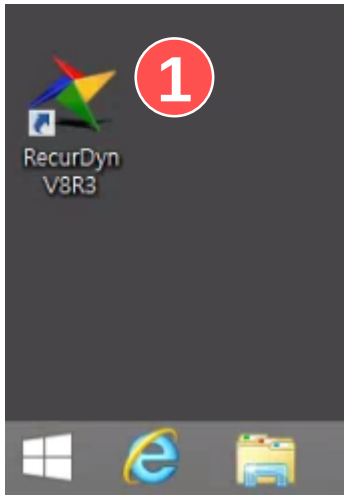
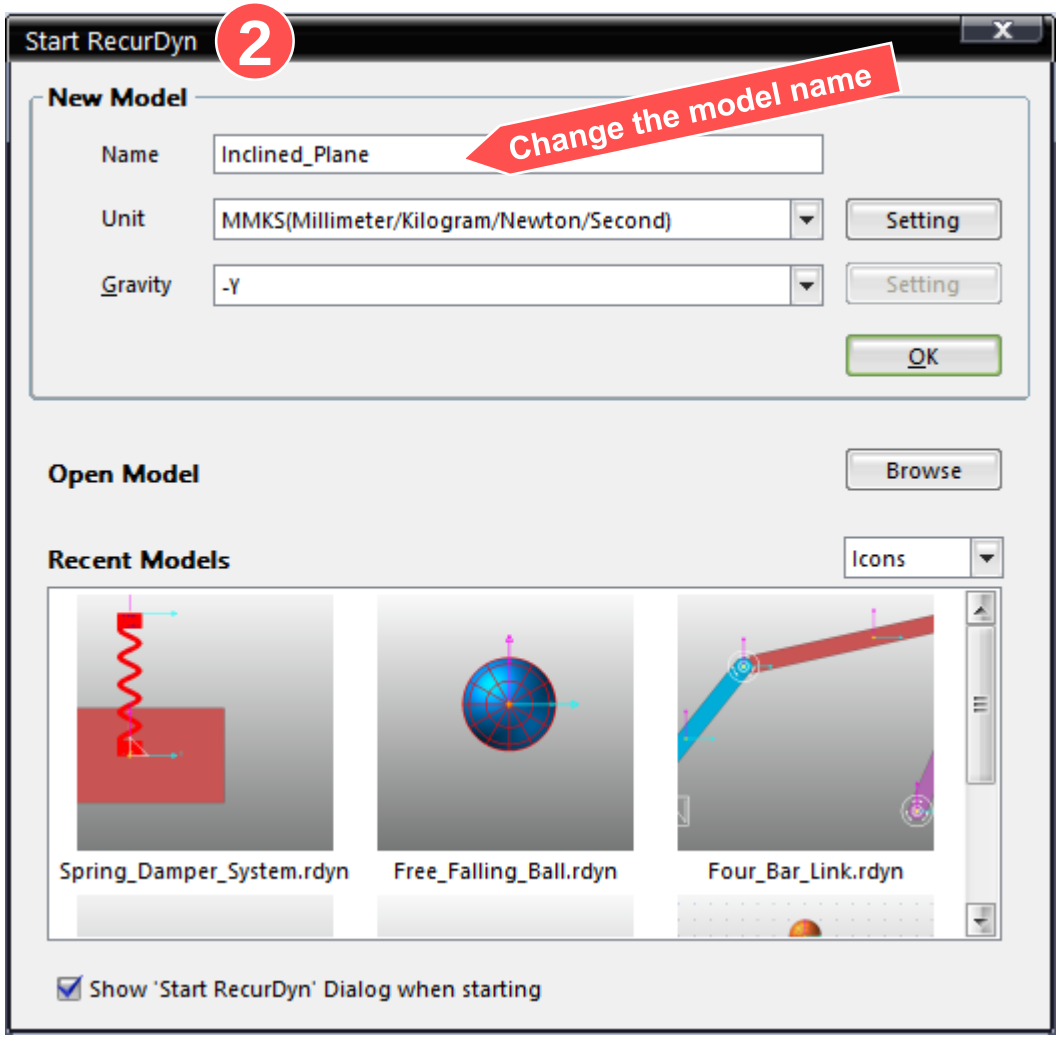
1. Running RecurDyn and Creating a New Model

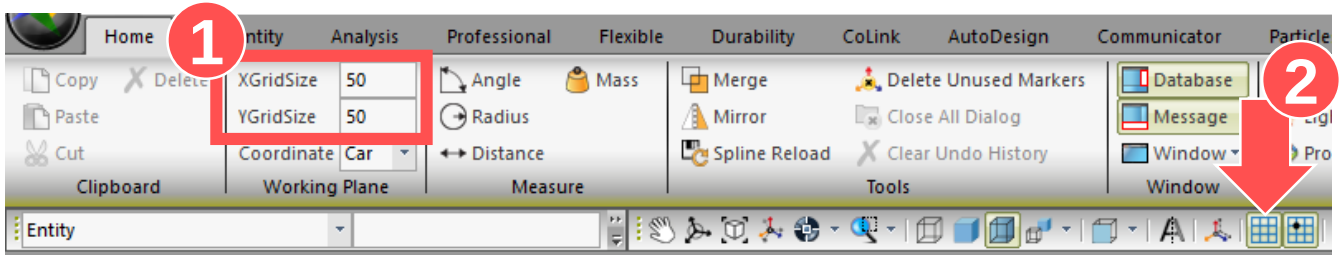
1. Double-click the RecurDyn icon on the Desktop to run RecurDyn.
2. Enter "Inclined_Plane" in the Name box and click **OK** to create a new model.

