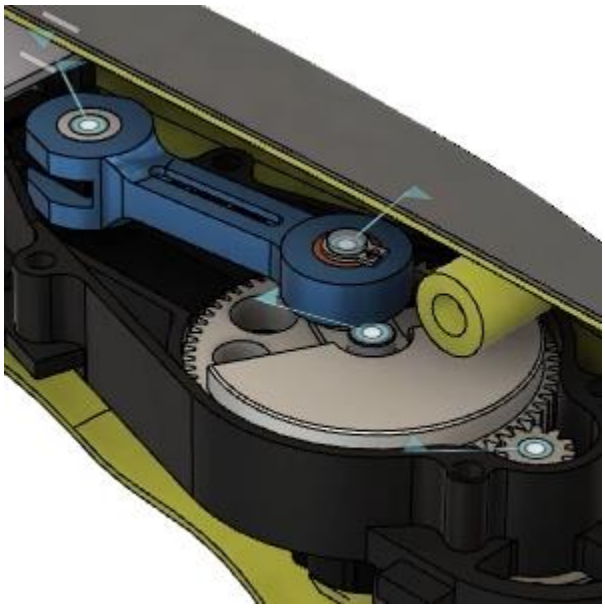
AUTODESK

Recreate reciprocating saw motion

In this module, you'll apply several joints to replicate a reciprocating saw's mechanical motion.

Learning objectives:

- Ground a component.
- Create a rigid group.
- Use As-built joints.



The completed exercise

1. Continue with the file from the previous module.

Figure 1. Continue with the file from the previous module

2. You created a joint to make the trigger work properly in the previous module. However, the other components don't have joints applied. If you move any of the components, click Position> Revert Position to return them to their original position.

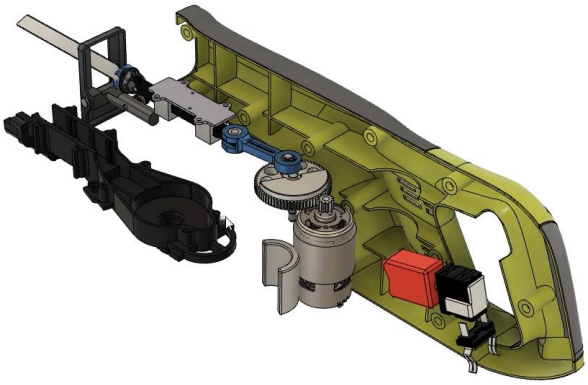


Figure 2. Inspect the file's components

3. In the Browser, right-click the saw handle casing component. Choose Ground from the menu and notice that the orange pin icon is added to the component.

Figure 3. Ground the saw handle casing

4. Expand the Internal_Mechanics component and select the Trigger component. Right-click it and choose Unground.

Figure 4. Unground the Trigger component

5. Expand the Blade Holder Assembly component and notice that all of the subcomponents need to move as a single unit. Select the Blade Holder Assembly component.

Figure 5. Inspect the Blade Holder Assembly

6. Click Assemble> Rigid Group.

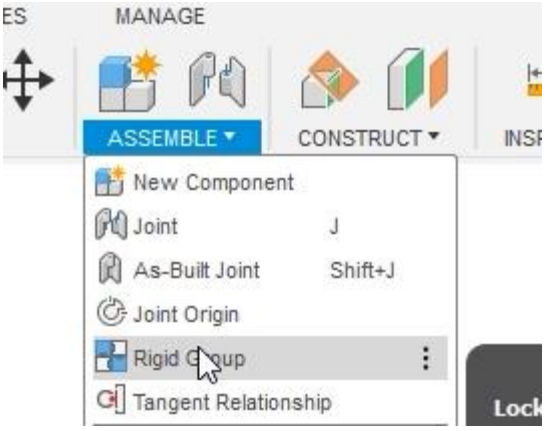


Figure 6. Open the Rigid Group tool

7. The selected component's six subcomponents are automatically added to the dialog's Components selection. Also add the Blade component to the selection, then OK the dialog.

