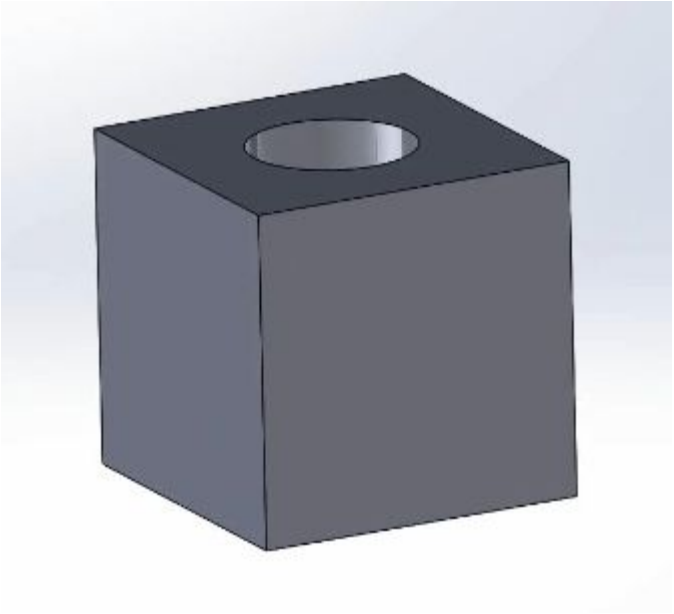
Advance SolidWorks

By Friend

Pre-workshop

- Make this part
- 10mm cube with a 5mm through-hole in the center
- Should take less than 5 minutes given the skills you learned during the previous workshop



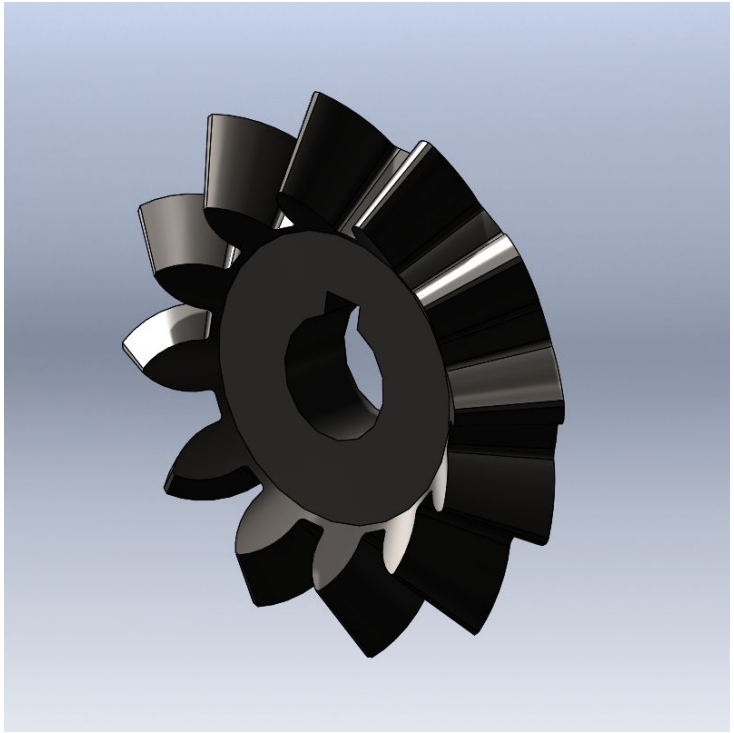
Downloading the gear

Find this gear in this workshop's folder, and make sure you can open it in SolidWorks

This gear is needed for the assembly.

Fun facts:

- Bevel gear is a 90deg gear
- Miter gear is a type of bevel gear where ratio is always 1:1



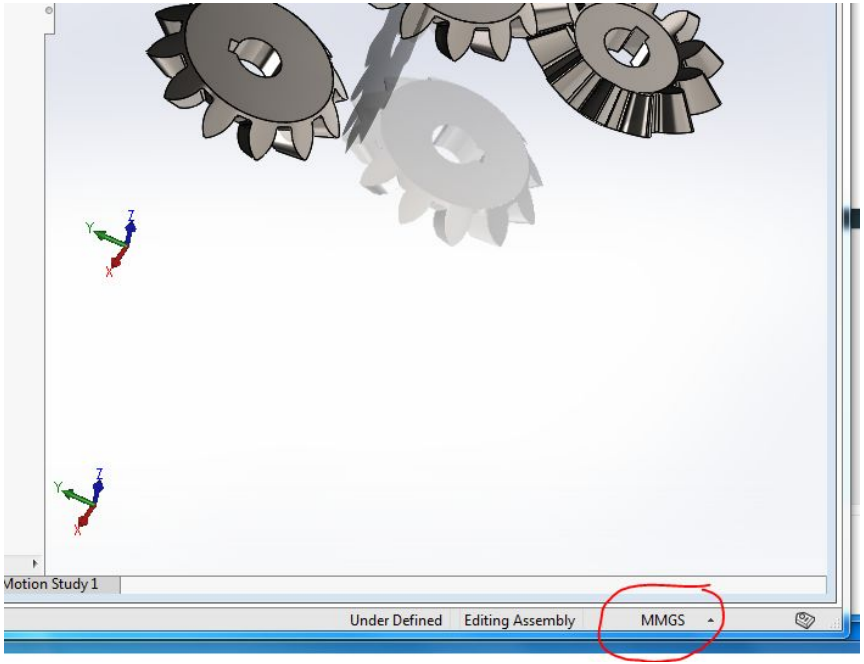
Agenda

- Mates, mechanical mates
- Motion study

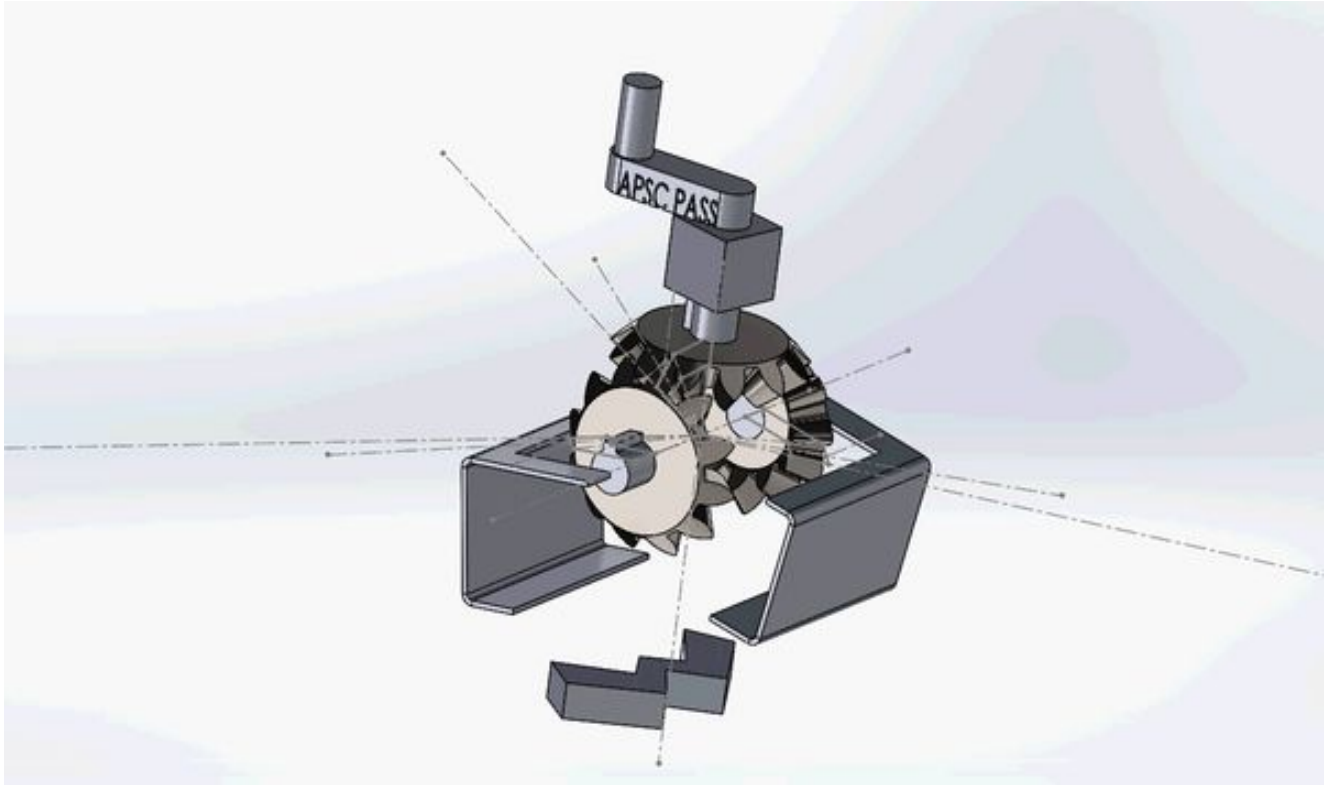
0. Setting up

Units

- Make sure you're in MMGS for this tutorial!