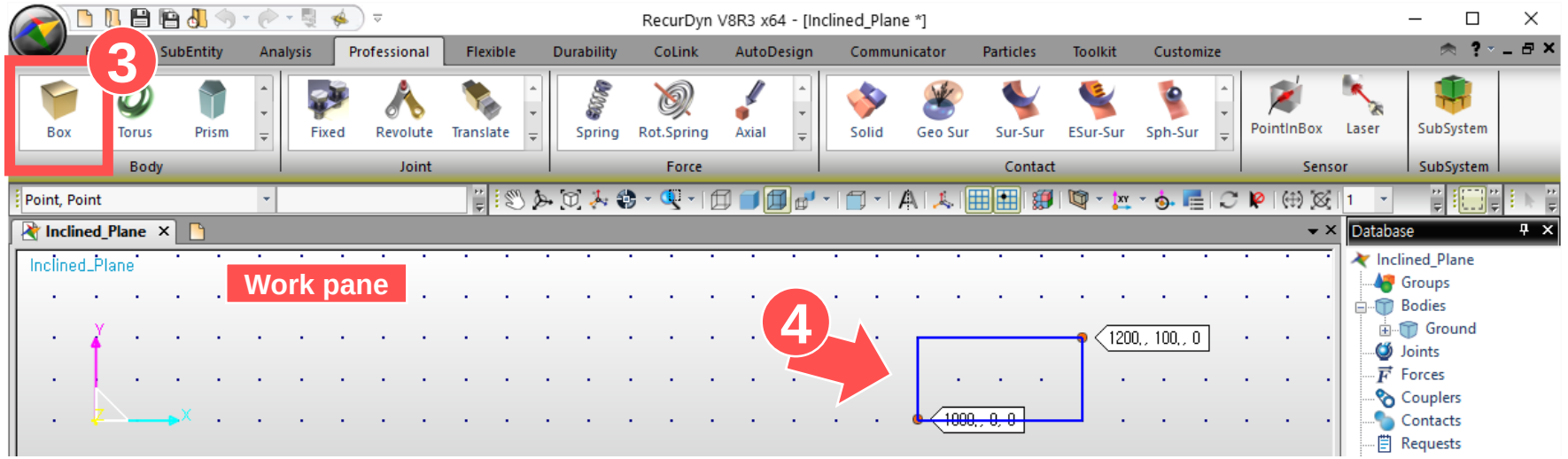


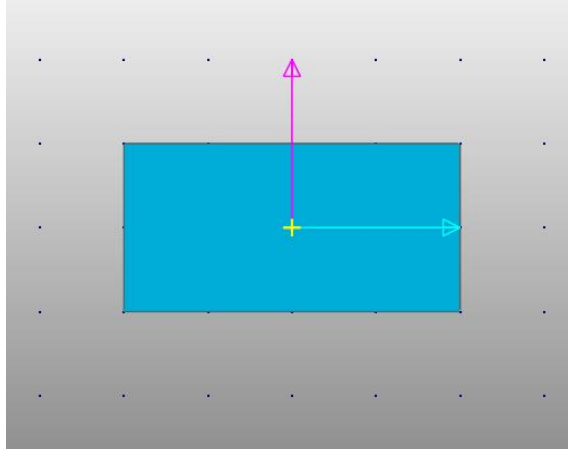


2. Creating a Box Body

1. On the Home tab, in the Working Plane group, enter "50" for the XGridSize and YGridSize coordinates respectively.
2. On the toolbar, click the Grid button to display the grid.
3. On the Professional tab, in the Body group, click Box.
4. Click point **(1000, 0, 0)**, and then click point **(1200, 100, 0)** on the work pane to create a box.

