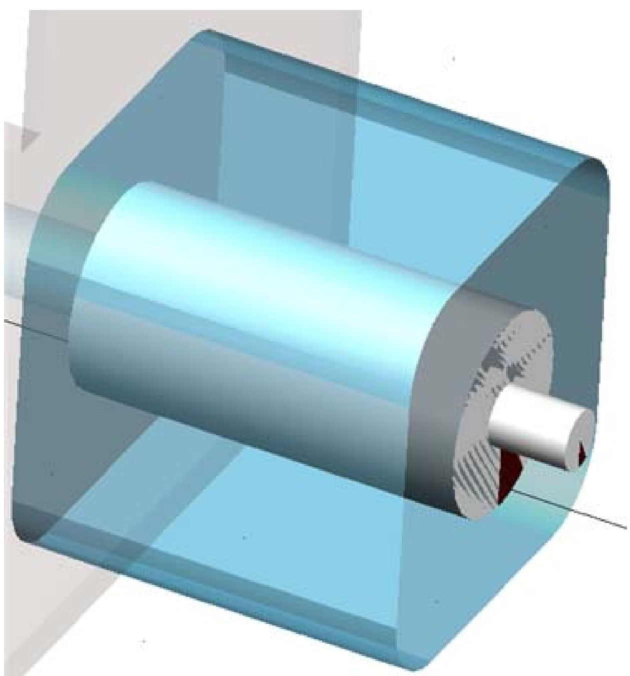
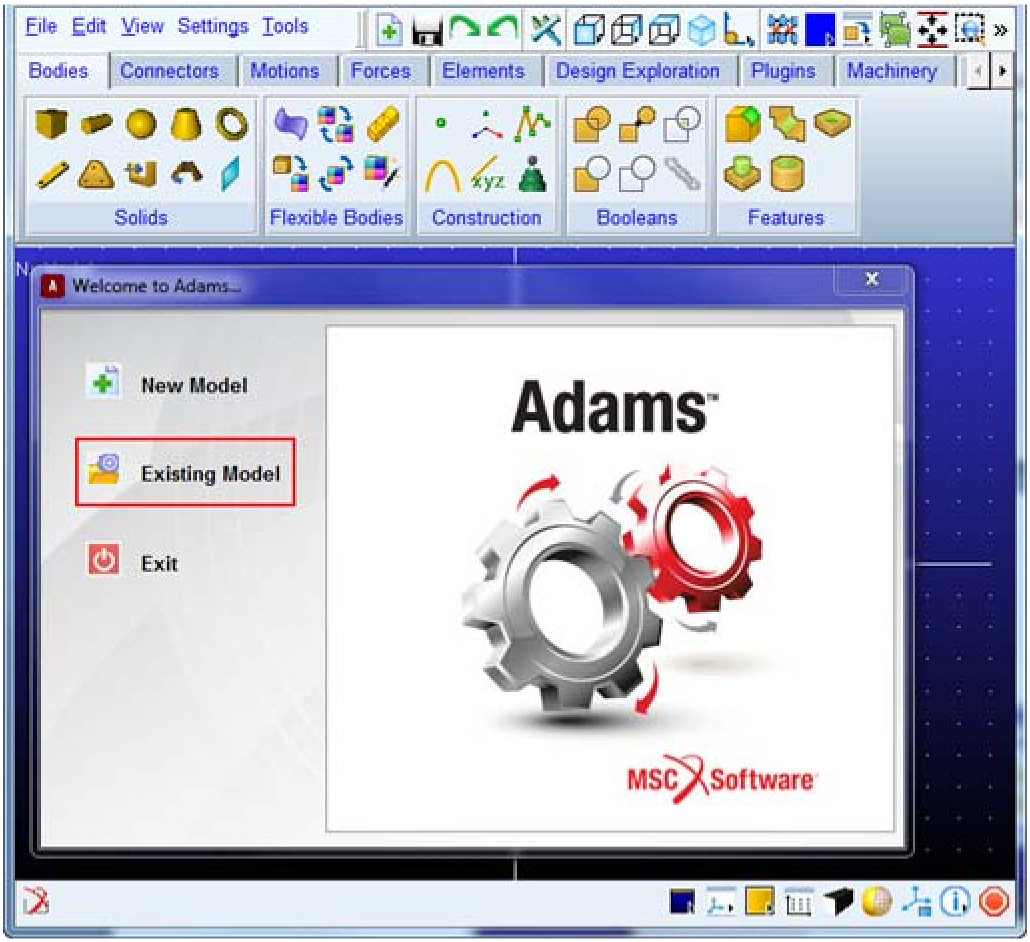