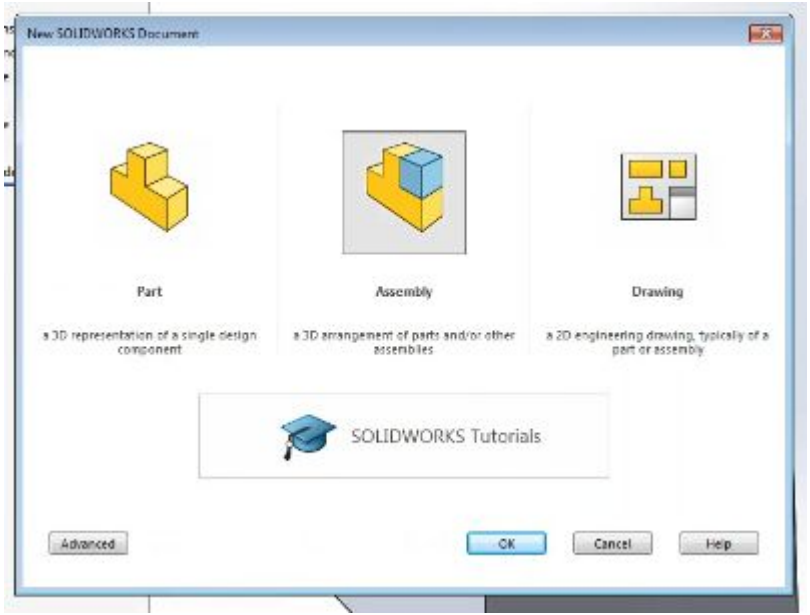
4. Mates, mechanical mates



Final product of this section

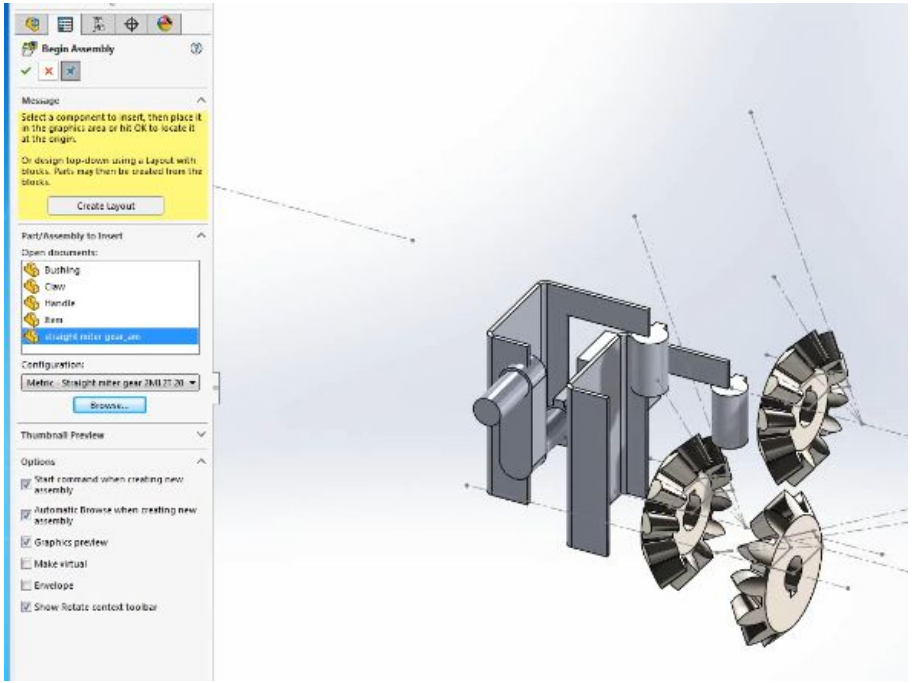
Start a new assembly

- File -> New -> Assembly



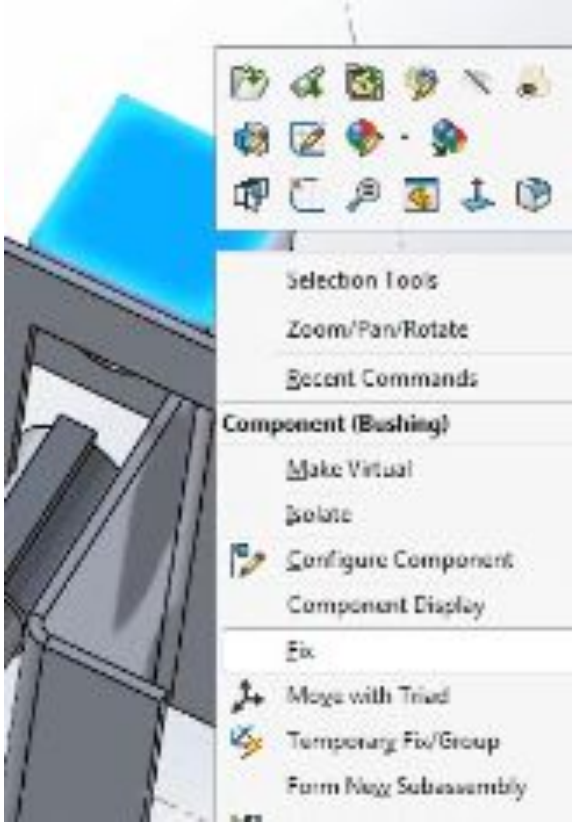
Start a new assembly

- “Begin Assembly” window should pop up
- Bring in the files accordingly:
  - X2 “Claw”
  - X1 “Handle”
  - X1 “Bushing”
  - X3 “Miter gear”(given)



Fix/float

- Right click on all the parts to check whether they are float or fix
- Make sure the bushing is the only part that is fix
- Fix it so that it can’t be moved around while mating

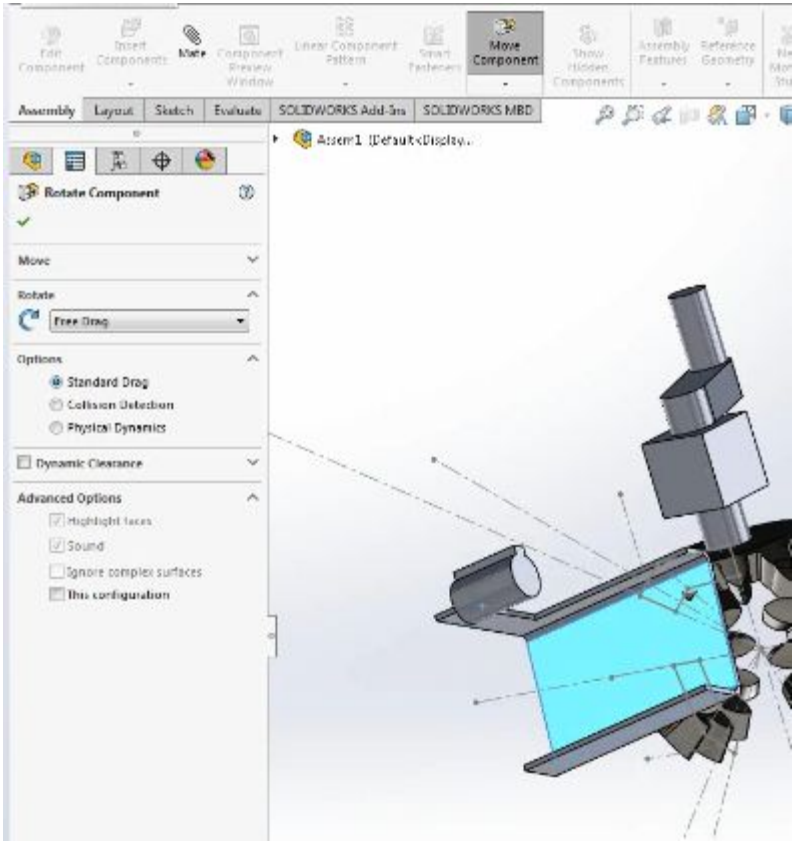


Mating

Step 1:

Check if the orientation of the two pieces are already somewhat aligned or not.

If not, rotate or move them (Pro-tip: right mouse moves; left mouse rotates).