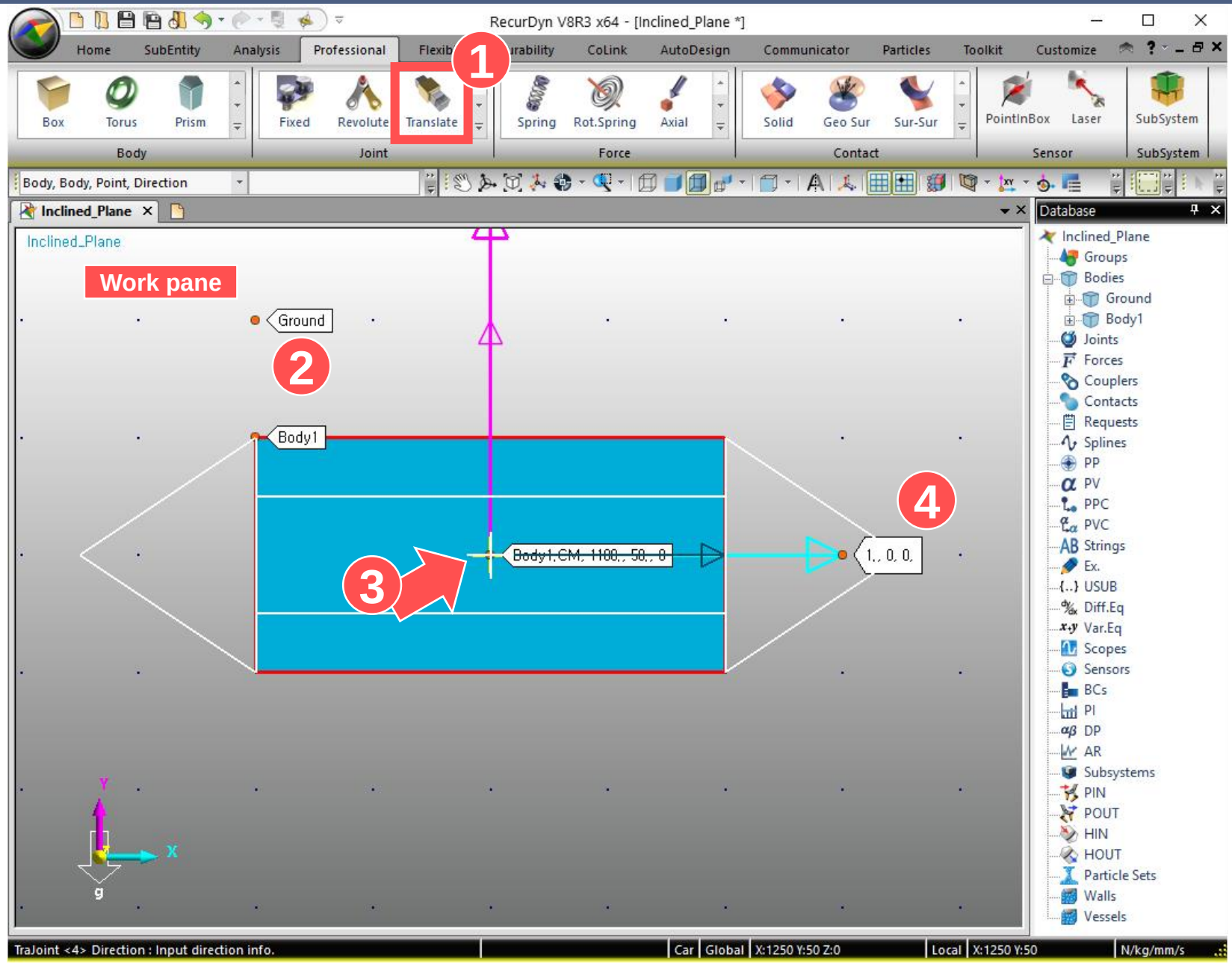






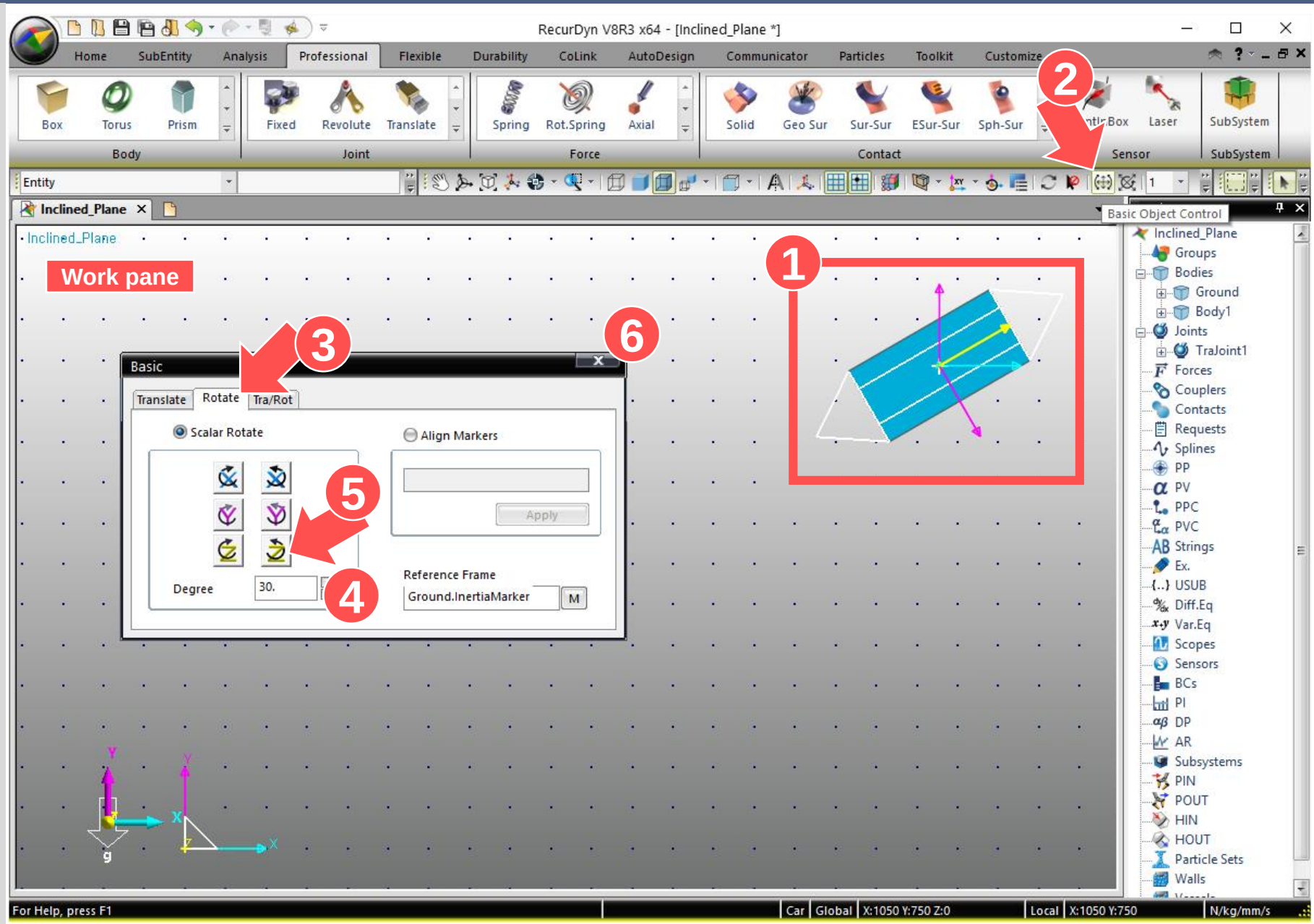
3. Creating a Constraint (Creating a Translate Joint)

1. On the Professional tab, in the Joint group, click Translate.
2. Click Ground and then click Body1 on the work pane.
3. Click the origin **(1100, 50, 0)** on the work pane.
4. Drag the translate joint to point **(1, 0, 0)** and select it on the work pane.



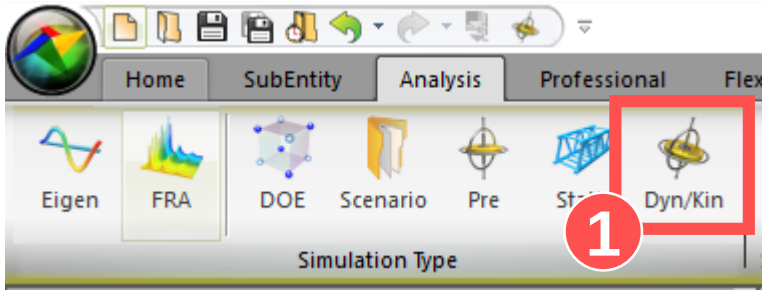
4. Applying an Inclined Plane to the Box Body