Figure 2 Motor Model

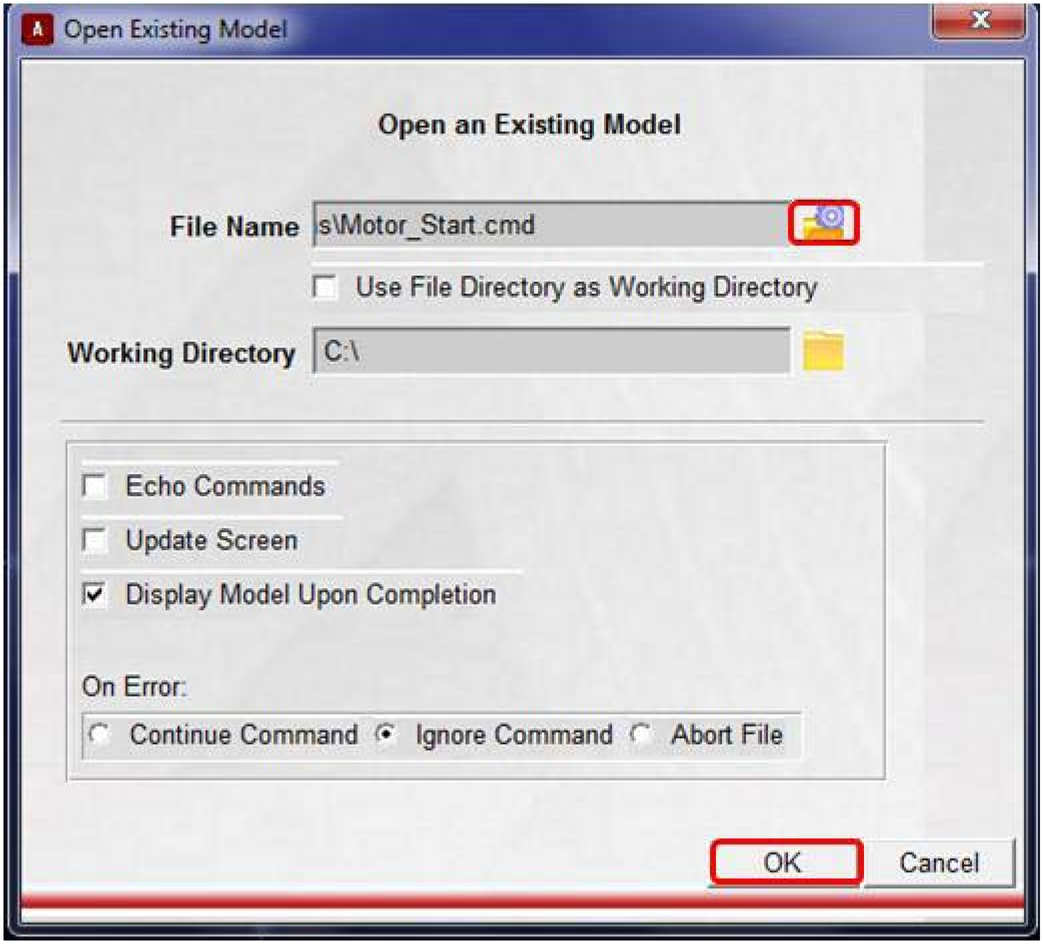
Analytical Method Motor Model

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

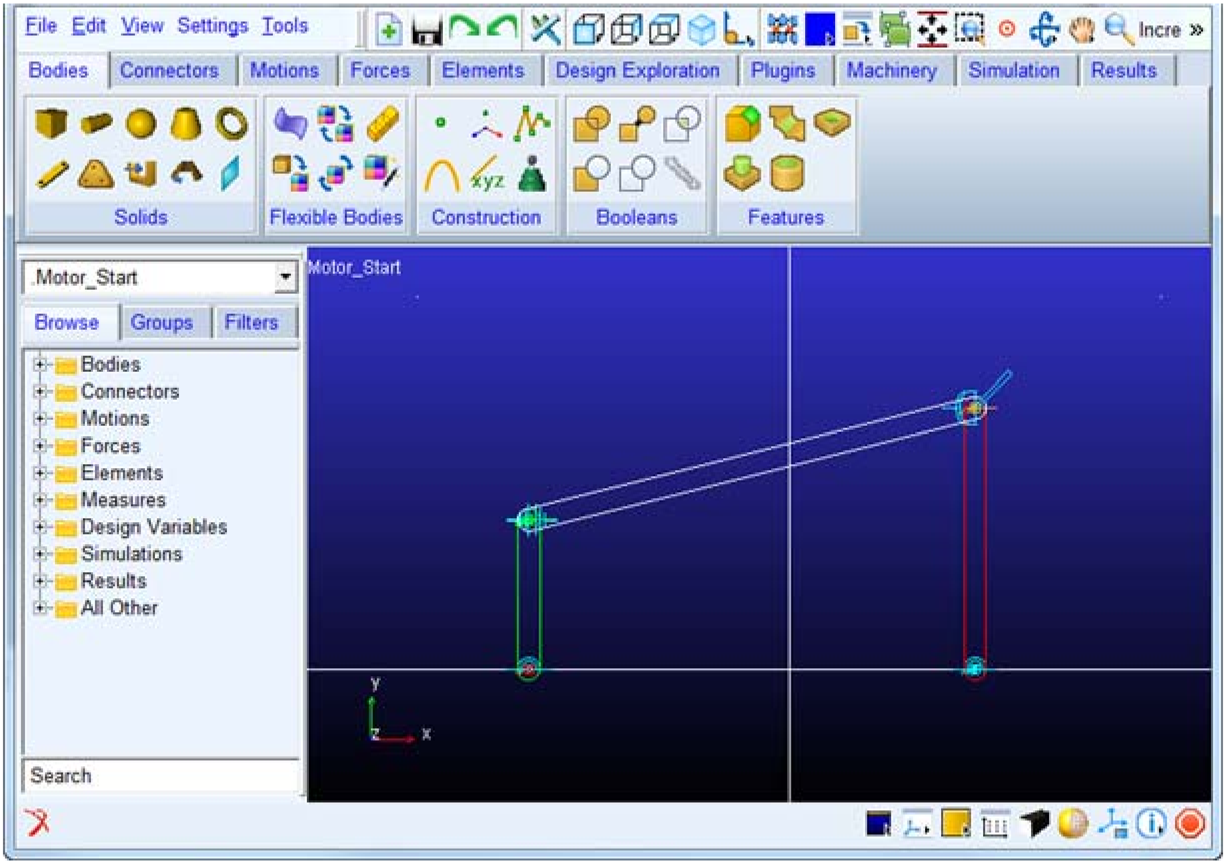


3. Open the model **Motor_Start.cmd** from the installation directory. For example, Windows 64 examples files placed in the below location: **C:\MSC.Software\Adams_x64\2013.2\amachinery\example\motor\Motor_Start.cmd**.

Tip:	Copy the example files folder and place it outside the working directory. Doing this, you can avoid having the working directory inside the Adams install folders.


Open Existing Model
Open an Existing Model
File Name
s\Motor_Start.cmd
Use File Directory as Working Directory
Working Directory
C:\
Echo Commands
Update Screen
Display Model Upon Completion
On Error:
Continue Command
Ignore Command
Abort File
OK
Cancel

4. The imported model will look like the one shown below.

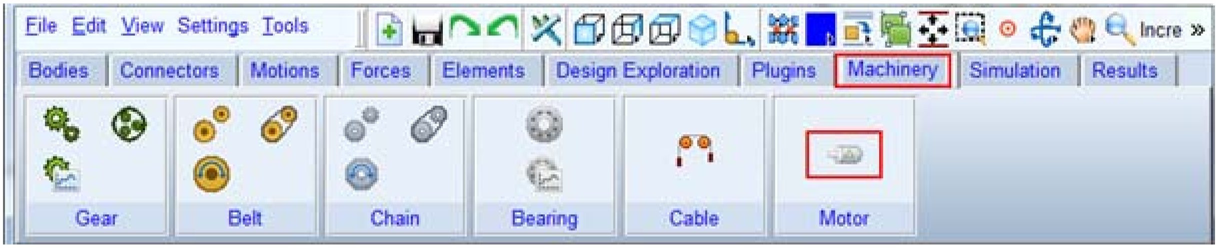


a. It has:

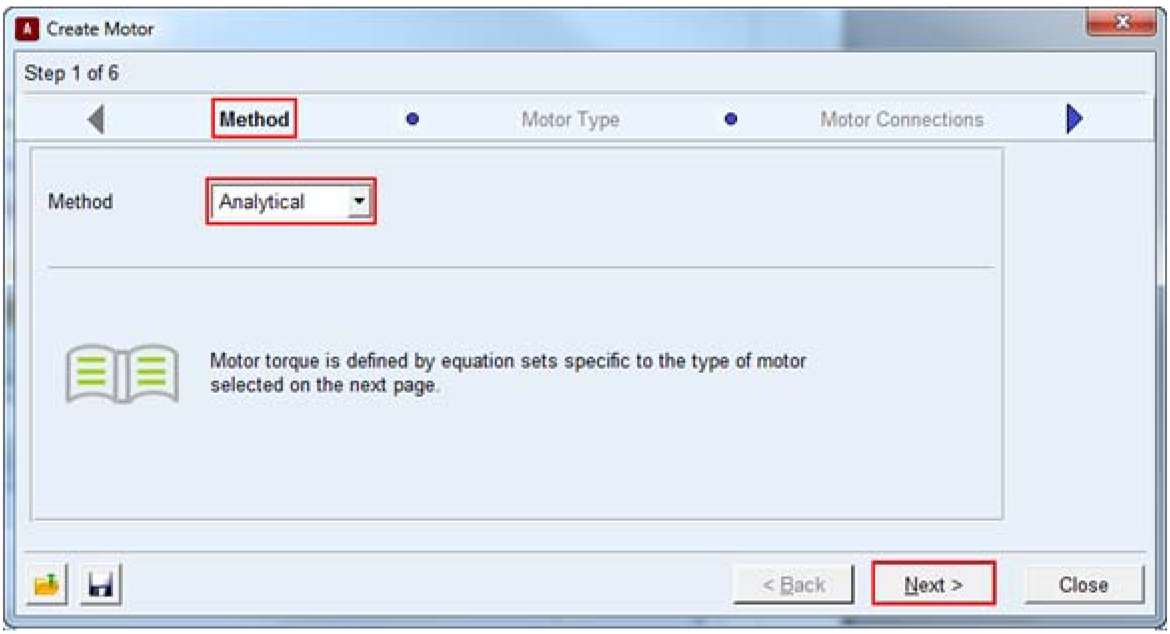
- Crank geometry connected with revolute and spherical joint with ground and connecting rod
- Connecting rod is connected to rocker with universal joint
- Rocker is connected to ground with revolute joint

5. Click the **Machinery** tab on the Adams/View ribbon.

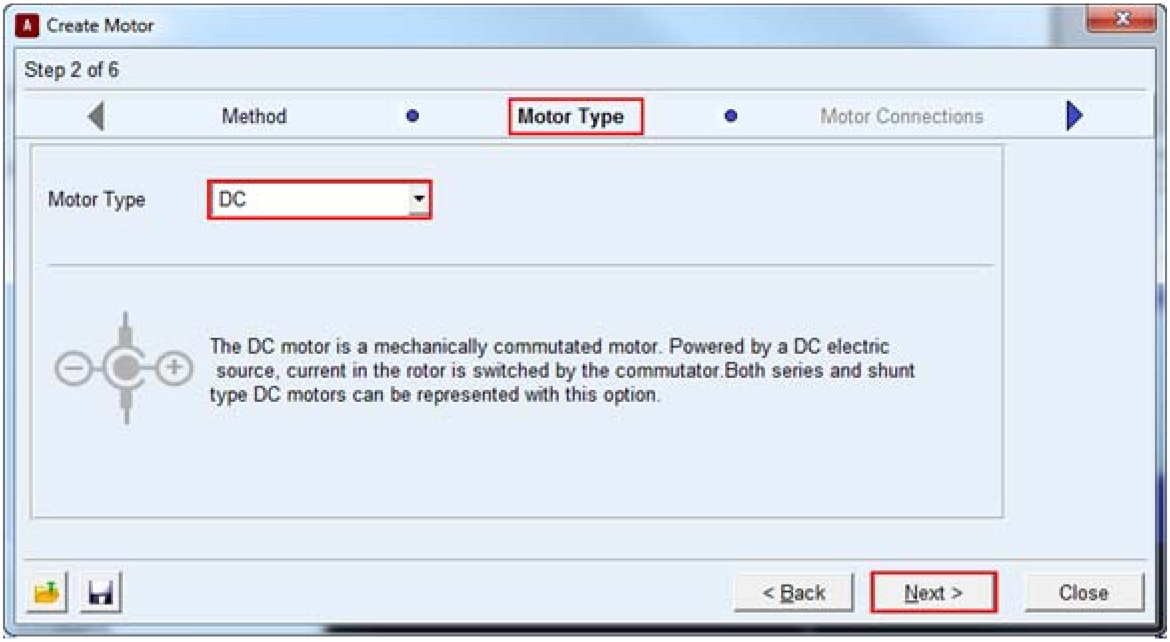
6. From the **Motor** container, click the icon for **Create Motor** icon.



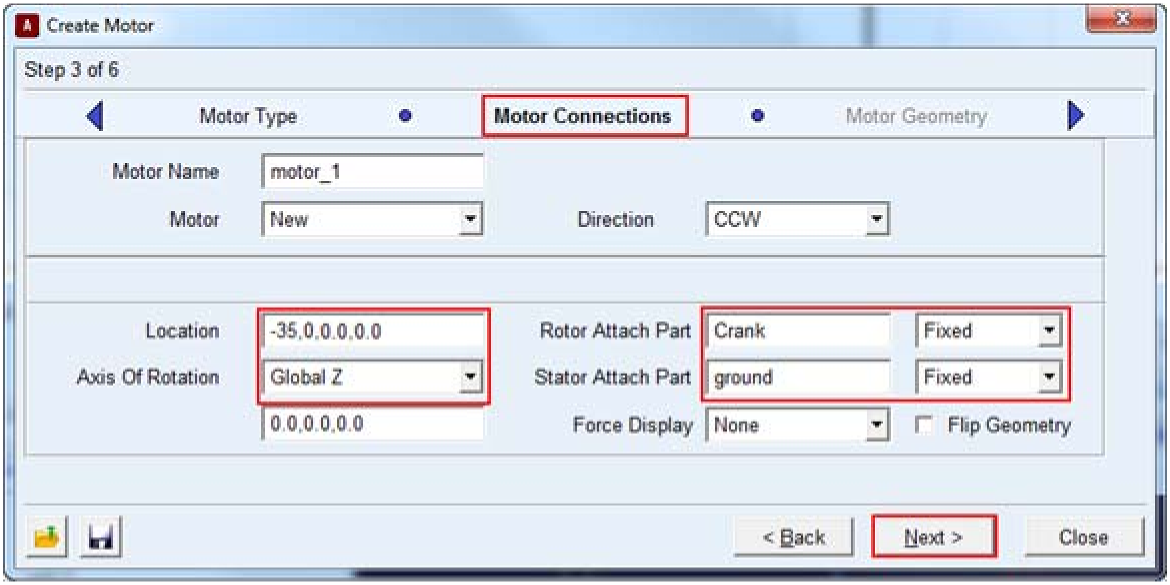
7. The motor creation wizard will launch. On the first page (**Method**) select **Analytical** from the **Method** option menu and click **Next**.