Figure 7. Choose the Components selection

8. The Blade Holder Assembly and Blade components are now grouped together and move as a single unit. Revert the position if you move the assembly.

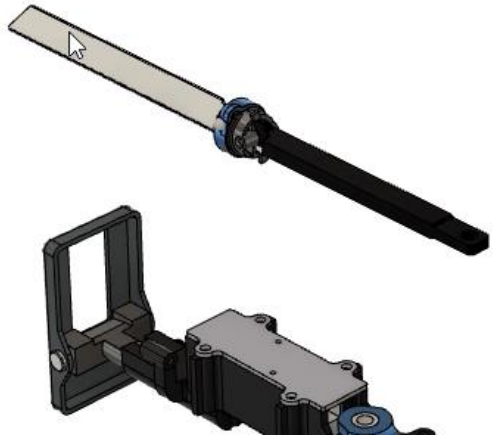


Figure 8. Inspect the Rigid Group

9. Click Assemble> Rigid Group. For the dialog's Components selection, choose the components shown in the image on the right. OK the dialog.

Figure 9. Create a Rigid Group

10. Create a new rigid group and choose the Gear Housing and saw handle casing components. This rigidly grouped the internal components to the saw casing. OK the dialog.

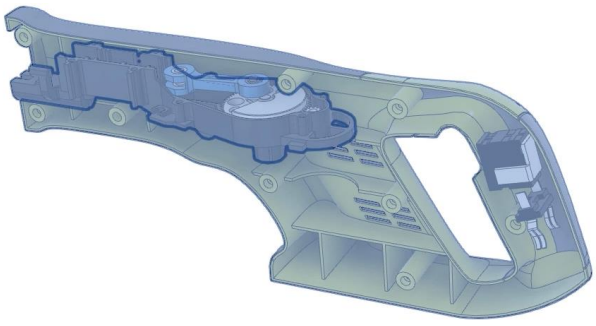


Figure 10. Create another rigid group

11. Use the Browser to hide all the unnecessary components so that you can focus on the components that need to have joints applied to them. The only visible components should be the Guide Block, Motor Internals, Big Gear Shaft, Blade Holder Assembly, Short Rod, Small Spur Gear, Large Spur Gear, Connecting Rod, and Blade components.