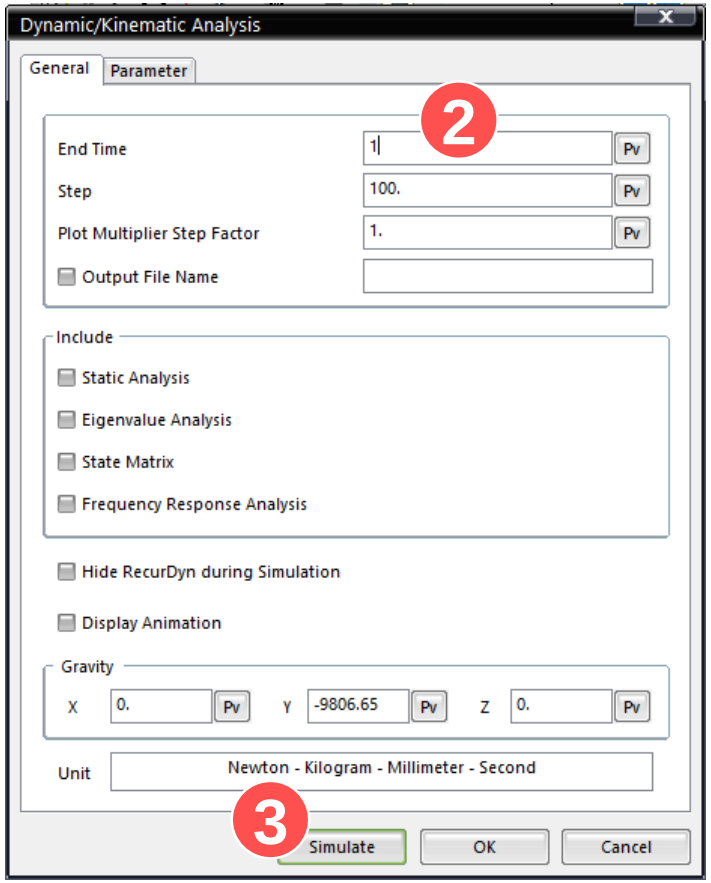
1. On the work pane, drag the mouse to select the box body and the joints.
2. On the toolbar, click the **Basic Object Control** button.
3. In the Basic Object Control dialog box, click the Rotate tab.
4. Enter "30" for the Degree.
5. Select the box body and joints as in step 1. Rotate the box body and joints 30 degrees counterclockwise about the origin (0, 0, 0)(Ground Inertia) along the z-axis by clicking the corresponding button.
6. Click the **X** button to close the dialog box.