8. The motor creation wizard will launch. On the next page (**Type**) select **DC** from the **Type** option menu and click **Next.**



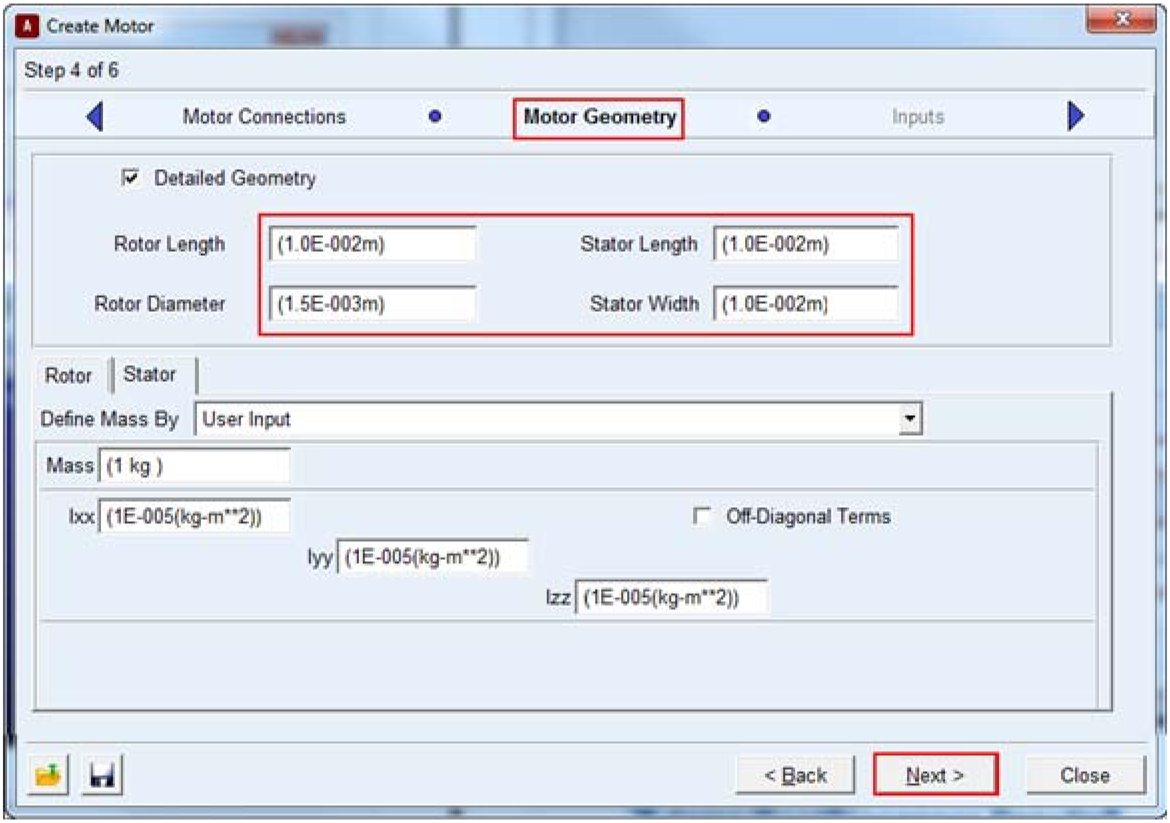
9. On the next page (**Motor Connection**) enter values for as given below (circled in Red) and click **Next**.



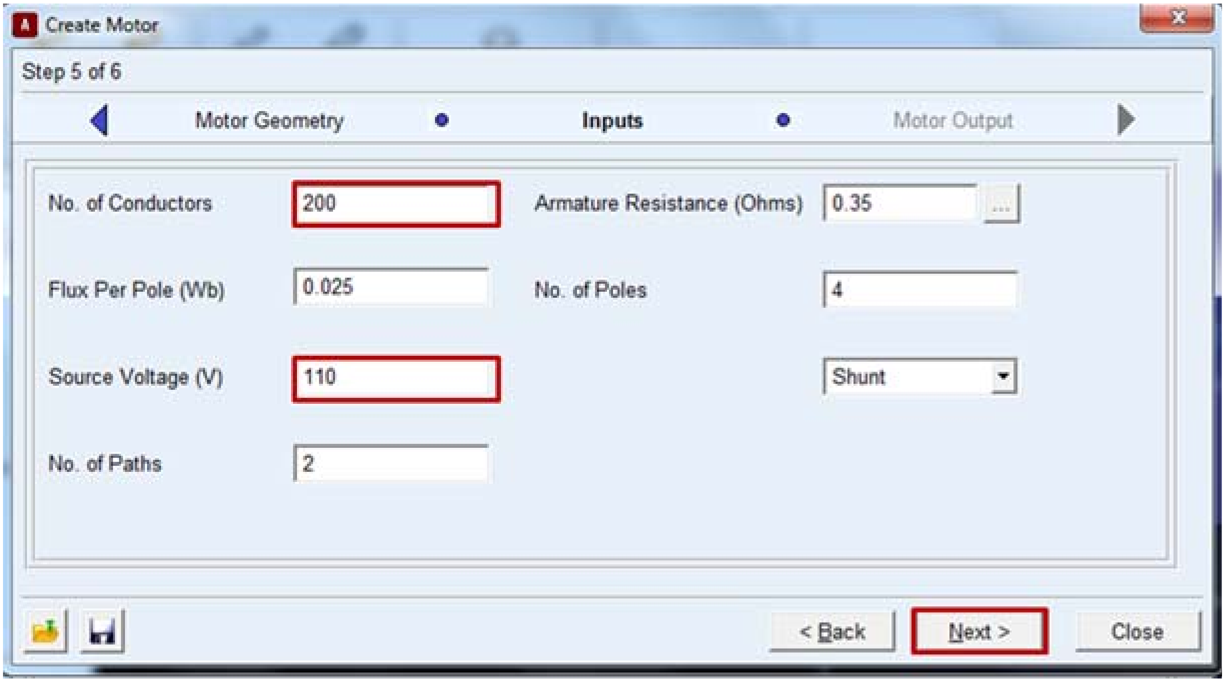
a. Enter the values for the following fields and accept the defaults for others as shown below

- Axis of Rotation as “Global Z”.
- Enter the values “-35.0,0.0,0.0” in mm for location.
- Rotor attach part as “Crank” from right-mouse-button option Guesses.
- Stator attach part as “ground” from right-mouse-button option Guesses.

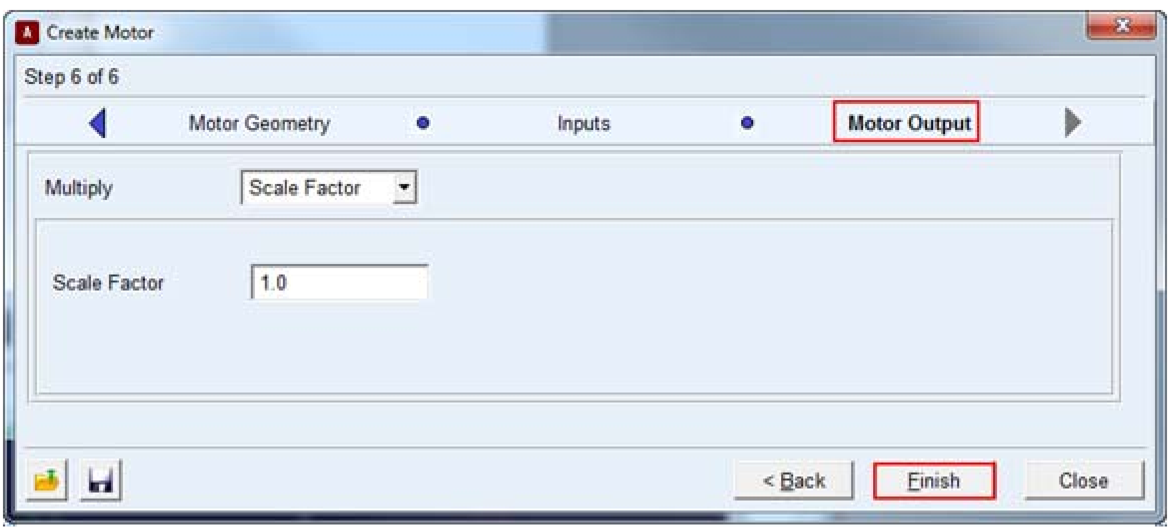
10. In the **Motor Geometry**, enter the values (circled in red) as shown below and accept the default values for others and click **Next**.



11. In the **Inputs** page modify the source voltage to **110**, the number of conductors to **200** and accept the default values for others. Click **Next**.