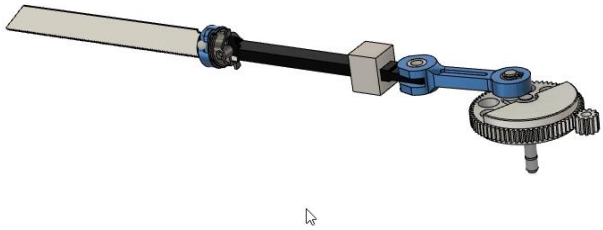


Figure 11. Hide most of the assembly's components

12. Click Assemble> As-Built Joint.

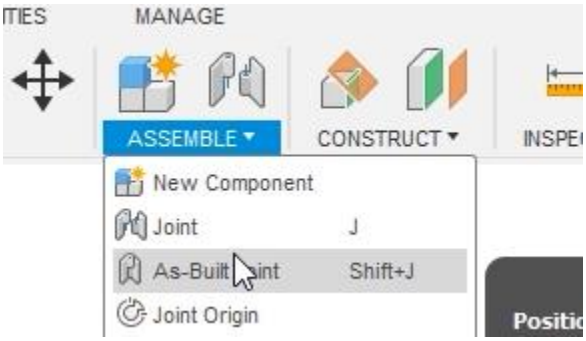


Figure 12. Open the As-Built Joint tool

13. Choose the Revolute option from the dialog's Joint Type menu.

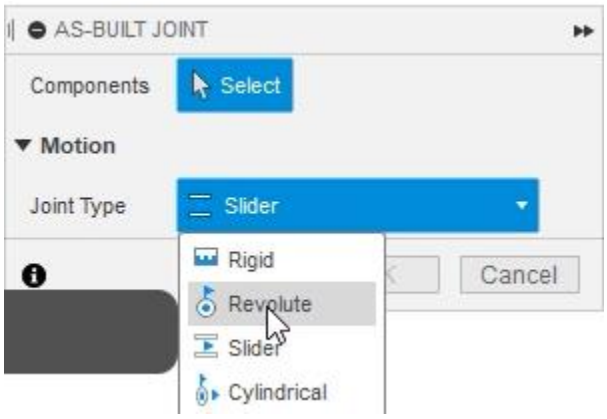


Figure 13. Choose the joint type

14. Choose the shaft shown in the image on the right as the dialog's first Components selection.

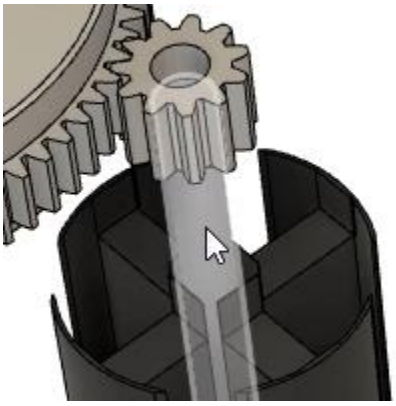


Figure 14. Choose the motor's shaft

15. Choose the circular edge shown in the image on the right as the dialog's second Components selection, then OK the dialog.

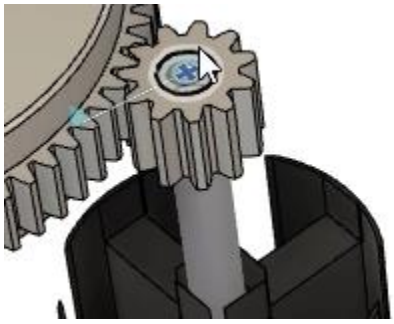


Figure 15. Choose the gear's circular edge

16. Click Assemble> As-Built Joint to open the As-Built Joint tool, then select the Large Spur Gear as the first Components selection.

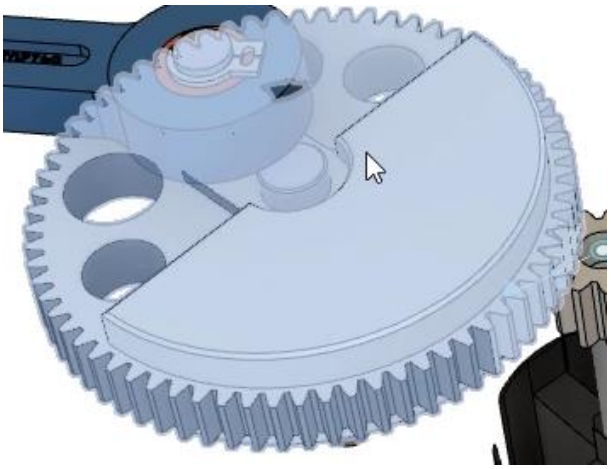


Figure 16. Open the As-Built Joint tool and choose the first Components selection

17. Choose the shaft's circular edge shown in the image on the right as the second Components selection, then OK the dialog.

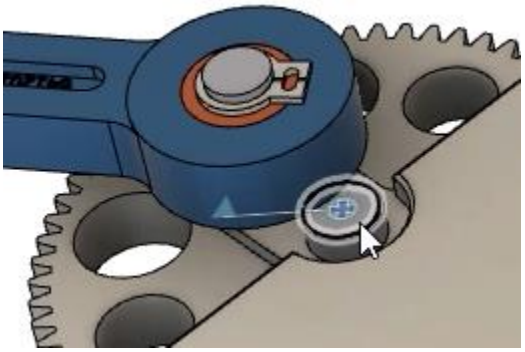


Figure 17. Select the shaft's circular edge

18. Open the Rigid Group tool and select the four components shown in the image on the right. The Circular Clip, Shaft, Bushing, and Large Spur Gear component. The blue Connecting Rod component is not part of the selection. OK the dialog.

