Machinery Gear Tutorial

This tutorial teaches you how to create spur gear pair using the 3D Contact modeling method. The Adams/Machinery Gear module supports multiple combinations of gear type and modeling methodology options.

This chapter includes the following sections:

- What You Will Create
- Creating Gear Pair
- Adding Motion/Friction
- Gear Output
- Simulation

What You Will Create

During this tutorial, you will model a spur gear pair consisting of two parts with detailed geometry each connected to ground via revolute joints. One gear will be driven by a prescribed motion; the other will be driven by a 3D contact force between the two geometries.

The figure shows the gear pair that you are going to create.



Figure 1 Spur gear pair

Creating Gear Pair

In this section, you will create a gear pair.

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



3. The gear pair creation wizard will launch. On the first page (**Type**) select **Spur** from the option menu and click **Next**.

A Create Gear Pair						
Step 1 of 6						
4	Туре	•	Method	٠	Geometry	
Gear Type	Spur		•			
	Spur gears als parallel and te	o known as stra eth are straight	aight-cut gears. In thi and parallel to the ax	s gear the axis is of rotation of	of the two shafts are the two shafts.	
<u></u>				< <u>B</u> ack	Next >	Close



4. On the next page (Method) select **3D Contact** from the option menu and click Next.

4	Method •	Geometry	Material	
Module 1.35 P	ressure Angle 20	Axis of Rotation Glo	obal Z • 0.0,0.0,0.0	
	GEAR1		GEAR2	
Name	Driver	Name	Driven External	
R New C Existin	ng	G New C Existi	ng	
Center Location	0.0.0.0.0	Center Location	81.0.0.0.0	
No. of Teeth	80	No. of Teeth	40	
Gear Width	13	Gear Width	13	
Bore Radius	0.0	Bore Radius	0.0	
Profile	Standard •	Profile	Standard	
Profile Shift Coeff.	0.0	Profile Shift Coeff.	0.0	
Addendum Factor	1.0	Addendum Factor	1.0	
Dedendum Factor	1.25	Dedendum Factor	1.25	
Tooth Modification		Tooth Modification		
Tip Relief Start	0.0	Tip Relief Start	0.0	
Tip Relief Coeff.	0.0	Tip Relief Coeff.	0.0	
Crown Magnitude	0.0	Crown Magnitude	0.0	
Geometry Settings	Profile points 10	Lavers 5		

5. Fill out the next page (Geometry) by as shown below and Click Next.

- 6. The next page (**Material**) defines the material properties to be used for the mass property calculations for each gear. You can modify the parameters which define the contact force model between the two gears. Accept the defaults and move on by clicking **Next**.
- 7. On the next page (Connection) you define how each gear is to be connected to the rest of the model. For this example, accept the defaults which mount each gear to ground via revolute joints and click Next.
- 8. On the final page (**Completion**), optionally save the content of the entire wizard to a file for reuse later by clicking the **Save** icon. Click **Finish** to create the gear pair.

Note: It may take a minute or so to create the gear pair geometry.

Adding Motion/Friction

Add a motion to the driver's revolute joint as follows:

- 1. Select the **Motions** tab from the Ribbon and from the **Joint Motions** container click on the icon for **Rotational Joint Motion**.
- 2. Then from the graphics window click the revolute joint for the Driver gear (Driver_1.gear_revolute).



Add friction to the revolute joint for the Driven gear as follows:

1. From the main menu click Tools and select Database Navigator.



2. From the database navigator select "**Constraint**" for the Filter option and select "gear_revolute" joint and click **OK**.

A Database Navigator	
Browse	•
- MODEL_1 MOTION_1 + Driven 1	Model Rotations
- Driver_1 gear fixed	ac_am_cyl (OFF) Fix
<pre>gear_revolute + amachinery + MDI</pre>	Revolute Library Library
)
All Objects	
Sort by Type	ight +
OK	Close

3. Click **Modify** from the information window as shown below:

model_1.driver_1.g	ear_revolute				
Apply Parent	Children Modify Verbose	Clear	Read from File	Save to File	Close
Object Name	: .MODEL_1.Driver_1.gear_revolut				
Object Type	: Revolute Joint				
Parent Type	: ac_am_cylindrical_gear_element	ł.			
Adams ID	: 0				
Active	: NO_OPINION				
I Marker	: .MODEL_1.Driver_1.gear_part.g	ear_attachme	int_ref		
J Marker	: .MODEL_1.ground.Driver_1_Ref_	1 (.MODEL 1	.Driver_1.ref_mark	er)	
Initial Condit	Lons				
	ACCOUNT OF ST				
Angular Disp	A REAL PROPERTY AND A REAL				

4. From the **Create Friction** dialog box, set "Mu Static" = "0.2" and "Mu Dynamic" = "0.1", accept the remaining defaults by clicking **OK** here and then complete by clicking **OK** from the **Modify Joint** dialog box.

	Create Friction	12
	Friction Name	MODEL_1.FRICTION_1
	Adams Id	1
	Comments	
Driver_1.gear_revolute	Joint Name Revolute Parameters	MODEL_1.Driver_1.gear_revolute
Driver_1.gear_part	Mu Static	0.2
around	Mu Dynamic	0.1
D dd	Friction Arm	1.0
Revolute •	Bending Reaction Arm	1.0
	Pin Radius	1.0
None 👻	Stiction Transition Velocity	0.1
January Mating(a)	Max Stiction Deformation	0.01
impose motion(s)	Friction Torque Preload	0.0
Initial Conditions	Effect	Stiction and Sliding
Apply <u>Cancel</u>	Input Forces to Friction:	♥ Reaction Force ♥ Bending Moment
	Driver_1.gear_revolute Driver_1.gear_part ground Revolute None Impose Motion(s) Initial Conditions Apply Cancel	Create Friction Name Adams Id Driver_1.gear_revolute Driver_1.gear_part ground Revolute Impose Motion(s) Initial Conditions Implex Motion(s) Initial Conditions Implex Motion(s) Initial Conditions Implex Motion(s) Initial Conditions Implex Forces to Friction: Implex Forces to Friction: Implex Forces to Friction: Initial Conditions Implex Forces to Friction: Implex

Simulation

1. Simulate your model for 6 seconds at 600 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 message window will appear once you click the start button. Please click close.)

<u>Eile Edit ⊻iew Settings I</u> ools	Image	i 🐛 🗱 🖪 🖬 🚰 🚰 🔍 🗢 🚓 »
dies Connectors Motions	Forces Elements Design Exploration	Plugins Machinery Simulation
Setup Simulate	Simulation Control	
model_1	Steps 💽 600	
Browse Groups Filters Bodies Connectors Motions Forces Elements Design Variables Simulations Results All Other	Sim. Type: Default Start at equilibrium Reset before running No Debug No Debug No Debug Vupdate graphics display Update graphics display Interactive C Scripted Simulation Settings	