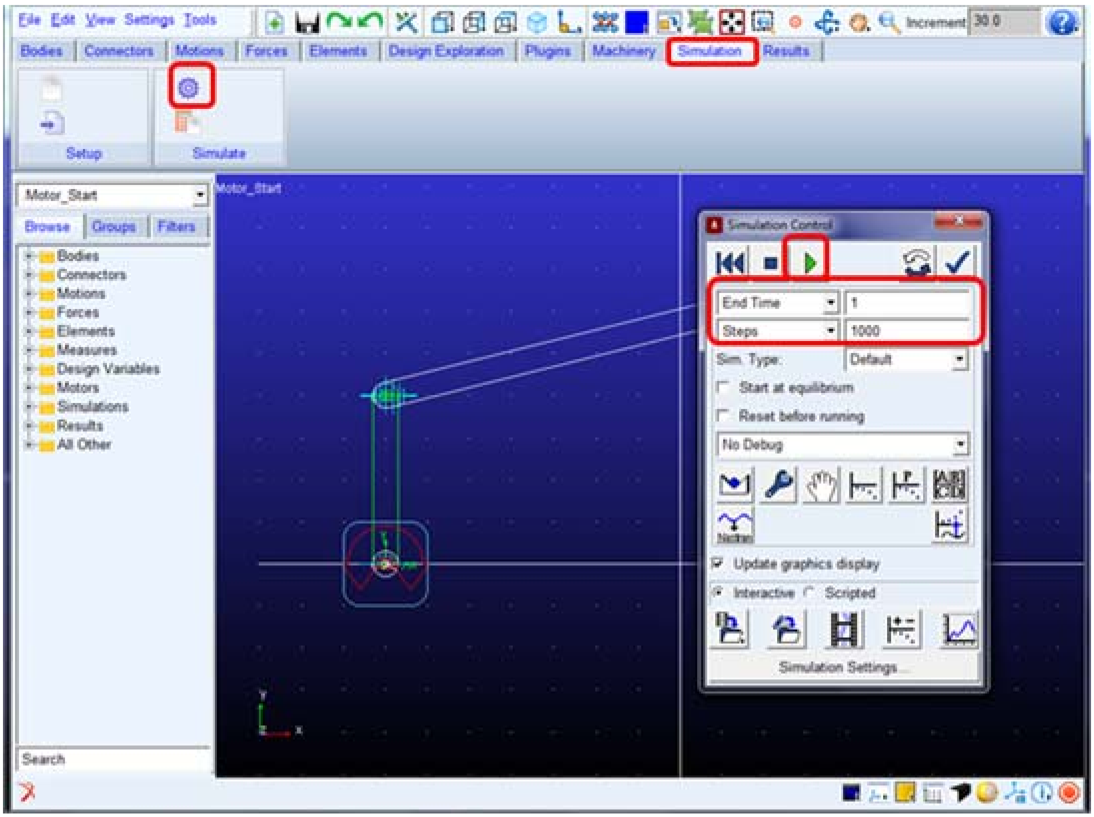


12. Accept the default values in the next page (**Motor Output**) and click **Finish**.



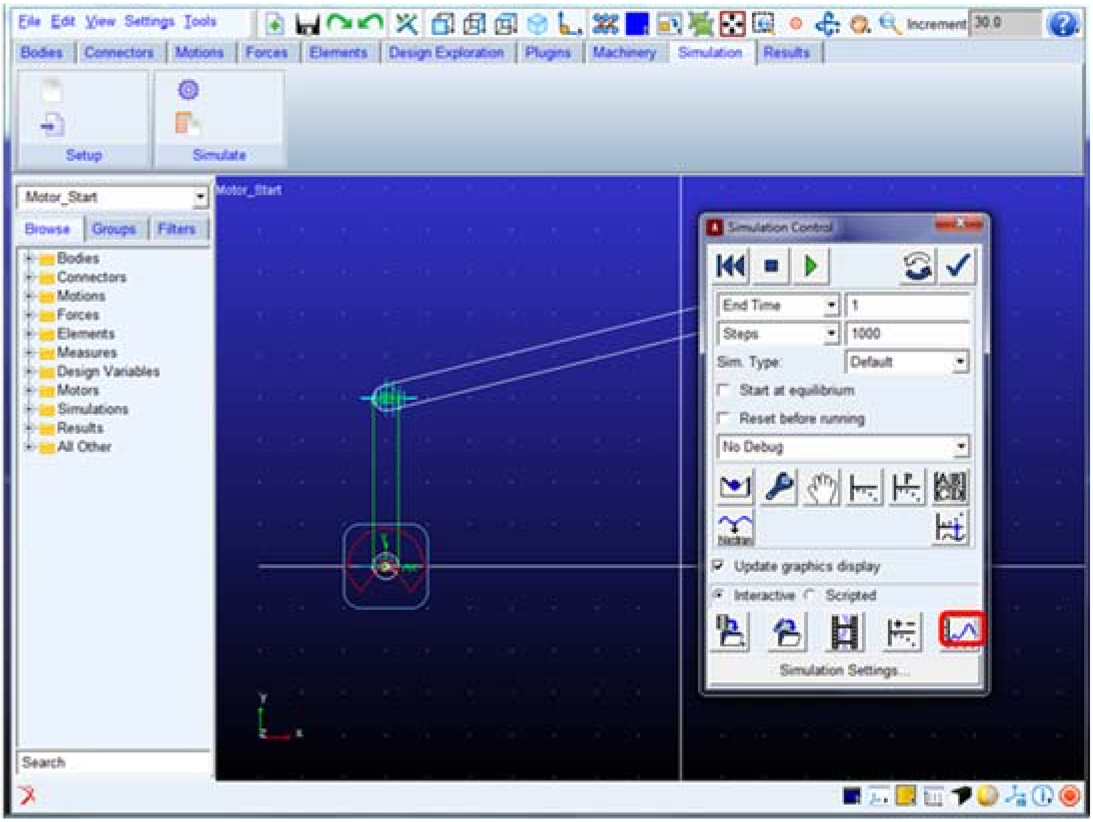
Simulation

Simulate your model for 1 second at 1000 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.