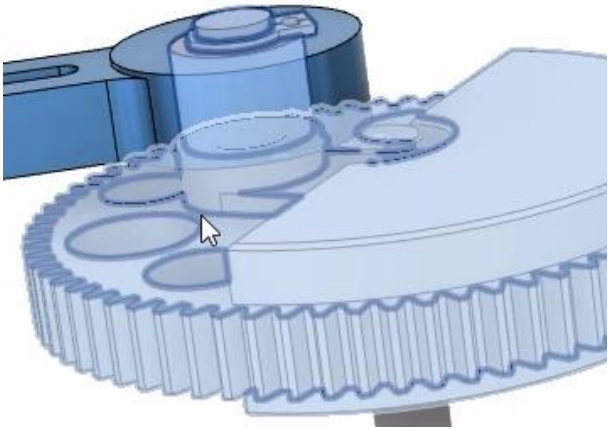


Figure 18. Create a Rigid Group

19. Open the As-Built Joint tool and choose the Connecting Rod component as the first Components selection. Choose the Circular Clip's edge shown in the image on the right as the second Components selection, then OK the dialog.

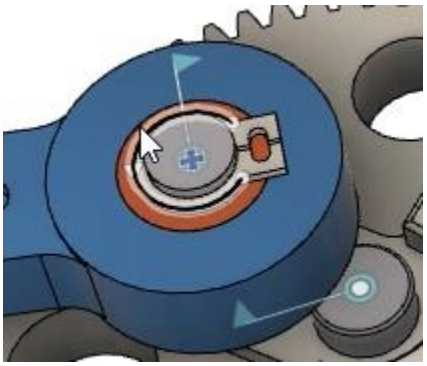


Figure 19. Create a new As-Built Joint

20. Open the As-Built Joint tool and choose the Connecting Rod component as the first Components selection. Choose the Bushing's circular edge shown in the image on the right as a second Components selection, then OK the dialog.

Figure 20. Create a new As-Built Joint

21. Open the As-Built Joint tool and choose the Slider option from the dialog's Joint Type menu.

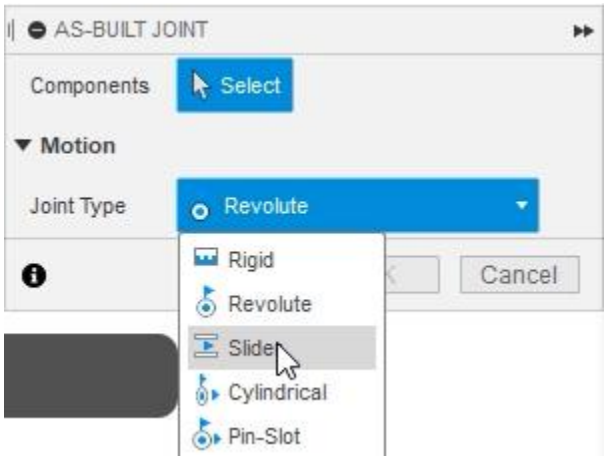


Figure 21. Open the As-Built Joint tool and choose the joint type

22. For the dialog's Components selection, choose the Blade Holder Assembly and Guide Block components. Choose the edge shown in the image on the right as the dialog's Snap selection, then OK the dialog.

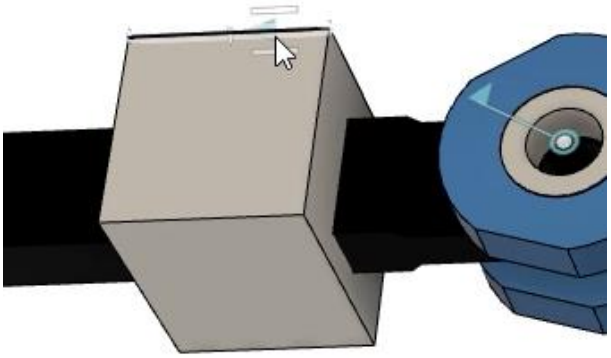


Figure 22. Create a Slider joint

23. Rotate one of the components and notice that there are two connecting rods in the file. Some of the joints might have been applied to the wrong connecting rod. This needs to be resolved. Revert the components to their original position by clicking Position> Revert Position.

