

### **1** Project 1 - Generate and Edit Gears

In this project, you create spur and bevel gear sets. You edit the gears to provide clearance for the shafts.



#### 1.1 Create Spur Gears

In this section of the project, you add a spur gear set to an assembly.

- 1. Using the Intro to CAD & CAE.ipj
- 2. Open GearBox-A.iam.





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3. From the Design ribbon, on the Power Transmission tab, click Spur Gear.



- 4. To set the Common values for the spur gear:
  - Un the Spur Gear Component Generator dialog box, under Common, for Design Guide, click Number of Teeth.
  - Version For Desired Gear Ratio, click 1 ul.
  - For **Module**, click 2.000 mm.
  - Eor Helix Angle, enter 0.
  - Verify that Internal is not selected.

Sp	ur Gears Component Generator						
	JF Design for Calculation	💕 🚽 😭 🖉					
	Common						
	Design Guide	Pressure Angle Helix Angle					
1	Number of Teeth 🔹	20.0000 deg (4) 0.0000 deg 🕨 🔀					
	Desired Gear Ratio	Unit Corrections Guide					
2	I Thernal 5	User 🔹					
	Module Center Distance	Total Unit Correction					
3	2.000 mm 👻 80.000 mm 👻	0.0000 ul 🕨 Preview					
	Gear1	Gear2					
	Component   Cylindrical Face	Component					

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- 5. To define the values for Gear 1:
  - In the Spur Gear Component Generator dialog box, under Gear 1, click the red arrow next to Cylindrical Face. Click the shaft 1.
  - Click the red arrow next to **Start Plane**. Click the bushing face <sup>2</sup>.
  - Drag the 3D Grip <sup>3</sup> to a value of 25.



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- 6. To define the values for Gear 2:
  - Rotate the view.
  - In the **Spur Gear Component Generator** dialog box, under **Gear 2**, click the red arrow next to **Cylindrical Face**. Click the shaft 1.
  - Click the red arrow next to **Start Plane**. Click the bushing face <sup>(2)</sup>.
  - Drag the 3D Grip  $\bigcirc$  to a value of 35.



7. To check your design, in the Spur Gears Component Generator, click







8. To add the gears to your assembly, click OK. In the File Naming dialog box, click OK.





9. Rotate the view.



10. From the **Design** ribbon, on the **Power Transmission** tab, click the **Spur Gear** flyout. Click **Bevel Gear**.





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- **11.** To set the **Common** values for the bevel gears:
  - In the **Bevel Gears Component Generator** dialog box, under **Common**, for **Facewidth**, enter **24.5**.
  - For Module, select 3.000 mm.

Common Gear Ratio		Facewidth		
0.6000 ul	+	24.5	- P-	
Module		Shaft Angle		
3.000 mm	-	90.0000 deg	- P-	
3.000 mm 3.500 mm	^			

- 12. To define the values for Gear 1:
  - In the Bevel Gear Component Generator dialog box, under Gear 1, click the red arrow next to Cylindrical Face. Click the shaft 1.
  - Click the red arrow next to Plane. Click the bushing face <sup>2</sup>.



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- 13. To define the values for Gear 2:
  - Rotate the view.
  - In the **Bevel Gear Component Generator** dialog box, under **Gear 2**, click the red arrow next to **Cylindrical Face**. Click the shaft 1.
  - Click the red arrow next to **Plane**. Click the bushing face 2.
  - Drag the **Facewidth** 3D Grip <sup>3</sup> to a value of **25**.
  - Drag the **Number of Teeth** 3D Grip <sup>(4)</sup> to a value of **21**.





- Change number of teeth
- **14.** Refine **Gear 1** by dragging the **Number of Teeth** 3D Grip <sup>(1)</sup> to a value of **38**.

- **15.** To review the gear calculations:
  - In the Bevel Gears Component Generator dialog box, on the Calculation tab, for
     Power under Gear 1, enter 100.
     Calculate

i Gears Component Generator							-
Design JG Calculation							
lethod of Strength Calculation						Results	
ISO 6336:1996						Ft	22715.551 N
ande	Gear 1				_	F.	24173.385 N
oads				Gear 2		v	4.402 mps
Power	P 100		۲.	98.000 kW		nes	15598.763 rpm
Greed		1000.00 rpm	,	1666.67 rpm		Gear 1	
Toro a		054 030 Nm		561 d00 Nm		<sup>Fra</sup>	4253.740 N
Torque		-		Jor - Harrison		12	4253.740 N
Efficiency		η 0.9	80 U			Pat .	7089.567 N
Material Values						F #2	0.530.4
Gear 1 📃 Use	r material				-	5	0.298 ul
Gear 2 🔄 Use	r material				- 📖	San	0.472 ul
Rendino Fatique Limit	Gen-	352.0 MPa	,	352.0 MPa		Sea	0.612 ul
Contact Eatinue Limit	-Pim	1140.0 MPa		1140.0 MPa		Gear 2	
Modula of Flasticity	- Heart	206000 MPa		206000 MPa		Pri	7089.567 N
Delegative Delegation of	-	0.900-4		0.300-4		F12	7089.567 N
Poisson's Kato	۴	0.300 G		0.300 0		Fai	4253.740 N
Heat Treatment		20	'	20		Fa2	4253.740 N
						SH	0.504 ul
Required Life		Lh 100	00 hr			Sp	0.279 ul
			_		_	PHR .	0.581.4
		Factors		Acouracy		-78	0.301.0



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- **16.** To review the gear calculation message:
  - In the **Bevel Gears Component Generator** dialog box, notice the red lines displayed after performing the calculation.
  - Click the chevrons ¥ to display the message.



17. This gear set will be driven by a motor. To size the motor, change the loads on the bevel gears:

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- In the Bevel Gears Component Generator dialog box, on the Calculation tab, for Power under Gear 1, enter 5.
- For **Speed**, enter **500**.
- Click Calculate

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• Calculation now indicates design compliance!

10:56:56 AM Design: Numbers of teeth are commensurable - sl 10:56:56 AM Design: Gear 2: The Unit Correction (x) is less tha 10:56:56 AM Design: Calculation indicates design compliance!



- **Project 1 Gear Generator** 
  - 18. To add the gears to your design, in the **Bevel Gears Component Generator** dialog box, click **OK**. In the **File Naming** dialog box, click **OK**.



- **19.** To edit the bevel gear set:
  - In the browser or graphics window, select the gears.
  - Right-click. Click Edit Using Design Accelerator.





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- **20.** To change the number of teeth in each gear, in the **Bevel Gears Component Generator** dialog box:
  - Under Gear1 enter 40.
  - Under Gear2, enter 20.
  - Click Calculate
     Click OK.
- 21. In the model browser, expand Bevel Gears:1 and Shaft 4





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22. Constrain the center plane of the Gears to their perspective shafts.

- Click the **Constrain** command
- From the model browser, Select 1 XZ Plane from Shaft:1 under Shaft:4
- Select 2 XZ Plane from the Gear2:1 under B Sevel Gears:1
- Select **Flush** for the solution
- Click Ok.





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23. Repeat the previous step for the other Bevel Gear and both Spur Gears.

• Now dragging any of the shafts will cause the other to move in accordance to the gear ratios set in the design accelerators.



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24. To edit a bevel gear:

- In the browser, double-click **Bevel Gear1:1**.
- Click the front face of the bevel gear, Click Create Sketch from the Mini-Toolbar



- Place a circle and constrain it to the origin, and extrude cut through the gear.
- Repeat for **Bevel Gear2:1**



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25. On the ribbon, from the Return tab, click Return.



26. Close all files. Do NOT save.