5. Performing Dynamic Analysis

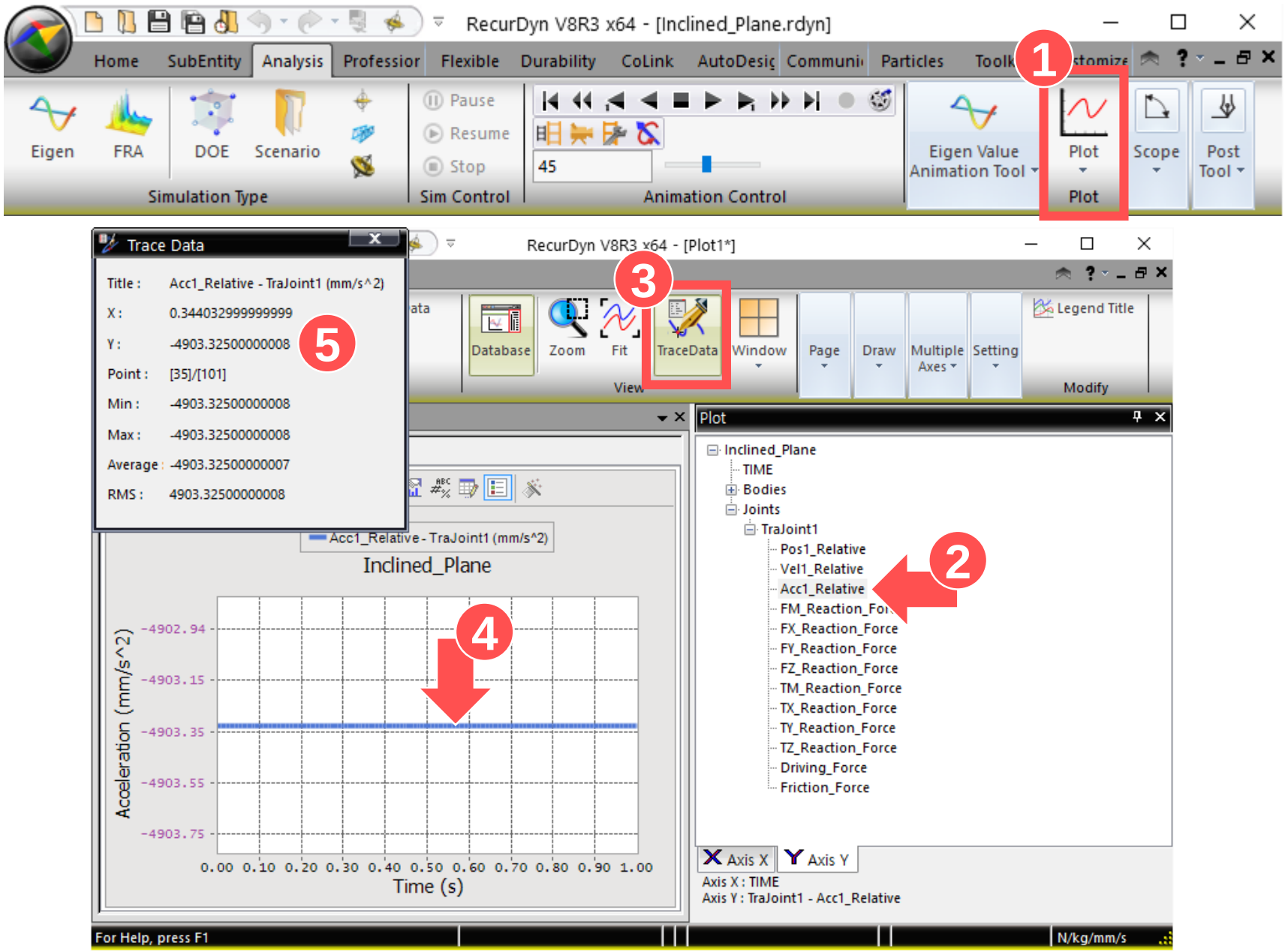
1. On the Analysis tab, in the Simulation Type group, click Dyn/Kin.
2. In the dialog box, click the General tab, and enter "1" for the End Time.
3. Click Simulate to run the simulation.