Figure 23. Rotate a component

24. Expand the Connecting Rod component, select the second instance of the Crank Arm component, right-click it, then choose Remove from the menu.

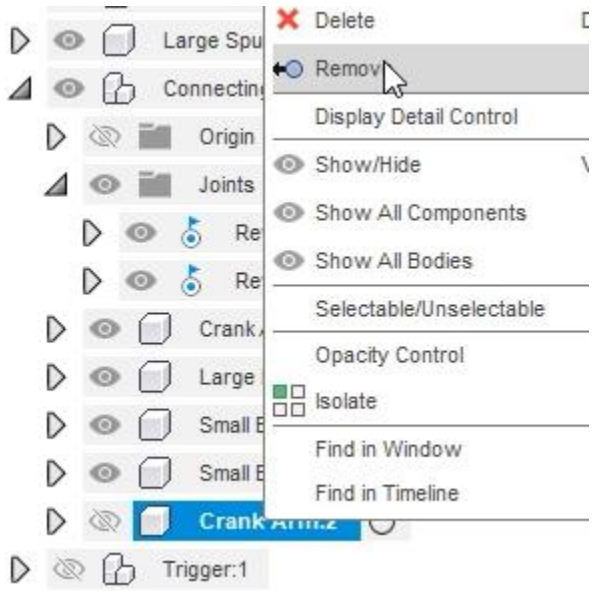


Figure 24. Remove the extra Crank Arm component

25. Open the Rigid Group tool, then select the Blade Holder Assembly and the two Small Bushing subcomponents inside the Connecting Rod component. OK the dialog to create the Rigid Group.

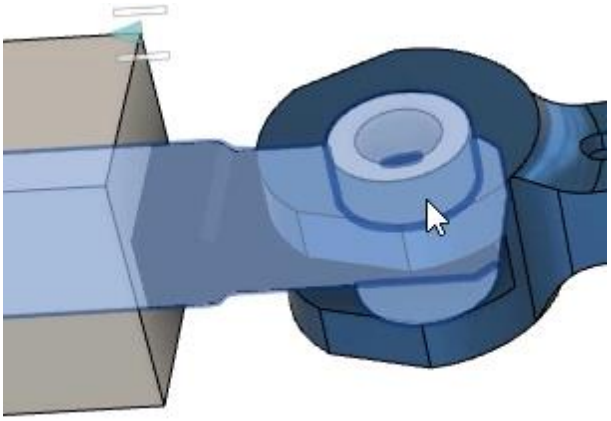


Figure 25. Create a rigid group

26. Rotate the Large Spur Gear component and notice which joints need to be re-created after you deleted the second instance of the Crank component. Use the As-Built Joint tool to re-create the necessary joints.

Figure 26. Re-create the necessary joints

27. After the joints are properly applied, rotating the Large Spur Gear component should actuate the blade assembly so that it reciprocates. Click Position> Revert Position after you finish exploring the motion. Notice that the large spur gear does not turn the small spur gear.