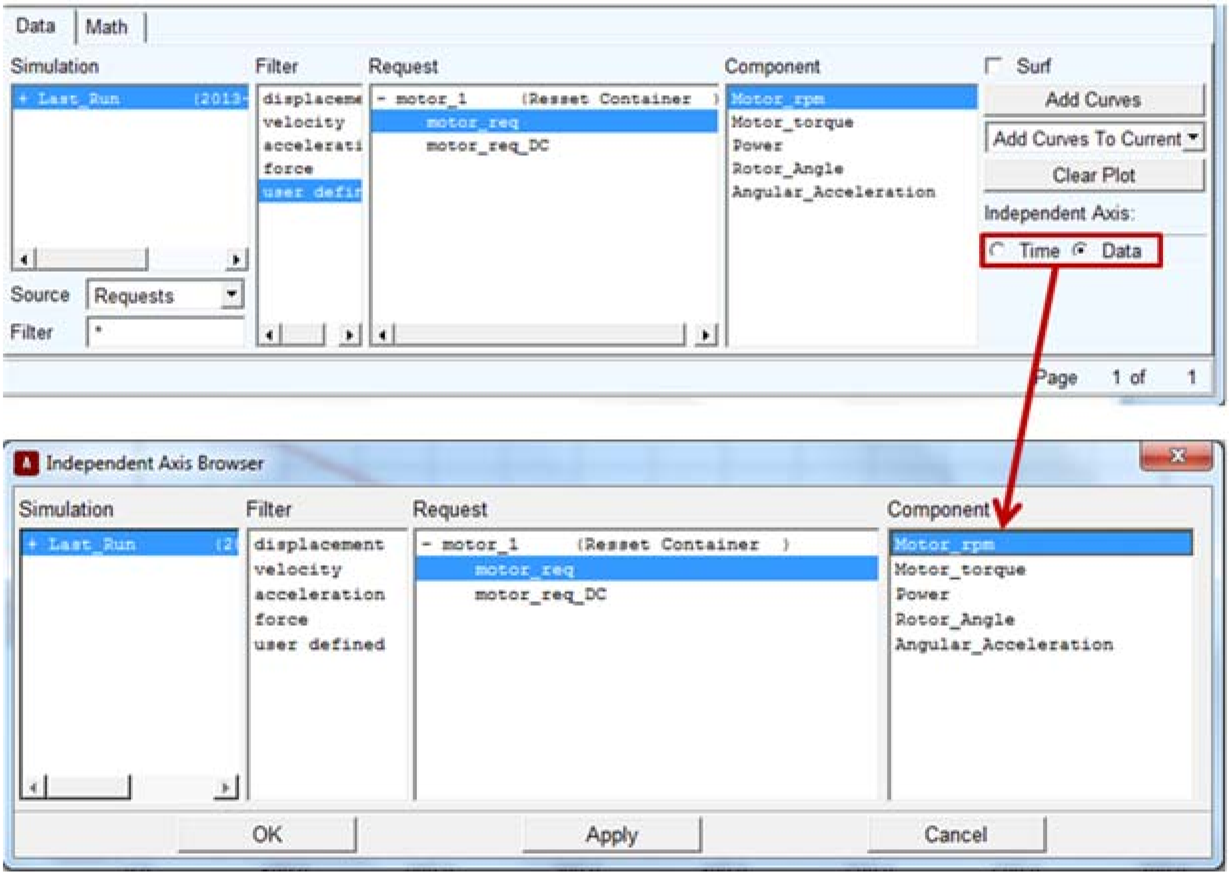


Adams/PostProcessor Results

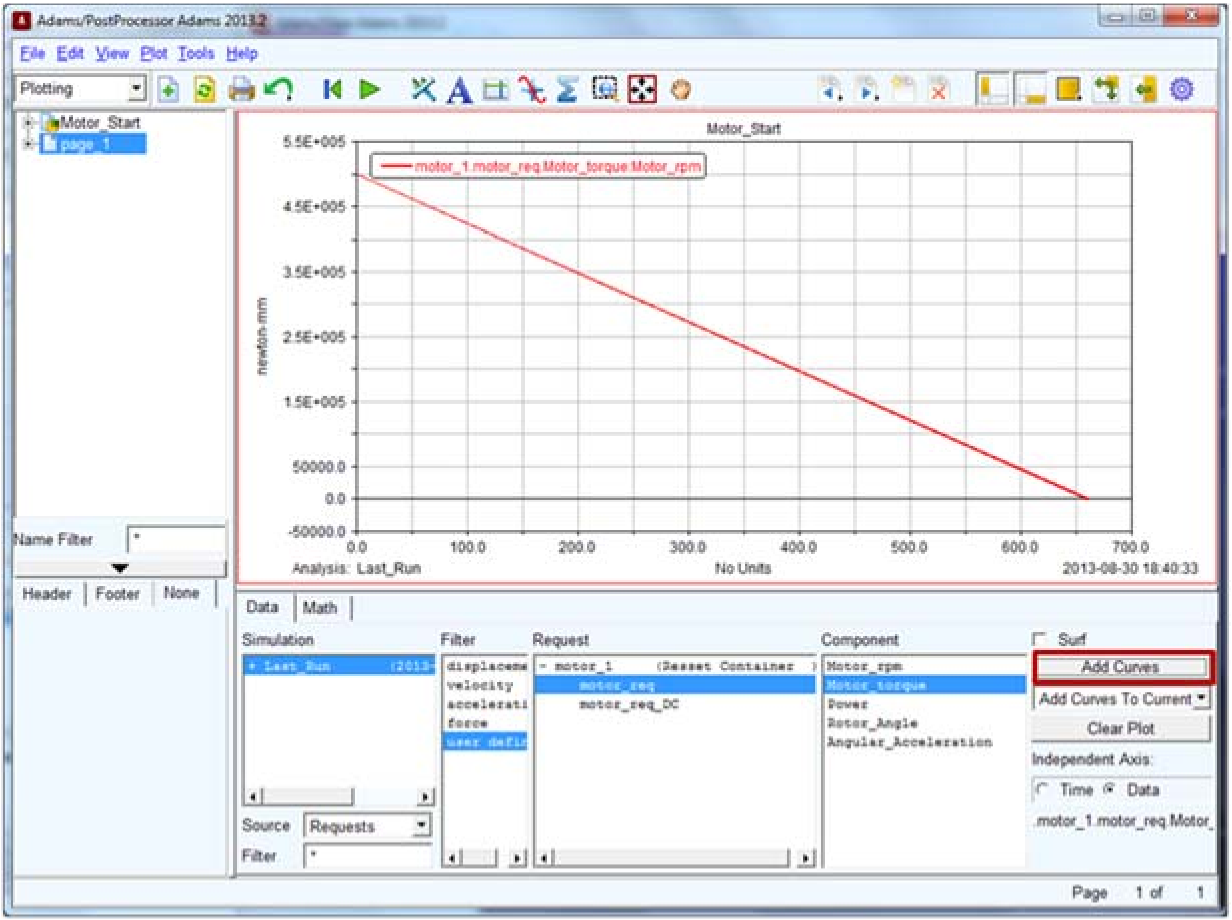
1. Switch to PostProcessor by clicking plotting icon from the Simulation Control.



2. In the Post Processor, Select the **Motor_rpm** as data for independent axis as shown below.



3. Select the items highlighted in blue below and then by clicking **Add Curves** button to plot the motor rpm vs torque.



External

The Adams/Machinery Motor module provides for the modeling of motor systems within the Adams/View environment. It supports multiple modeling methodology options including an external modeling method. This example shows how to create a motor using the external method from the minimal set of input parameters.

This chapter includes the following sections:

What You Will Create

You will model a motor consisting of two parts (Stator and Rotor) with simple geometry. The stator and rotor will be attached to the ground and crank (Input) respectively. The crank is connected with a revolute joint and a spherical joint to the ground and connecting rod respectively. The connecting rod is connected to the rocker via a universal joint. The rocker is connected to ground via a revolute joint. The crank will be driven by a prescribed torque provided via ESL (External System Library, which is a binary representation of model generated by MATLAB®) and the simulation will be carried out entirely inside Adams. The torque created in the motor will be based on this external model.

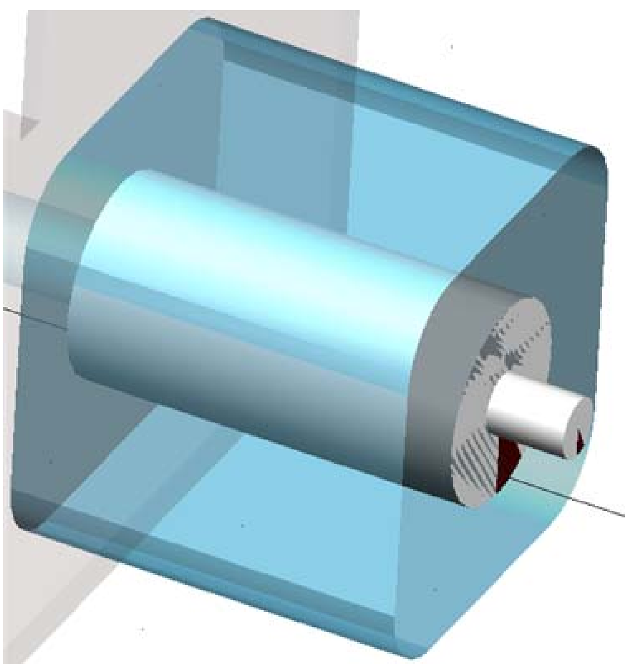
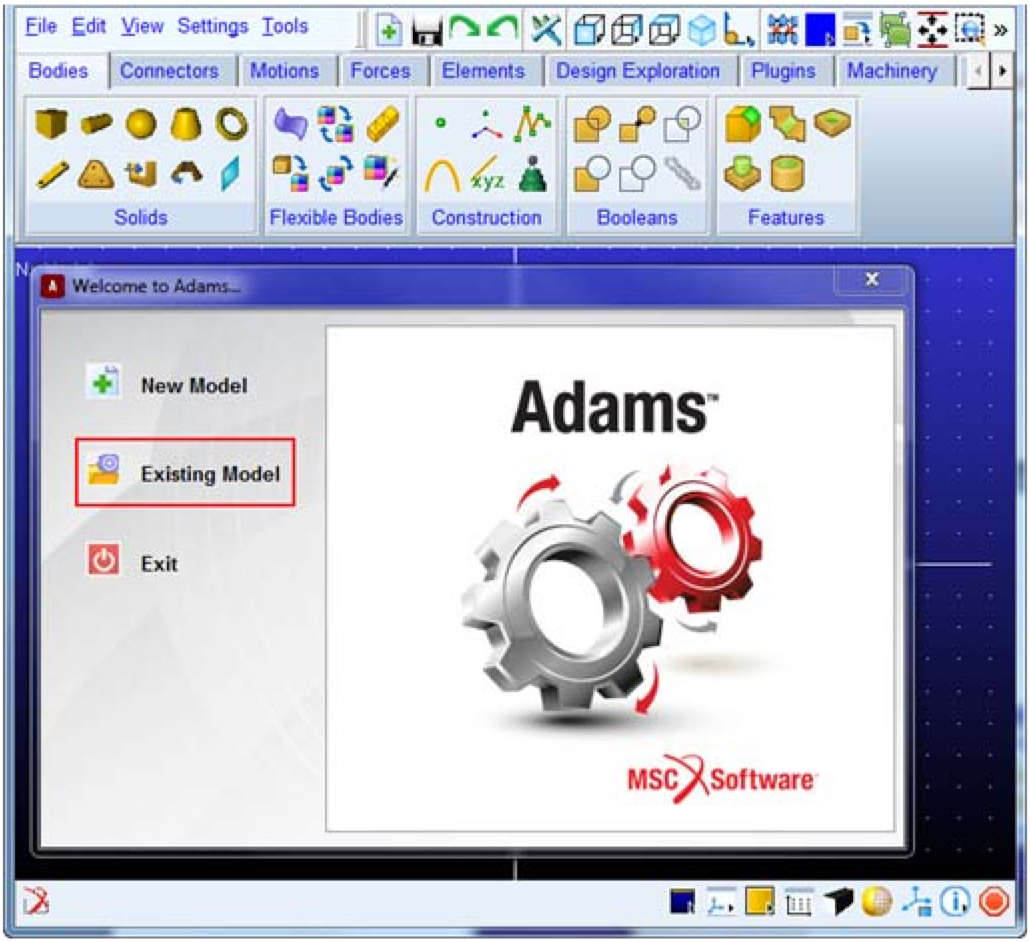