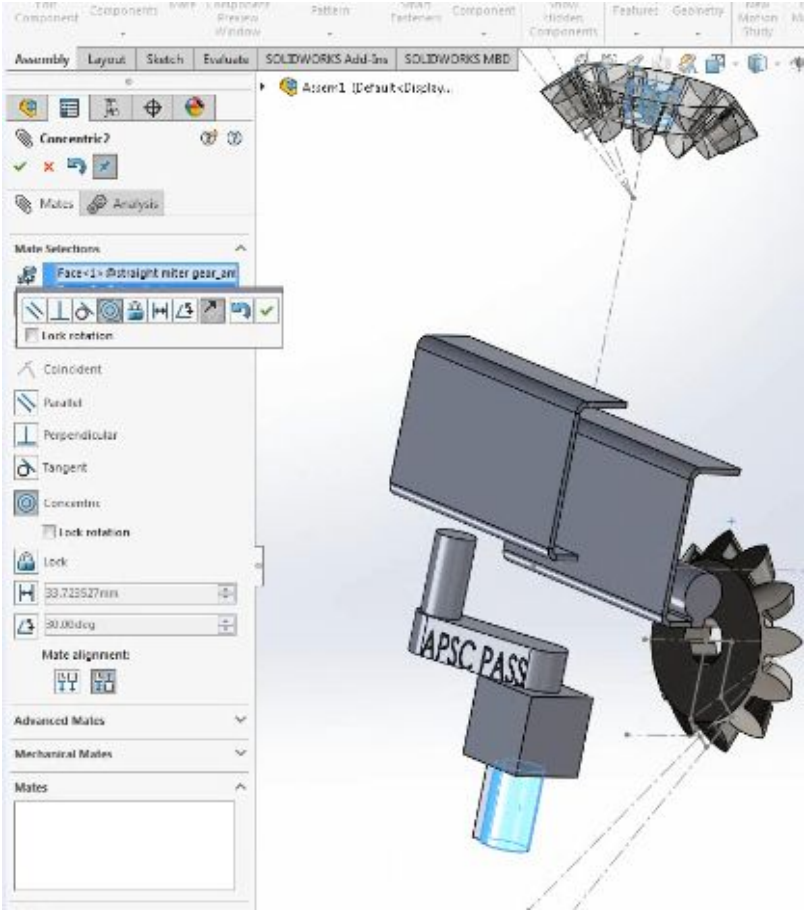
Mating

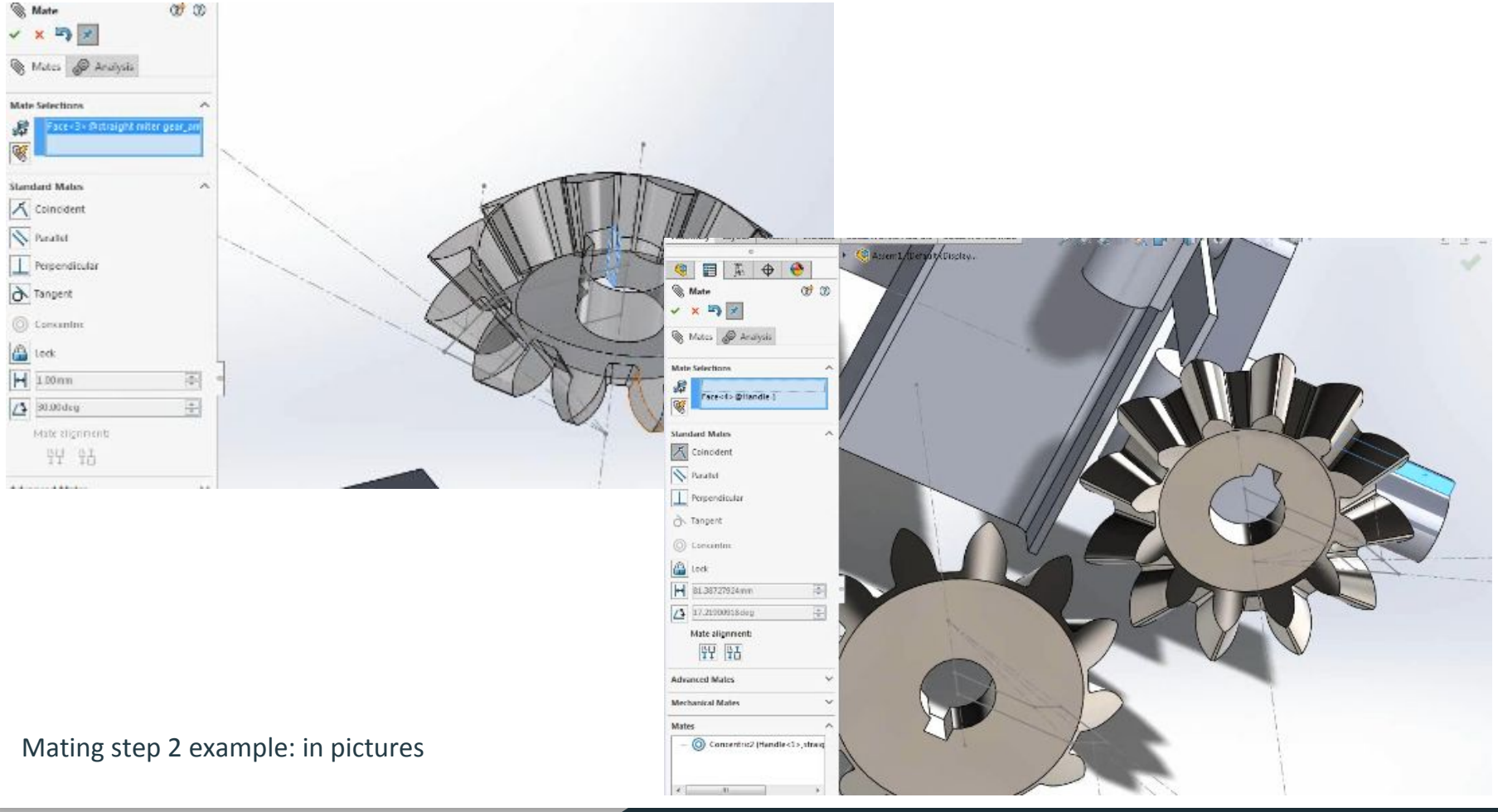
Step 2:

Think about how the pieces interact with each other. For example, between the gear and the shaft:

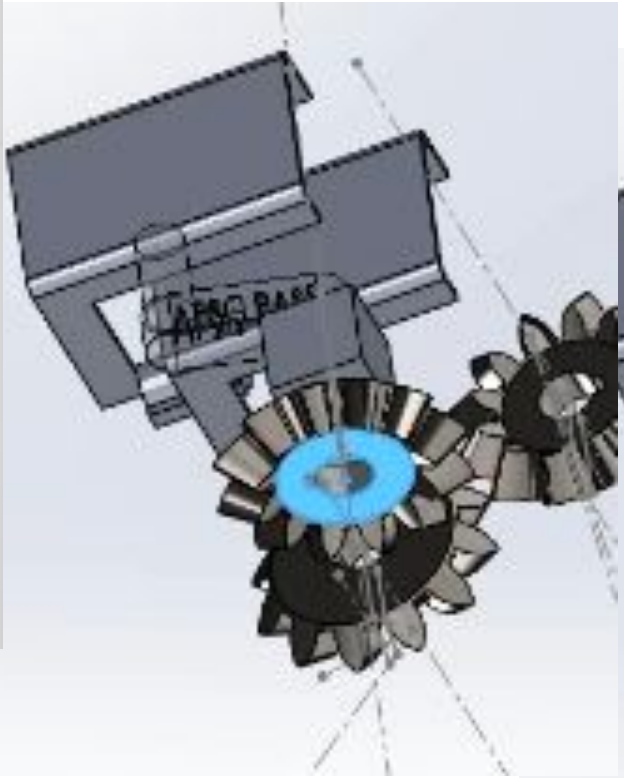
1. You would need a concentric mate so the shaft center aligns with the gear center. However, if this is it, then the shaft would rotate freely inside the gear and the gear wouldn't turn...
2. Therefore, you need to add a mate between the key's(in this case, the key already is a part of the shaft) side-face and the gear's keyhole. However, if this is it, while the gear would turn, the shaft would be sliding in and out the gear freely…
3. Therefore, you need to add coincident mate between a end-face and the inside of the gear. Now, if this is it, the shaft would not slide freely while still rotate freely and move the gear with it. Add anymore mates, and the assembly wouldn't have the movements we want anymore(ie, shaft wouldn't move freely or the gear would rotate).