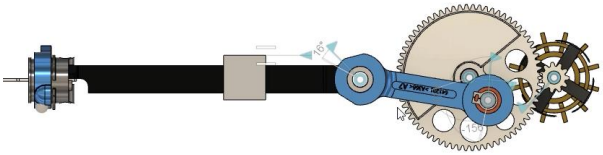


Figure 27. Actuate the assembly

28. Click Assemble> Motion Link.

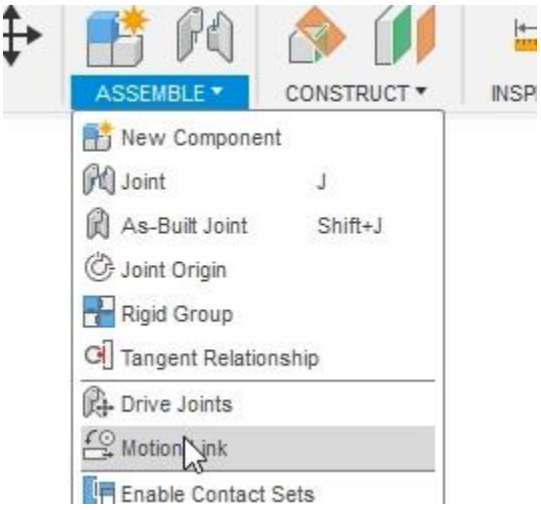


Figure 28. Open the Motion Link tool

29. A Motion Link allows you to select two joints and create a relationship between them. For the dialog's Joints selections, choose the blue Revolute joint icons applied to the large and small spur gears. The joints will animate after making the second selection. Notice that they are both spinning at the same speed, but the small spur gear should be spinning much faster than the large spur gear because of the different number of teeth.

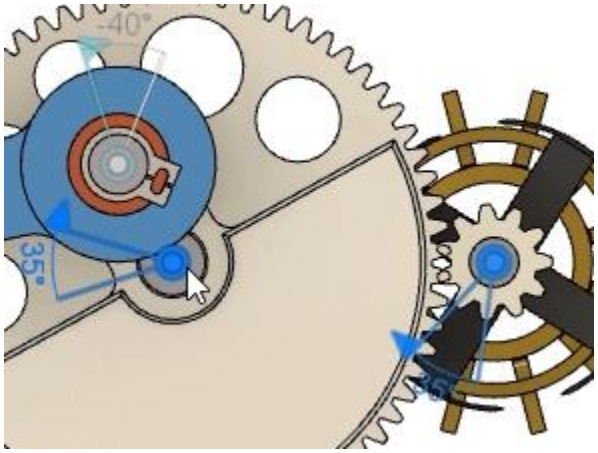


Figure 29. Choose the two joints

30. The large spur gear has 68 teeth and the small spur gear has 11. Enter 68 into the large spur gear's revolute joint box, then enter 11 into the small spur gear's revolute joint box. Your dialog might display the joints differently if you selected them in a different order. OK the dialog after you finish customizing the ratio.

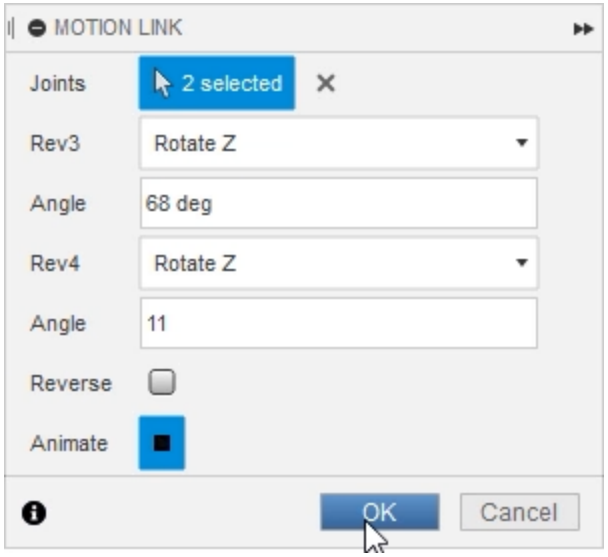


Figure 30. Customize the gears' ratio

31. Click and drag the large spur gear and notice that the small spur gear moves appropriately. The gear teeth might slightly overlap if they were not precisely positioned before you created the revolute joints. Click Position> Revert Position to return the components to their original position.