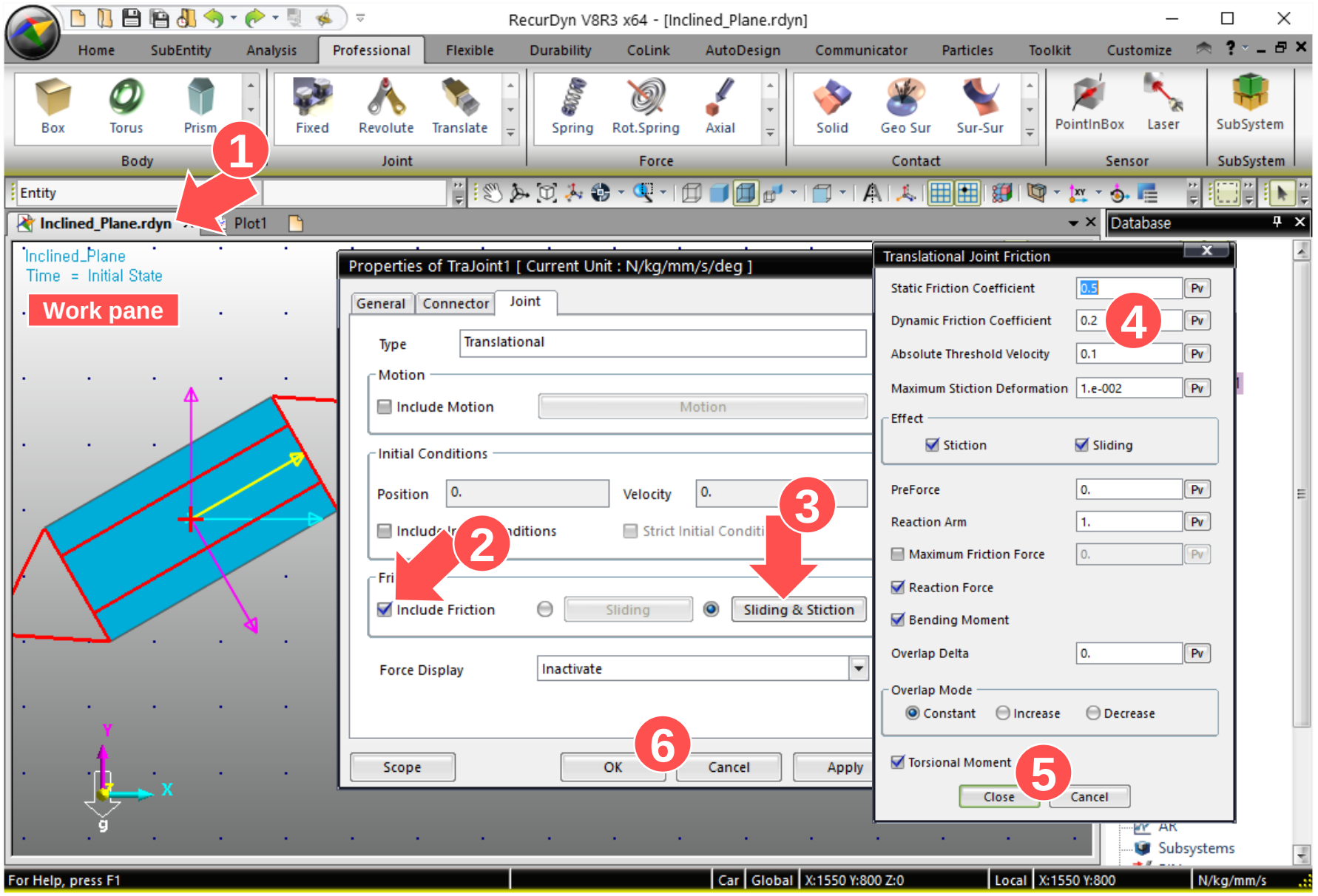
6. Checking the Acceleration of a Box on an Inclined Plane

1. On the Analysis tab, in the Plot group, click Plot.
2. On the Plot database pane, click Joint, click TraJoint1, and then double-click Acc1_Relative to create a graph.
3. Click TraceData.
4. Click to select the created graph.
5. Check the y-value (acceleration of the box) in the Trace Data dialog box.