Figure 3 Motor Model

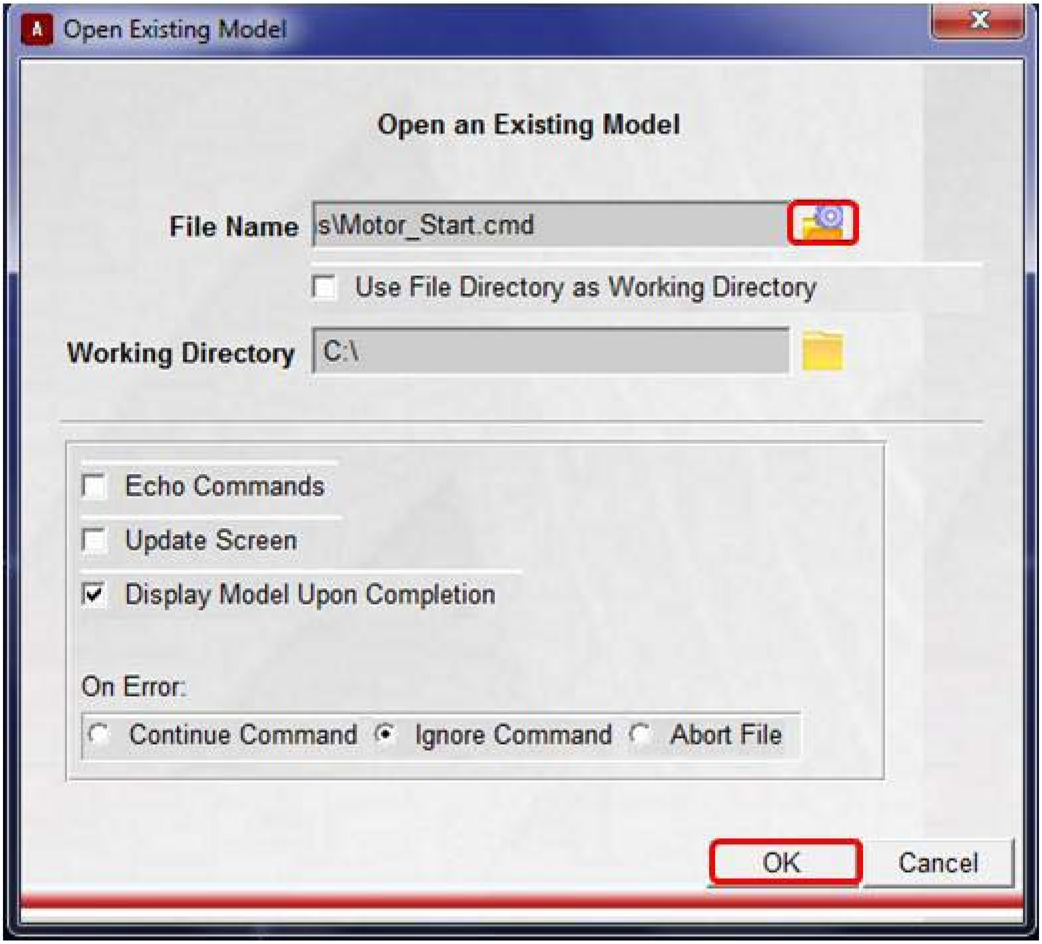
External Method Motor Model

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

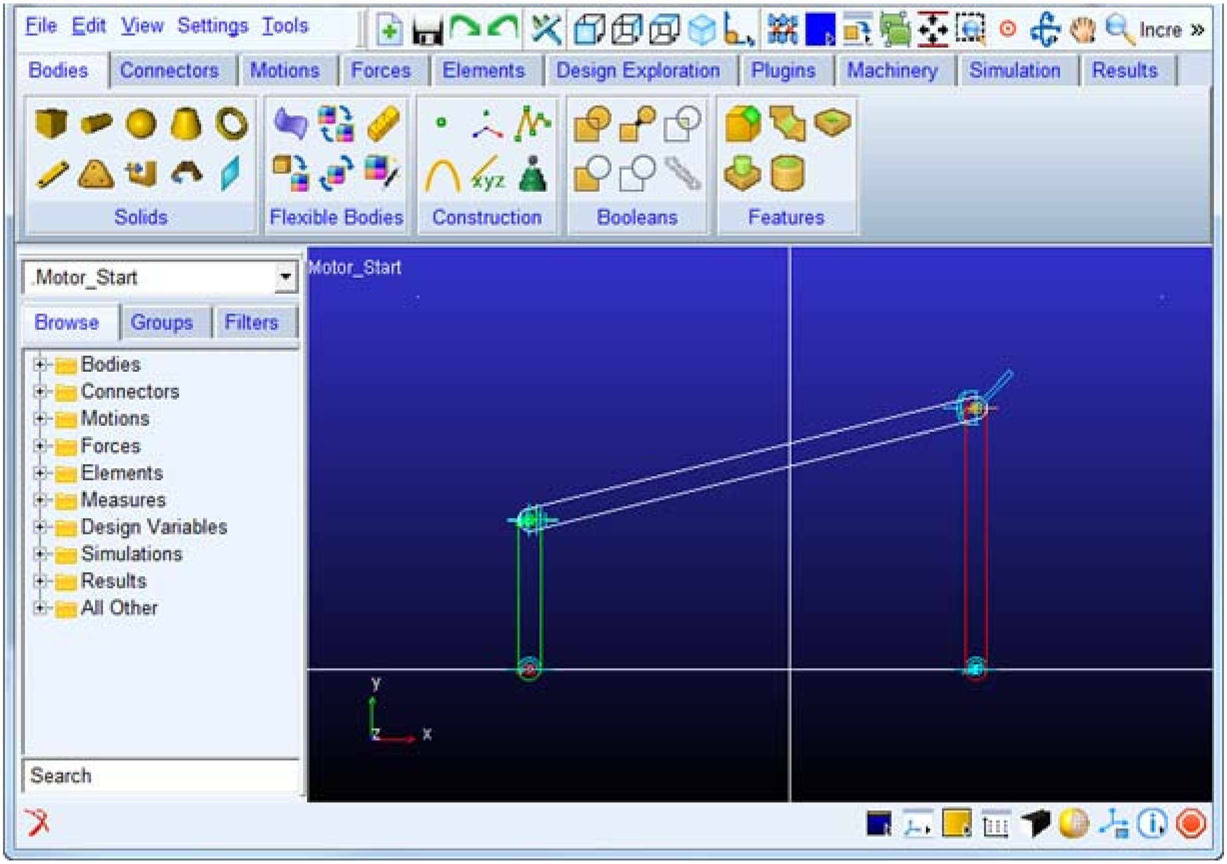


3. Open the model **Motor_Start.cmd** from the installation directory. For example, Windows 64 examples files placed in the below location: **C:\MSC.Software\Adams_x64\2013.2\amachinery\example\motor\Motor_Start.cmd**.

Tip:	Copy the example files folder and place it outside the working directory. Doing this, you can avoid having the working directory inside the Adams install folders.


Open Existing Model
Open an Existing Model
File Name
s\Motor_Start.cmd
Use File Directory as Working Directory
Working Directory
C:\
Echo Commands
Update Screen
Display Model Upon Completion
On Error:
Continue Command
Ignore Command
Abort File
OK
Cancel

4. The imported model will look like the one shown below.

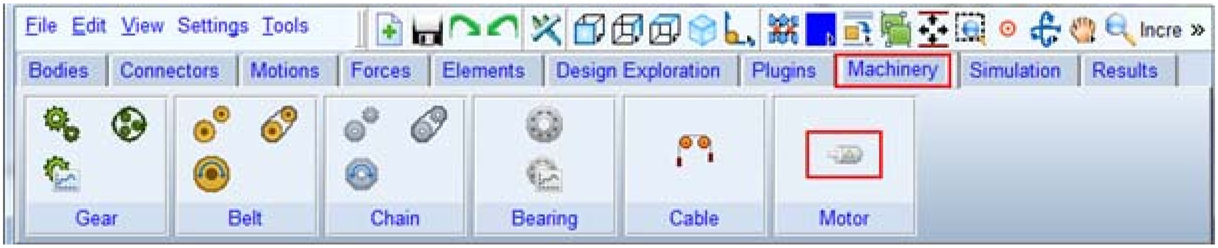


a. It has:

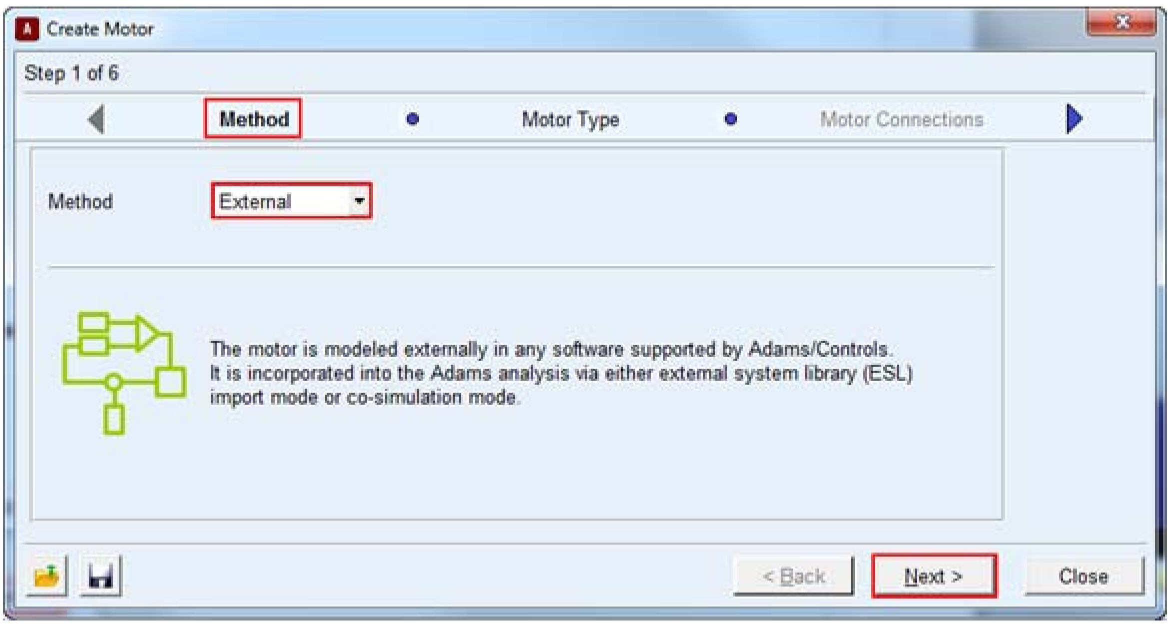
- Crank geometry connected with revolute and spherical joint with ground and connecting rod
- Connecting rod is connected to rocker with universal joint
- Rocker is connected to ground with revolute joint

5. Click the **Machinery** tab on the Adams/View ribbon.

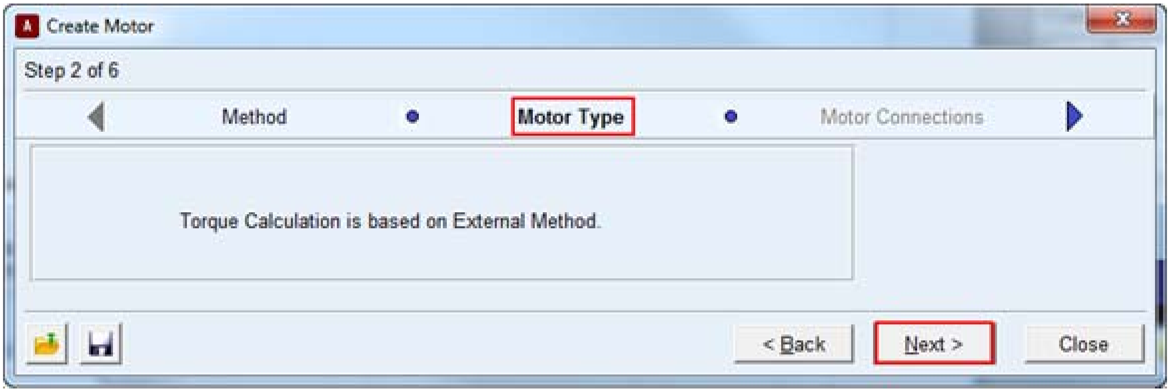
6. From the **Motor** container, click the icon for **Create Motor** icon.