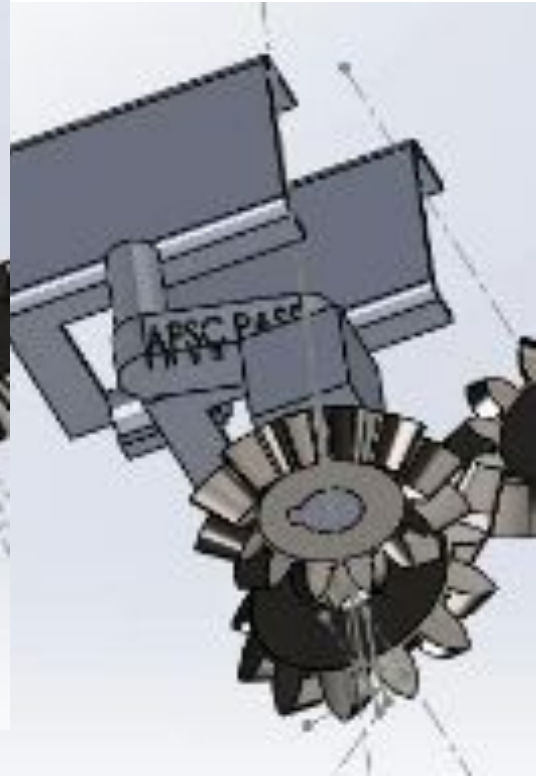
Mating step 2 example: in pictures





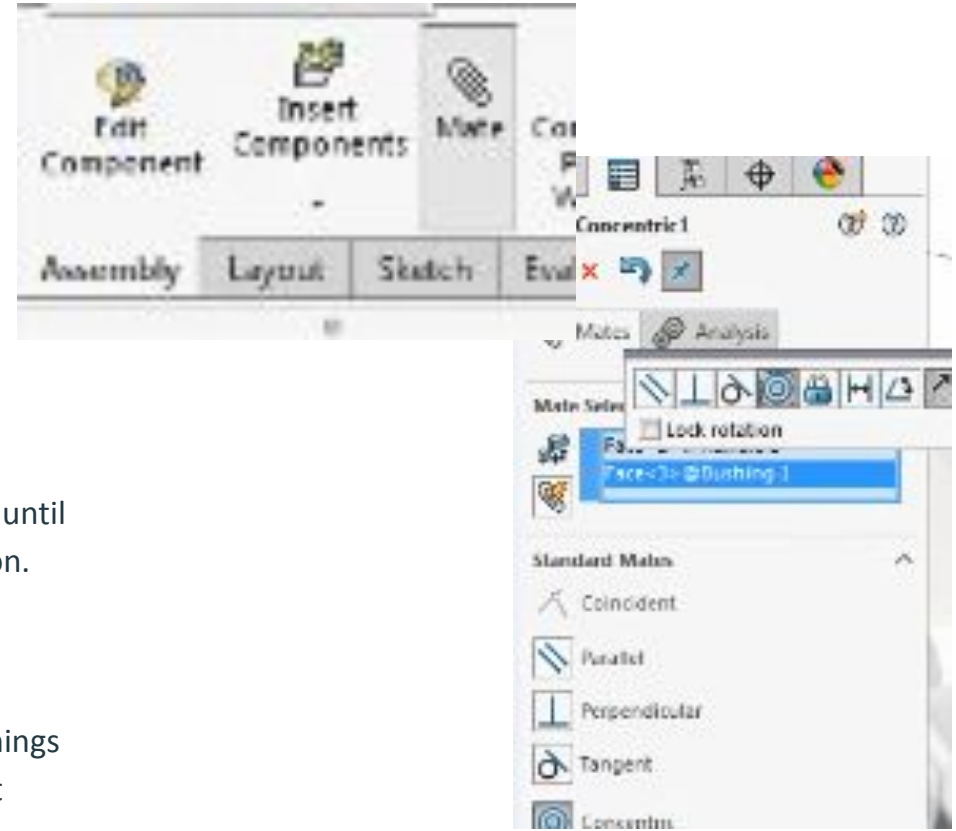
Mating step 2 example: in pictures





Mating step 2 example: in pictures

Mating



Step 3:

Add the mates accordingly. Keep adding mates until you get the desired movement, shown earlier on.

Gear movements are shown next slide.

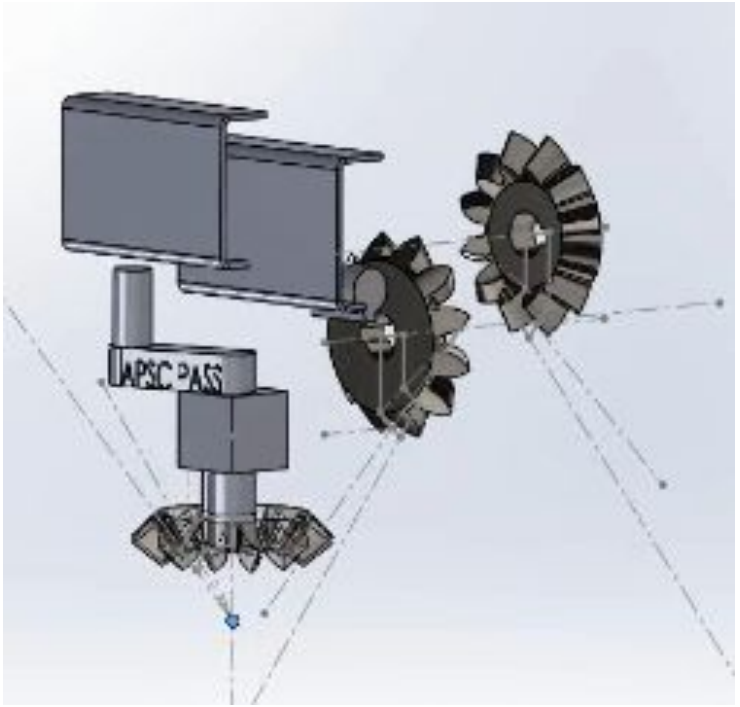
Be patient with yourself. Understanding how things move and interact with each other is a skill that takes time to develop.

Mating gears

- To mate gears successfully, you need to see the drawing lines
- On the sidebar, click on the gear -> Base-Revolve -> BasProSke to show the drawing lines

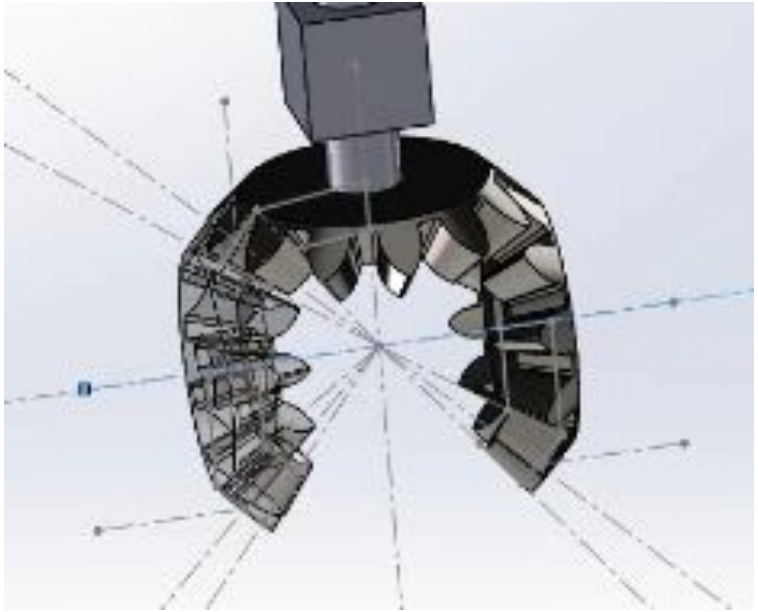
Mating gears

- Mate one of the gears to the handle like shown previously
- Make sure that the handle is properly mated to the bushing
- Orient that gears so that the two other gears are perpendicular to the on-handle gear and facing opposite to each other