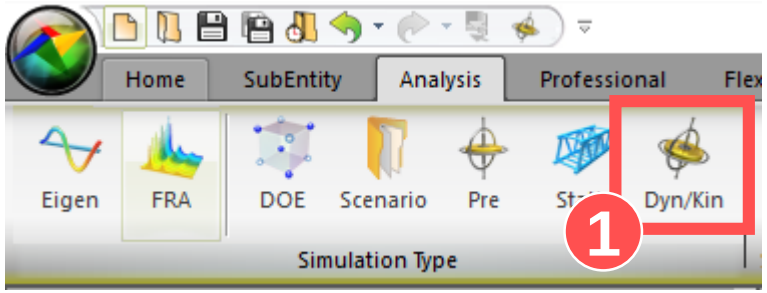
7. Applying Friction

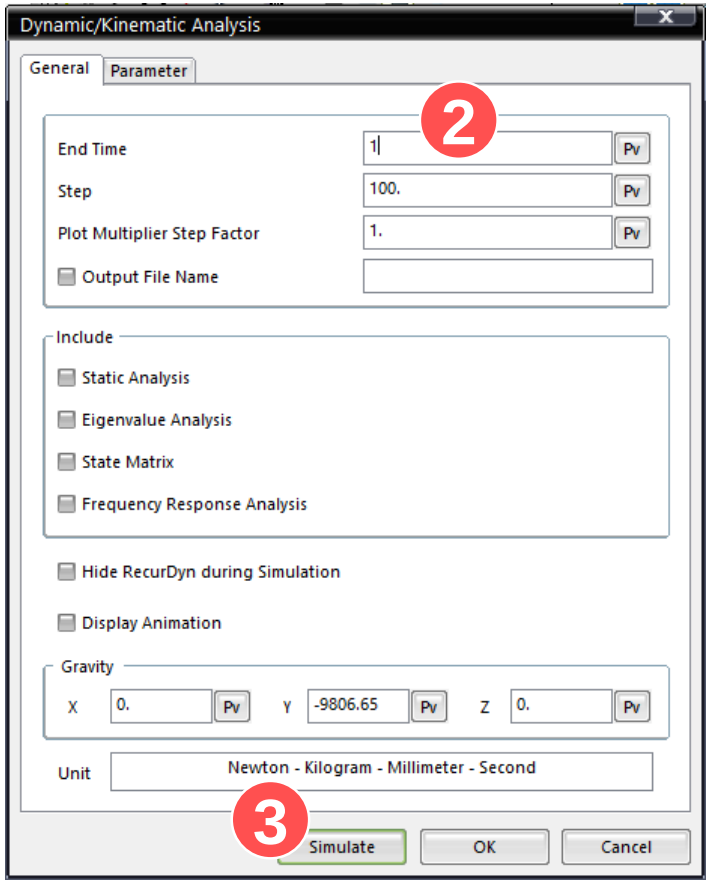
1. Click the Inclined_Plane.rdyn tab to switch to the RecurDyn modeling screen.
2. Select TraJoint1 on the work pane and press P. When the Properties of TraJoint1 dialog box appears, click the Joint tab and select the Include Friction check box.
3. Click Sliding & Stiction.
4. In the Translational Joint Friction dialog box, enter "0.2" for the Dynamic Friction Coefficient.
5. Click **Close**.
6. Click **OK** to apply the changes.