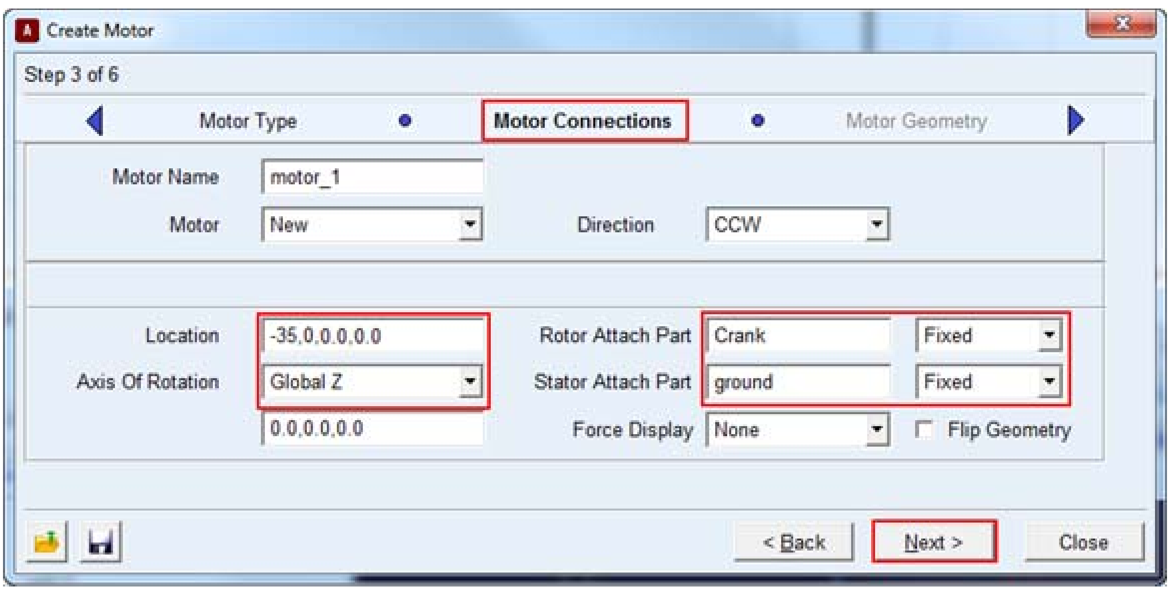
7. The motor creation wizard will launch. On the first page (**Method**) select **External** from the **Method** option menu and click **Next**.



8. On the next page (**Motor Type**) click **Next** to proceed.



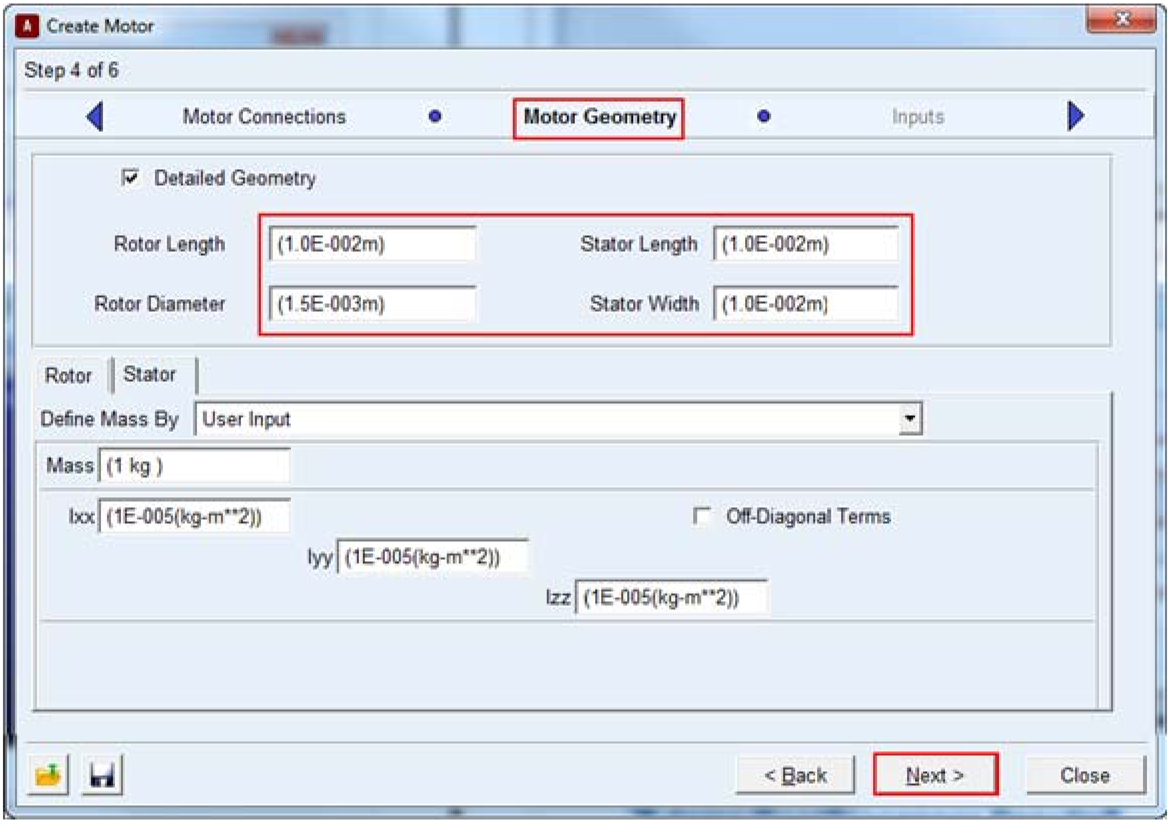
9. On the next page (**Connection**) enter values for as given below (circled in Red) and click **Next**.



a. Enter the values for the following fields and accept the defaults for others as shown below

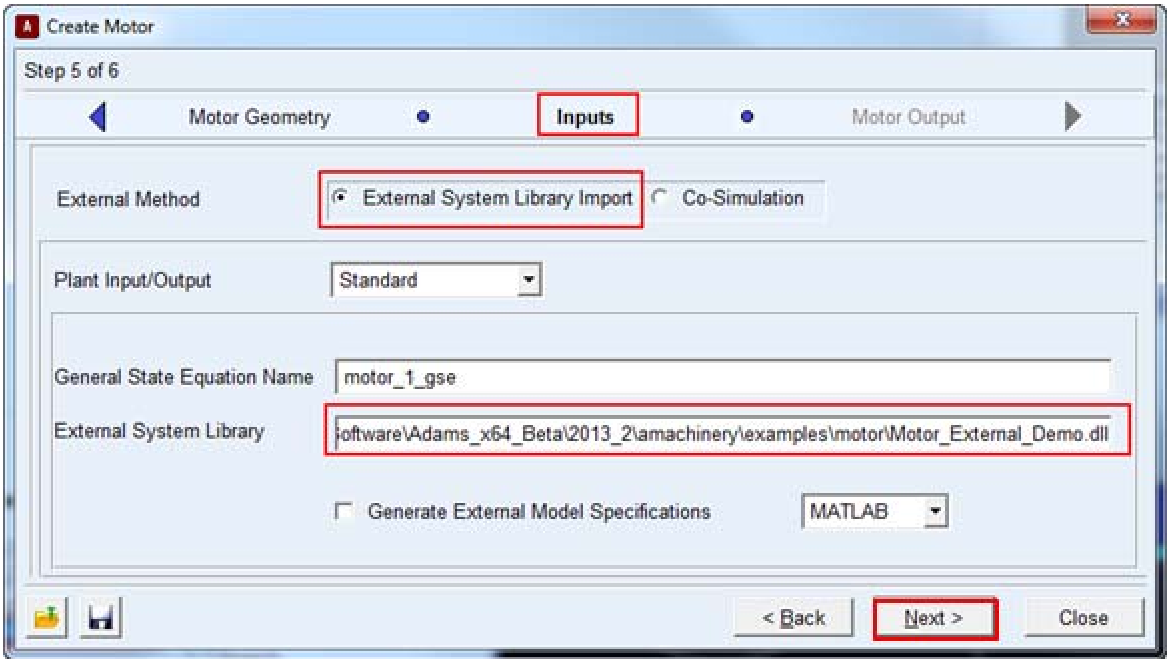
- Axis of Rotation as “Global Z”.
- Enter the values “-35.0,0.0,0.0” in mm for location.
- Rotor attach part as “Crank” from right-mouse-button option Guesses.
- Stator attach part as “ground” from right-mouse-button option Guesses.