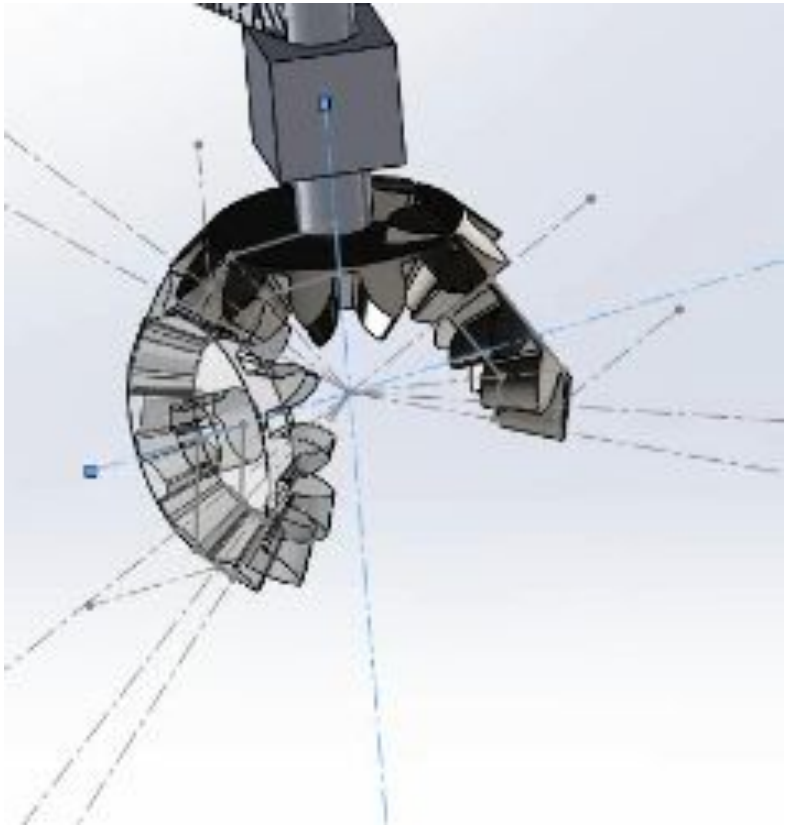
Mating gears

- Select the point on the gear drawing where the lines converge
- Coincident mate this point of all three gears together



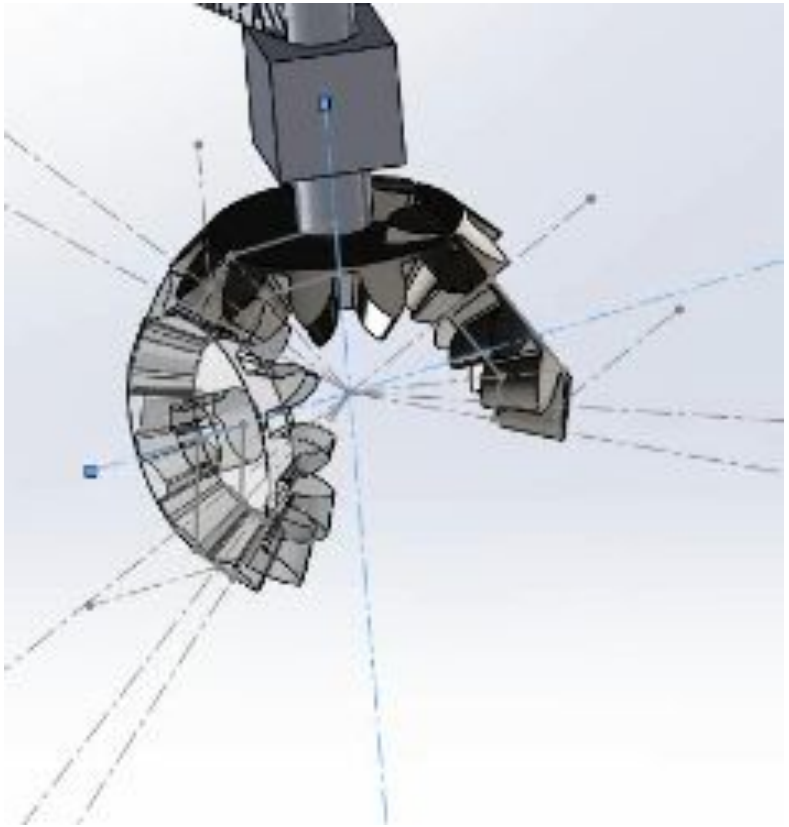
Mating gears

- Perpendicular mate the rotating line of the two gears perpendicular to each other
  - In this picture, the other gear is rotated slightly to more clearly show the square of the other two gear



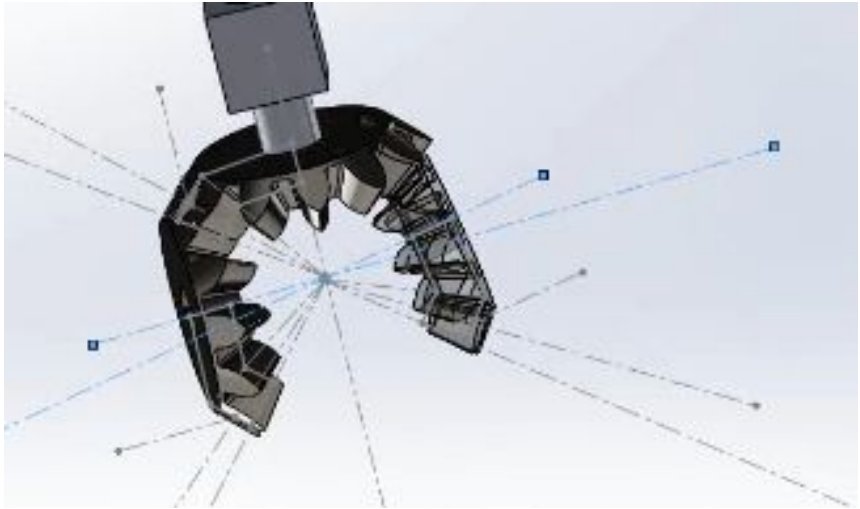
Mating gears

- Perpendicular mate the rotating line of the two gears perpendicular to each other
  - In this picture, the other gear is rotated slightly to more clearly show the square of the other two gear