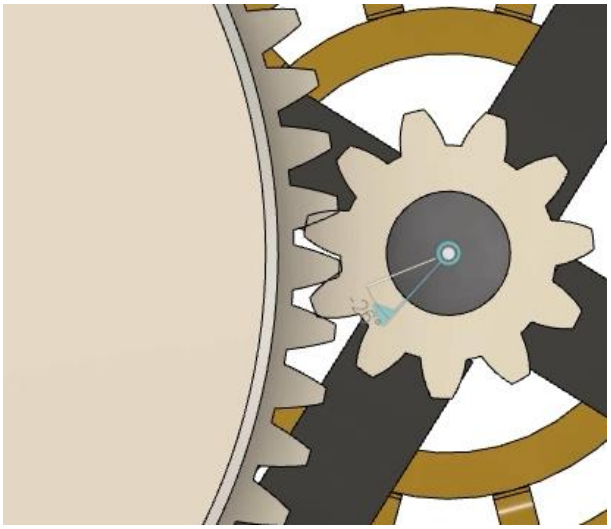


Figure 31. Inspect the result

32. Right-click the Browser's top level and choose Show All Components from the menu.

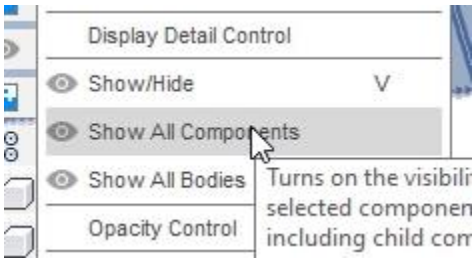


Figure 32. Show all the file's components

33. All of the file's joints can be animated using a Motion Study. Click Assemble> Motion Study.

Figure 33. Open the Motion Study tool

34. Choose the large spur gear's revolute joint as the joint the study will drive.

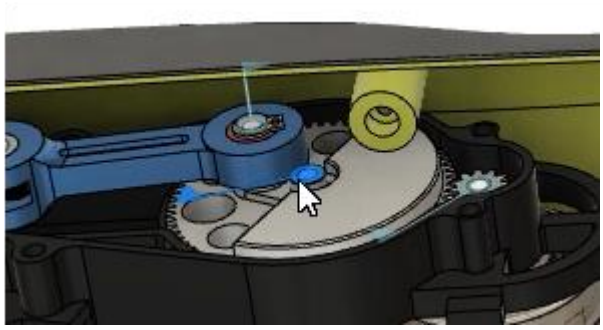


Figure 34. Choose the joint to drive

35. Inside the Motion Study dialog, click the timeline at the 40 mark, then enter **360** into the Angle box. Press Enter.

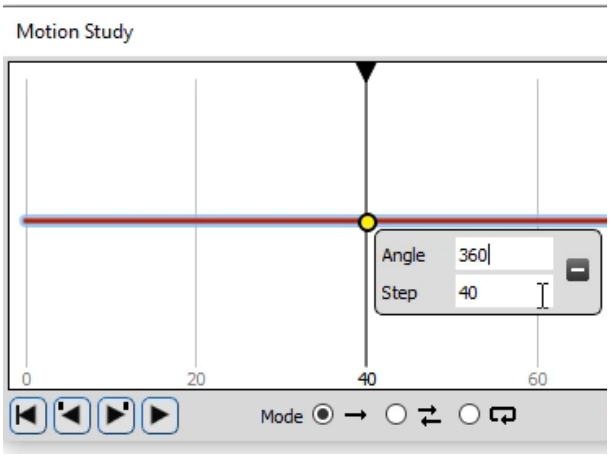


Figure 35. Specify the study's parameters

36. Activate the Loop option at the bottom of the dialog, then press Play. Notice that the spur gear rotates 360° by the time it gets to the timeline's 40 mark. Because you activated the Loop option, the blade continues to reciprocate on an endless loop. OK the Motion Link Dialog after you finish watching the animation.

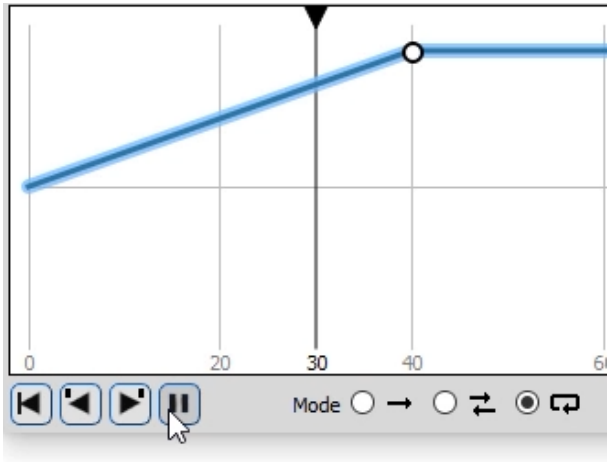


Figure 36. Press Play

37. Note that the Motion Study was added to the Browser's Motion Studies folder and can be accessed at any time. Click Position> Revert Position, then save the file.