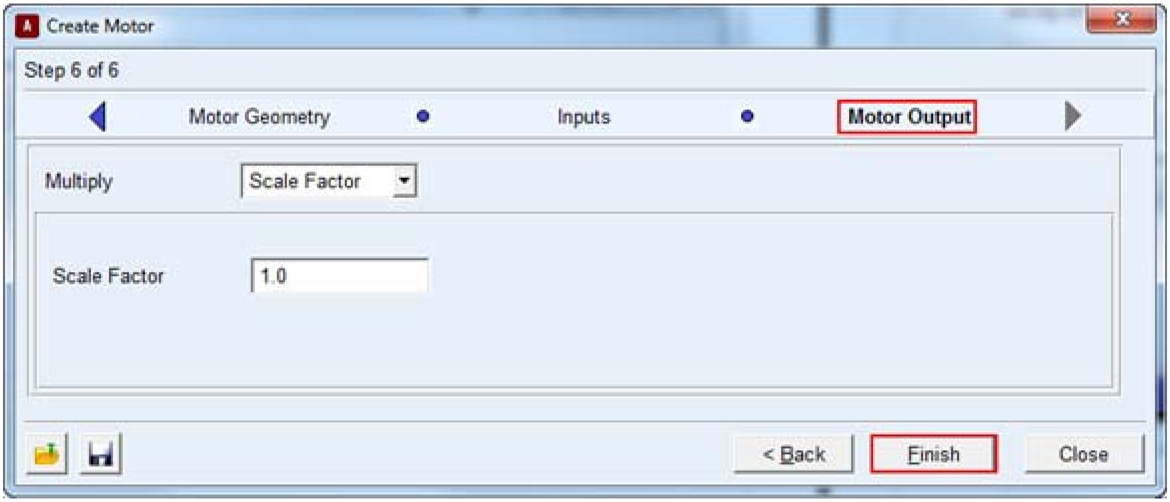
10. In the **Motor Geometry**, enter the values (circled in red) as shown below and accept the default values for others and click **Next**.



11. In the **Inputs** page select **External System Library Import** option and select the **Motor_External_Demo.dll** created by MATLAB® via the right-mouse-button option from GUI as shown below. Click **Next**.

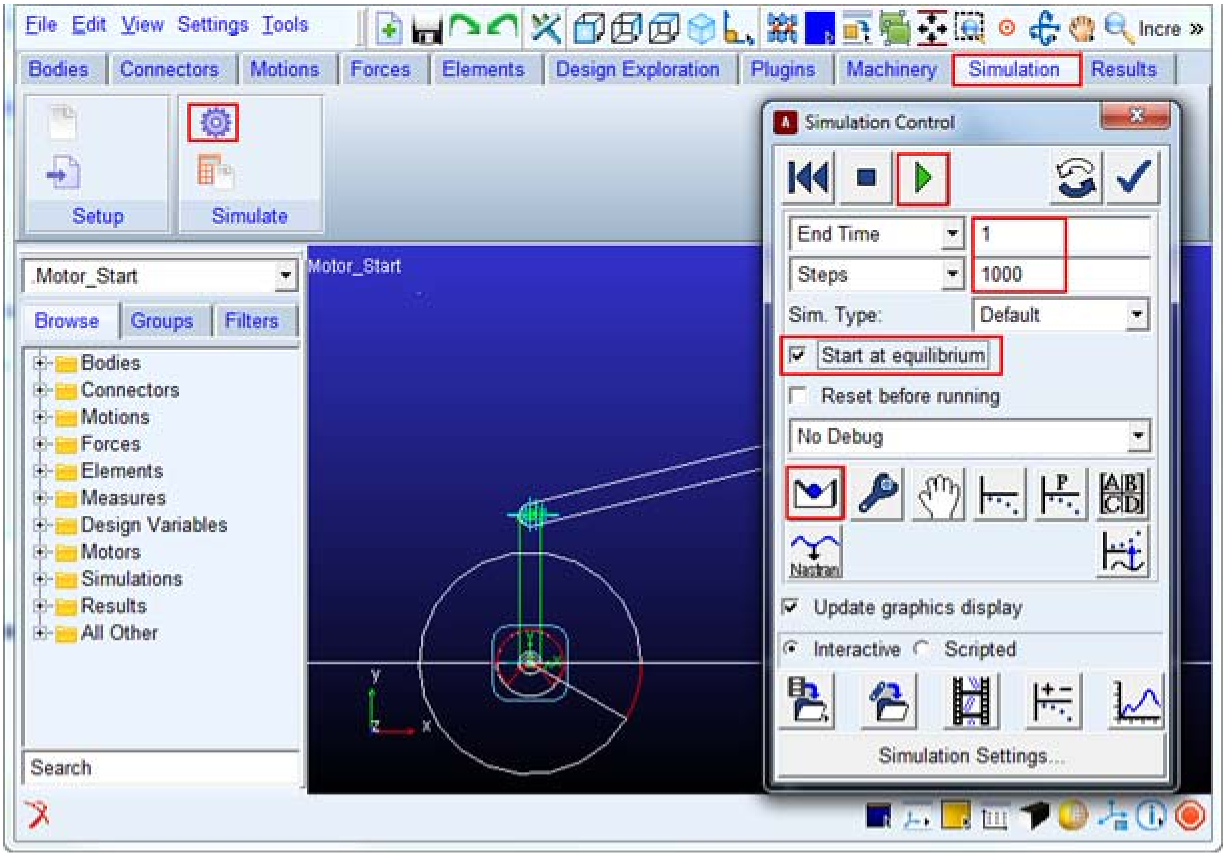
Important: Please select the *.dll* based on your platform. The *.dll* is different for all three platforms.




Create Motor
Step 6 of 6
Motor Geometry
Inputs
Motor Output
Multiply
Scale Factor
Scale Factor
1.0
< Back
Finish
Close

Simulation

Simulate your model for 1 second at 1000 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.

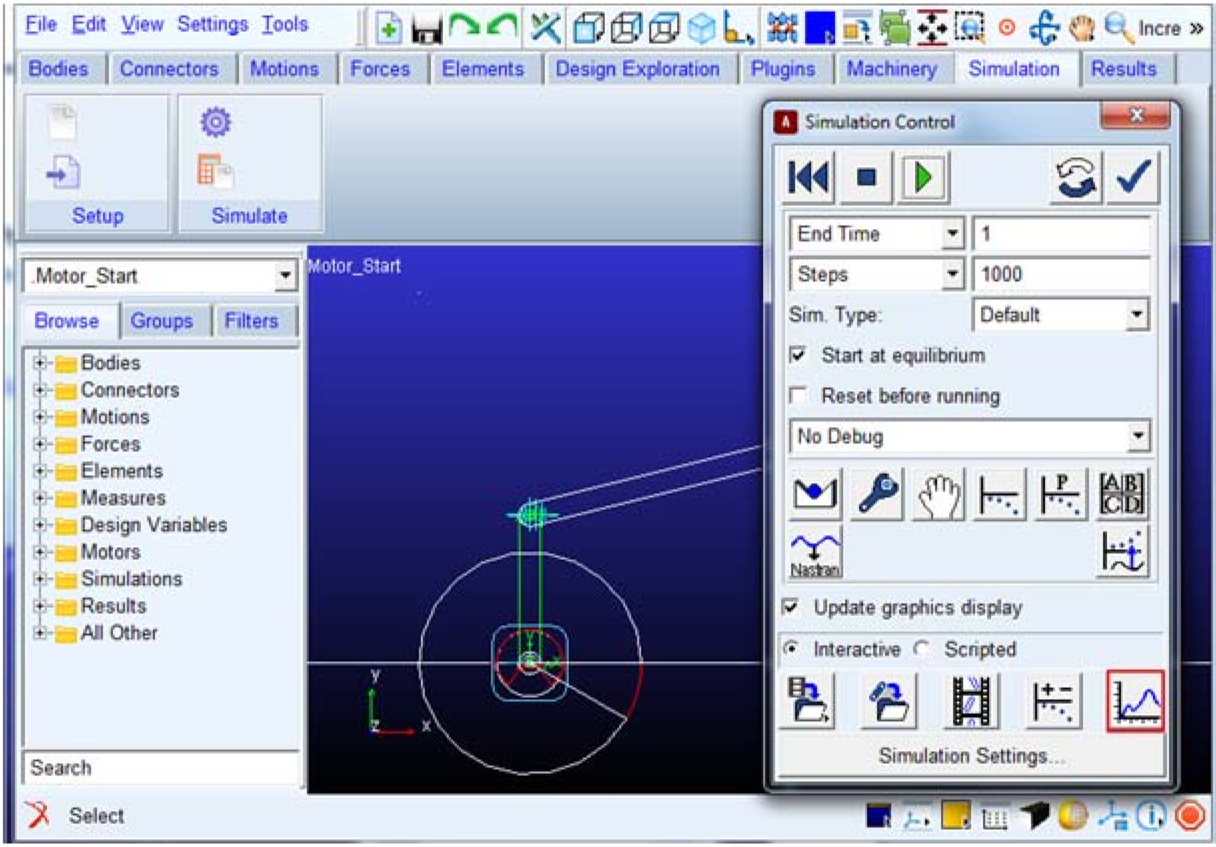


a. Before running the simulation, do the following steps in the order mentioned below:

- Check the **Start at equilibrium**
- Click the **Find Static Equilibrium**
- Now run the simulation by clicking **Start Simulation Button**

Adams/PostProcessor Results

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



2. In the Post Processor, Select the items highlighted in blue and then by clicking **Add Curves** button to plot the torque transmitted.