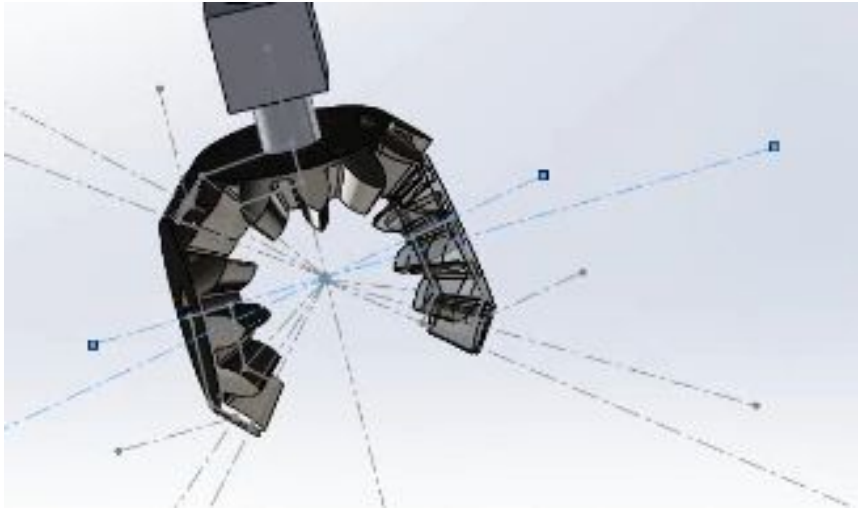
Mating gears

- Coincident mate the rotation lines of the two gears that are facing each other



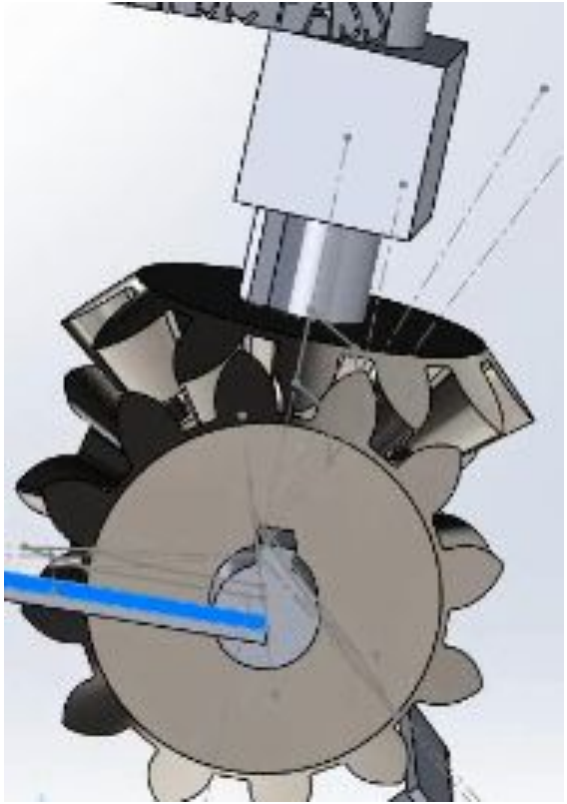
Mating gears

- Coincident mate the rotation lines of the two gears that are facing each other



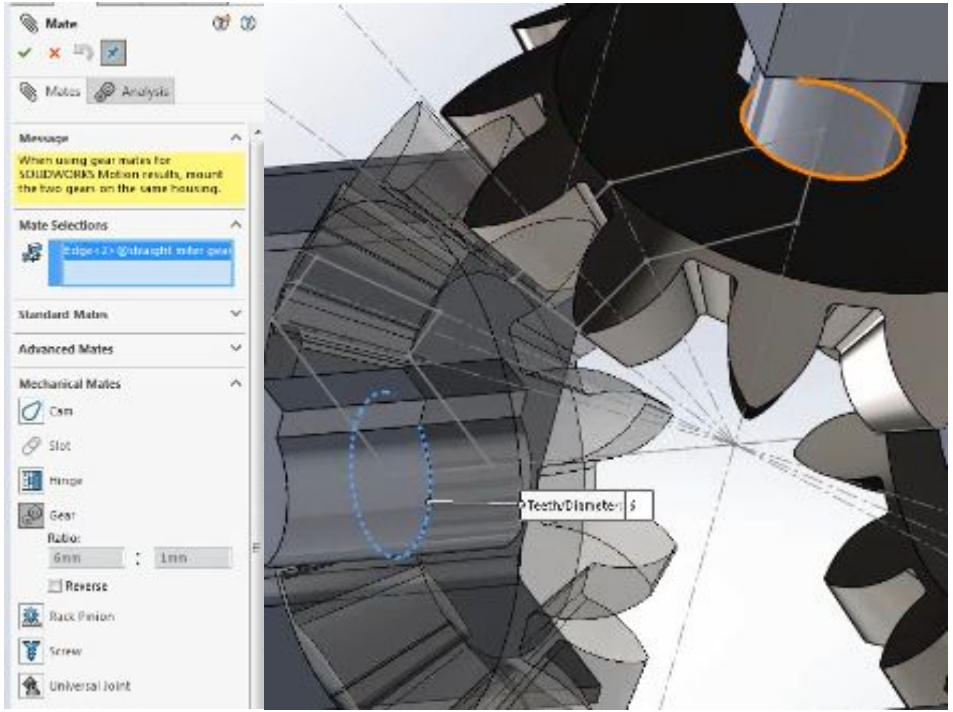
Mating gears

- Align the gears so that the teeth don’t hit each other
  - This won’t matter for Soldiworks to generate the gear movement, but it looks nicer



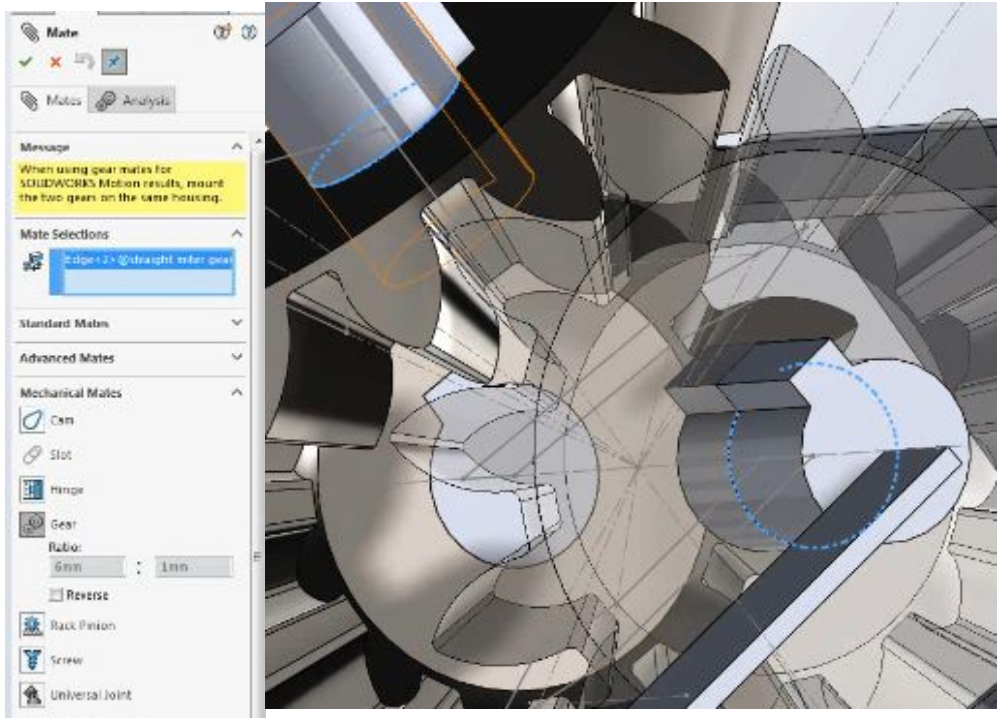
Mating gears

- Mate -> Mechanical Mates -> Gear
- Select the two shaft hole edges
- Ratio can be any number, as long as it’s 1 to 1
    - Solidworks should pre-select 1:1 for you
    - Miter gears are a special type of bevel gear that are 1:1 ratio



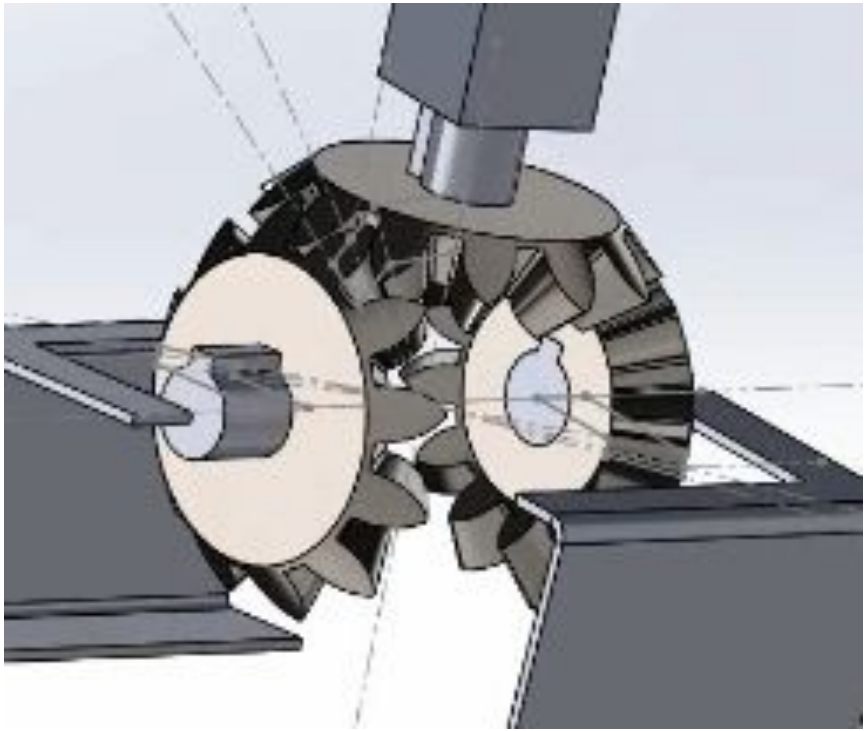
Mating gears

- Repeat for the other gear



Mating gears

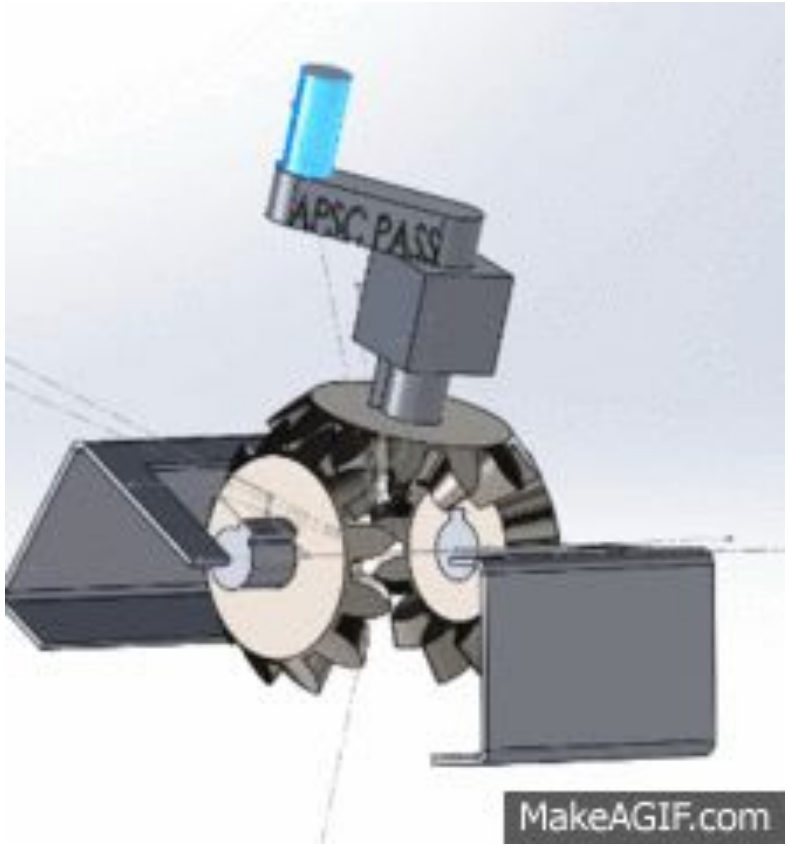
- Your gear mates are done!