Figure 37. Notice the Motion Study's location

38. Click Show Data Panel to open the Data Panel.

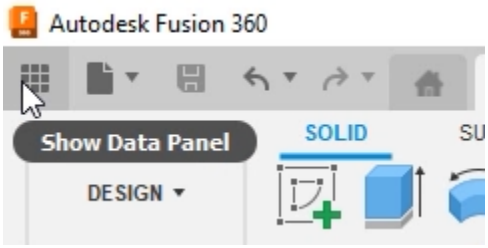


Figure 38. Open the Data Panel

39. Navigate to the *parametric link.f3d* file supplied with the course, then drag and drop it into the Canvas area.

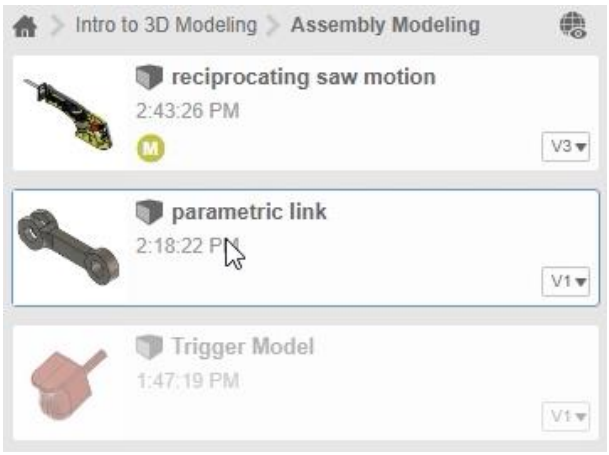


Figure 39. Drag and drop the parametric link into the Canvas area

40. OK the dialog without moving the new parametric link.

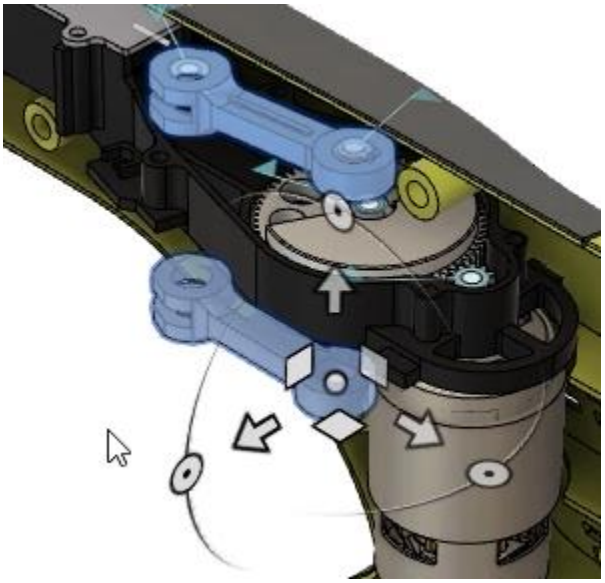


Figure 40. Accept the parametric link's location

41. The chain-link icon next to the parametric link component indicates that the component is linked to an external file. If necessary, you can right-click the component and choose to break the link to the external file. The joints from the original Crank Arm component could be re-associated with the new parametric link component. Save the file and continue to the next module.

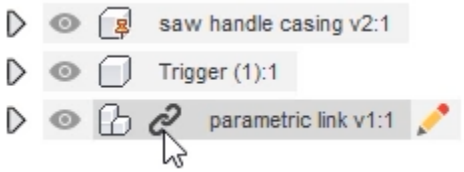


Figure 41. Notice the component's icon