8. Performing Dynamic Analysis

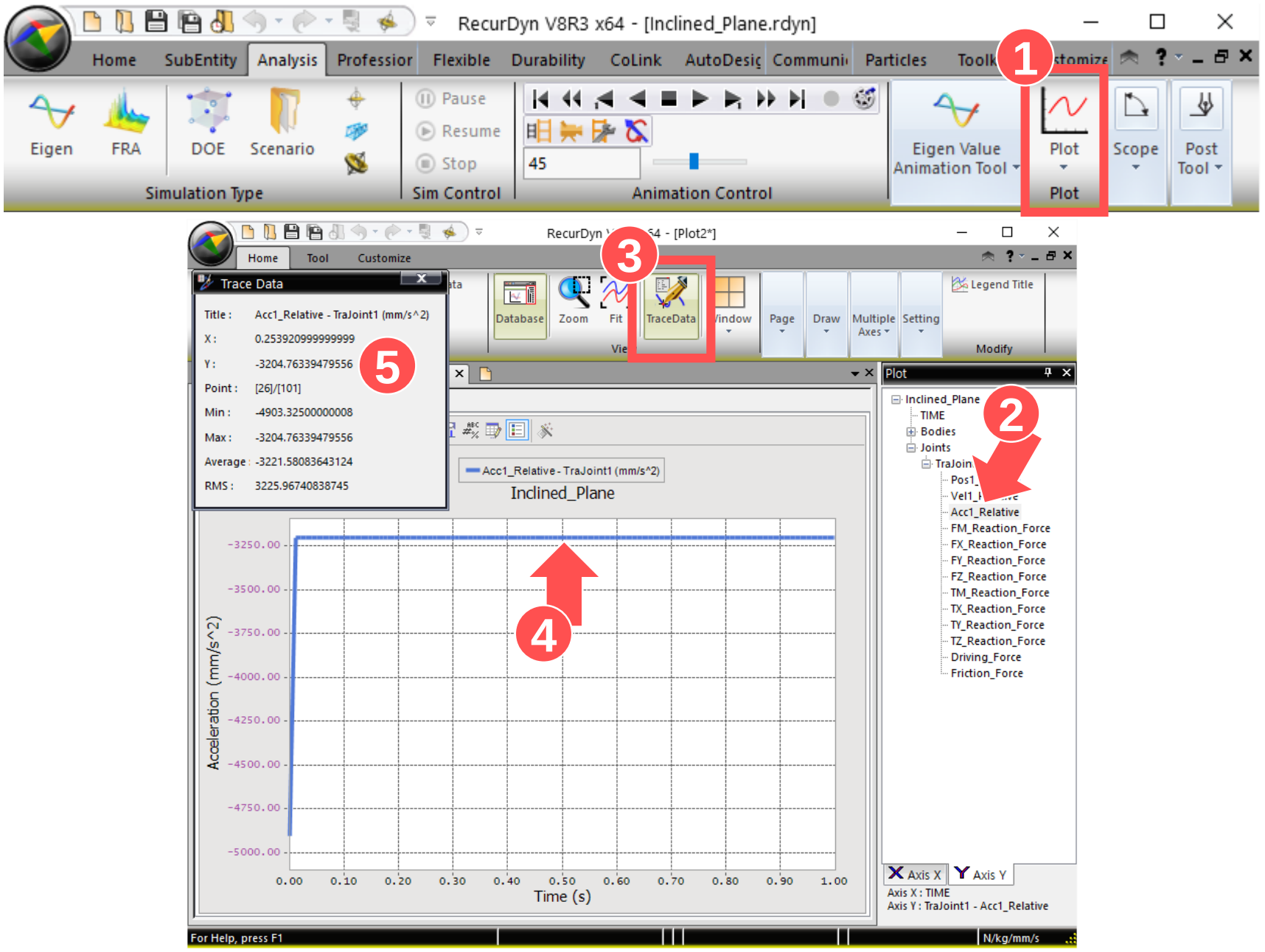
1. On the Analysis tab, in the Simulation Type group, click Dyn/Kin.
2. In the dialog box, click the General tab, and enter "1" for the End Time.
3. Click Simulate to run the simulation.





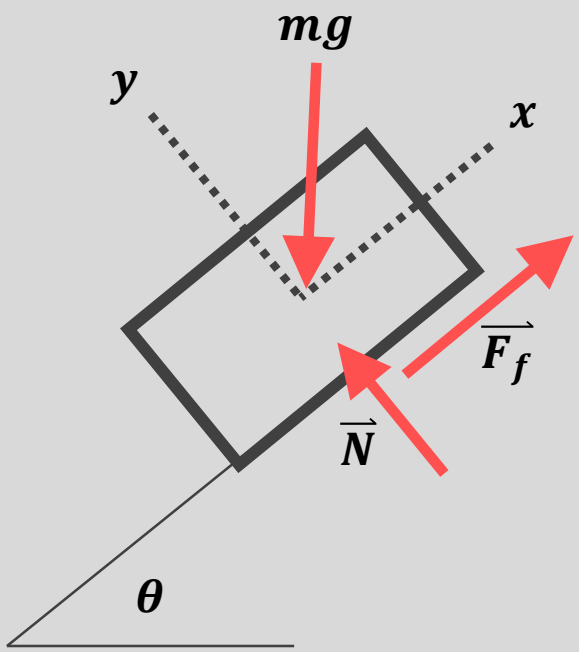
9. Checking the Acceleration of a Box on an Inclined Plane

1. On the Analysis tab, in the Plot group, click Plot.
2. On the Plot Database pane, click Joint, click TraJoint1, and then double-click Acc1_Relative to create a graph.
3. Click **TraceData**.
4. Click to select the created graph.
5. Check the y-value (acceleration of the box when friction is applied) in the Trace Data dialog box.



10. Analytical Solution

- Calculating acceleration when friction is not applied
- Calculating acceleration when friction is applied



Analysis Results of RecurDyn

- When friction is not applied : -4903.32 mm/s^2
- When friction is applied : -3204.76 mm/s^2

Calculating acceleration when friction is not applied

$$\sum F_x = ma_x$$

$$-mg \cdot \sin\theta = ma_x$$

$$a_x = -g \sin\theta$$

$$a_x = -9806.65 \sin 30$$

$$a_x = 4903.32\ mm/s^2$$

Calculating acceleration when friction is applied

$$\sum F_x = ma_x : \ F_f - mg \cdot \sin\theta = ma_x$$

$$\mu_d \cdot N - mg \cdot \sin\theta = ma_x$$

$$\mu_d \cdot mg \cdot \cos\theta - mg \cdot \sin\theta = ma_x$$

$$\mu_d \cdot \cos\theta - \sin\theta = \frac{a_x}{g}$$

$$a_x = (\mu_d \cos\theta - \sin\theta) \cdot g$$

$$a_x = (0.2 \cos 30 - \sin 30) \cdot (-9806.65)$$

$$a_x = -3204.76\ mm/s^2$$