Done!

When you have added all your mates, you should get this movement.

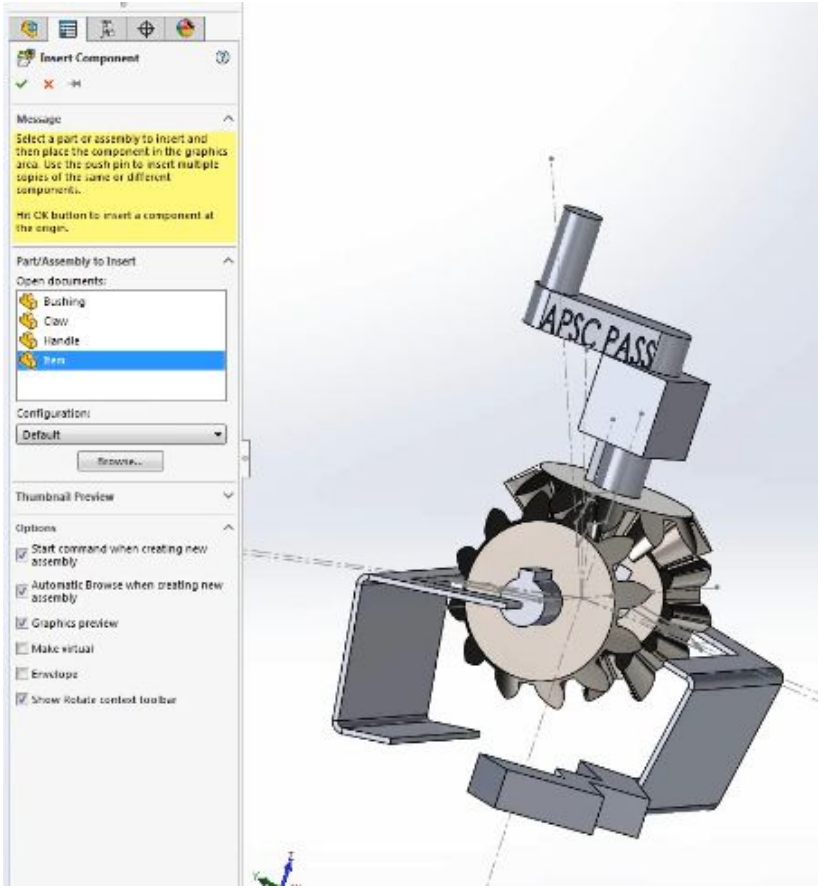
Save the file as “Assembly”, but don’t close it yet.



5. Motion study

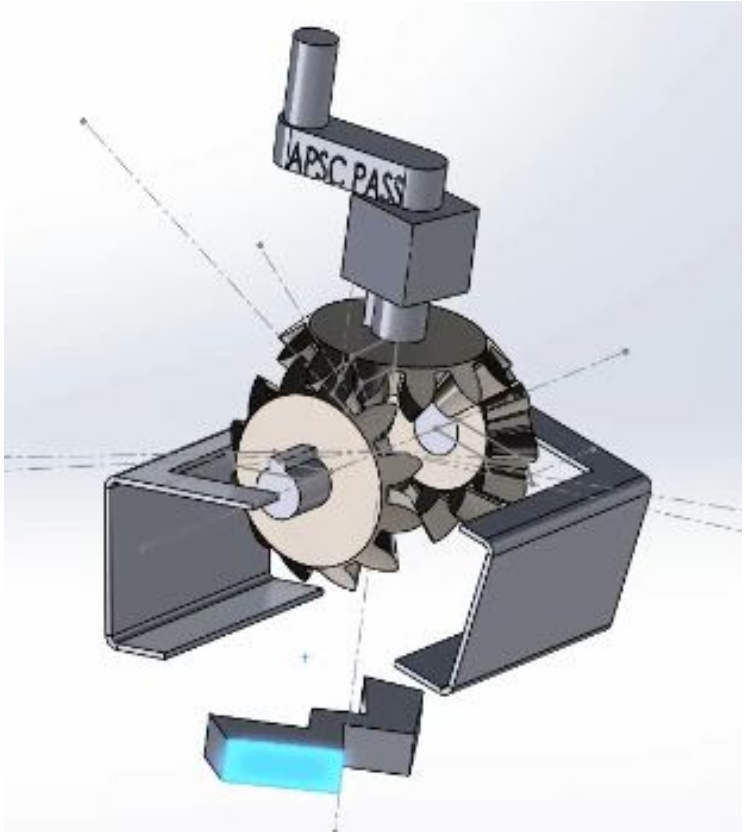
Motion study

- Insert “Item”
- Move it so that it’s somewhere in the bottom of the claw



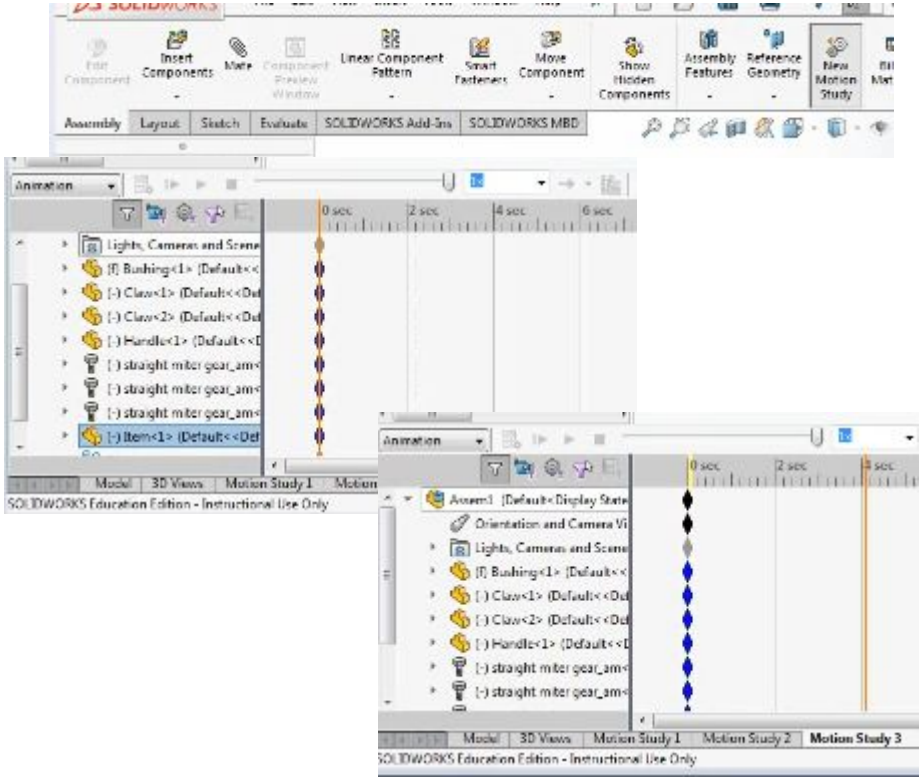
Motion study

- Align your view so that you can see the claw work nicely
  - Something like this view
  - Solidworks will use the view you have currently as the view in the motion study
  - It’s possible to change view, but it’s much easier to adjust to a good view now



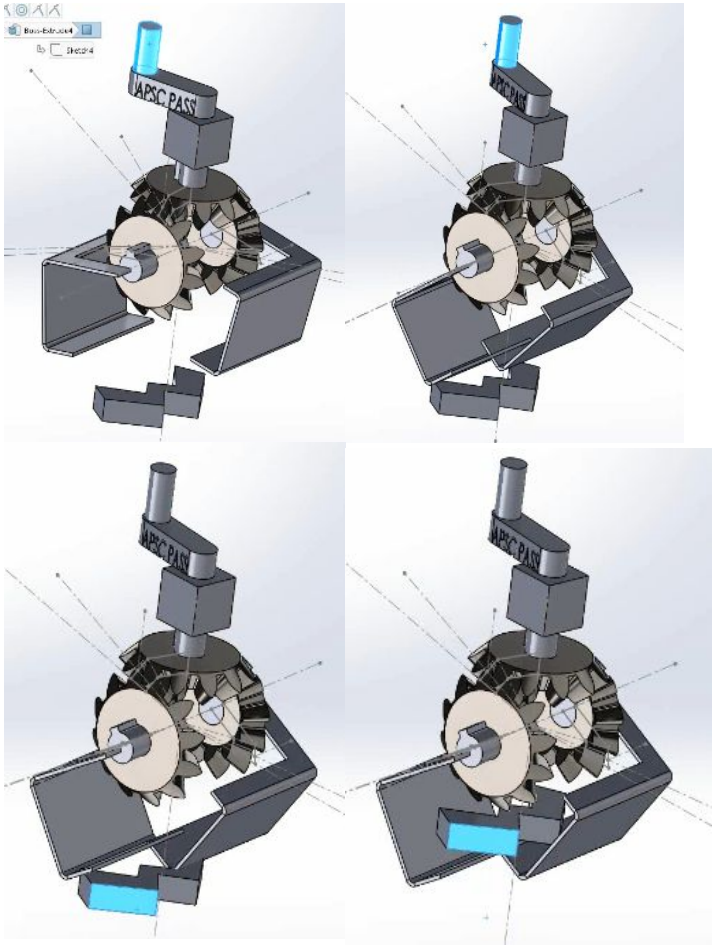
Motion study

- Click “New Motion Study”
- You’ll see a timeline in the bottom of the screen
- Drag the time bar to around 4 s



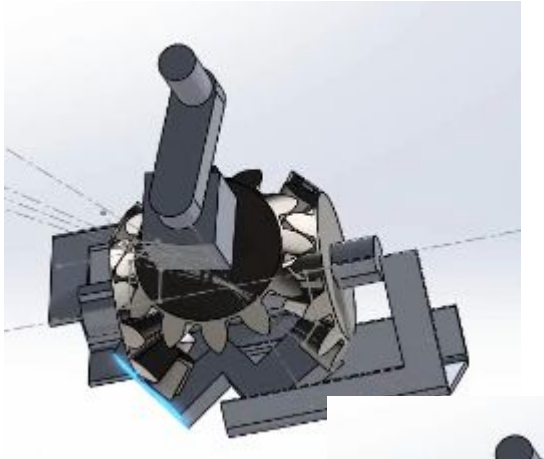
Motion study

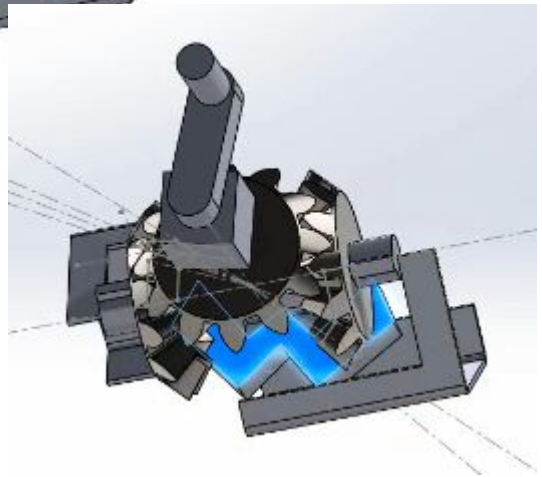
- Move the handle and the item as if the claw is working to pick the item up
- You should have only 2 keyframes at 4 s mark



Motion study

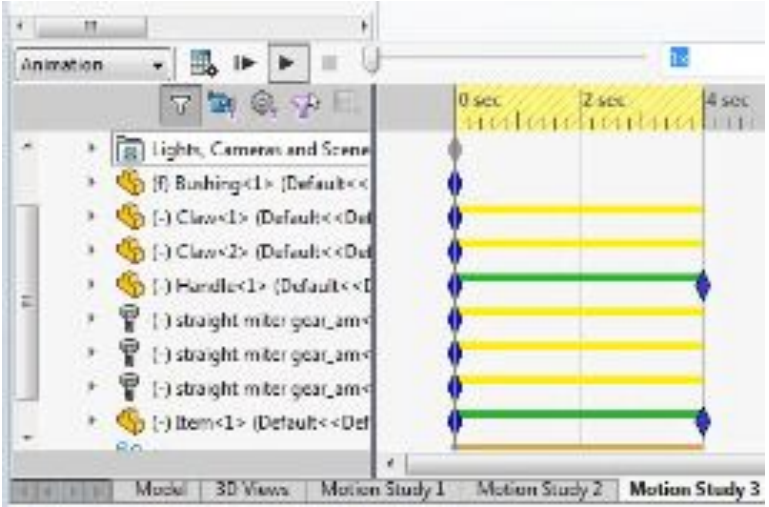
- Rotate around to see from different angles whether the item is inside the claw or not
- Adjust accordingly





Motion study

- Wind back to the 0 s and press play to check whether the animation came out right
  - What happened when I did this check is that the claw was moving fine, but the item didn't move until it jumped to place in the end; don't worry, because generally as long as the keyframes are right, the animation will come out fine



Motion study

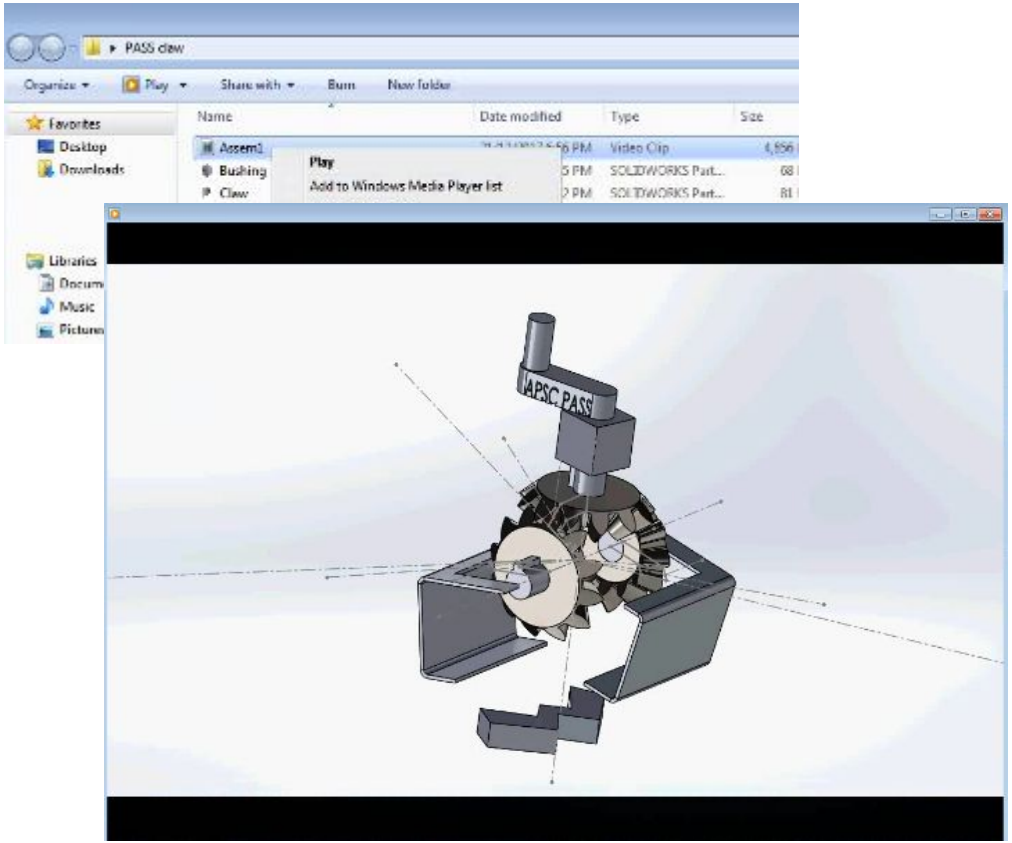
- Click “Save Animation” if you’re good with what you have
- This window will pop up
- Name your file, choose where to save it, and leave other settings as is
- Click “Save”

Motion study

- This window will pop up
- Untick the “Key frame every n frames” option
  - When I did it, rendering usually fails unless I untick this; might not fail for you though
- Click “OK” and let the program render

Done!

- Save your assembly
- Try playing your video!



Some further readings

- Engineering drawing https://www.solidworks.com/sw/resources/getting-started-part-and-assembly-drawings.htm there should also be a tutorial you can follow along when you download SolidWorks
- Other SolidWorks introductory resources https://www.solidworks.com/sw/resources/getting-started-with-solidworks.htm