Introduction to Assemblies

Curriculum Guide

Week 3
07/17 - 07/21

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Announcements

This week, we will be going through assemblies on Onshape.

Watch the Week 3 video on sketching in Onshape here.

Please complete the midterm check-in form for mentees.

Weekly Learning Goals

- Understanding the principle behind CAD assembly and mates
- Creating an assembly profile on OnShape
- Learn different types of mates and what situations require them
- Choose and apply different mates when assembling a model using multiple parts

Terminologies and Definitions

In CAD, you can use specified functions to connect and define relations between multiple parts. This is known as an assembly and is important when *simulating functional parts that interact with other parts.*

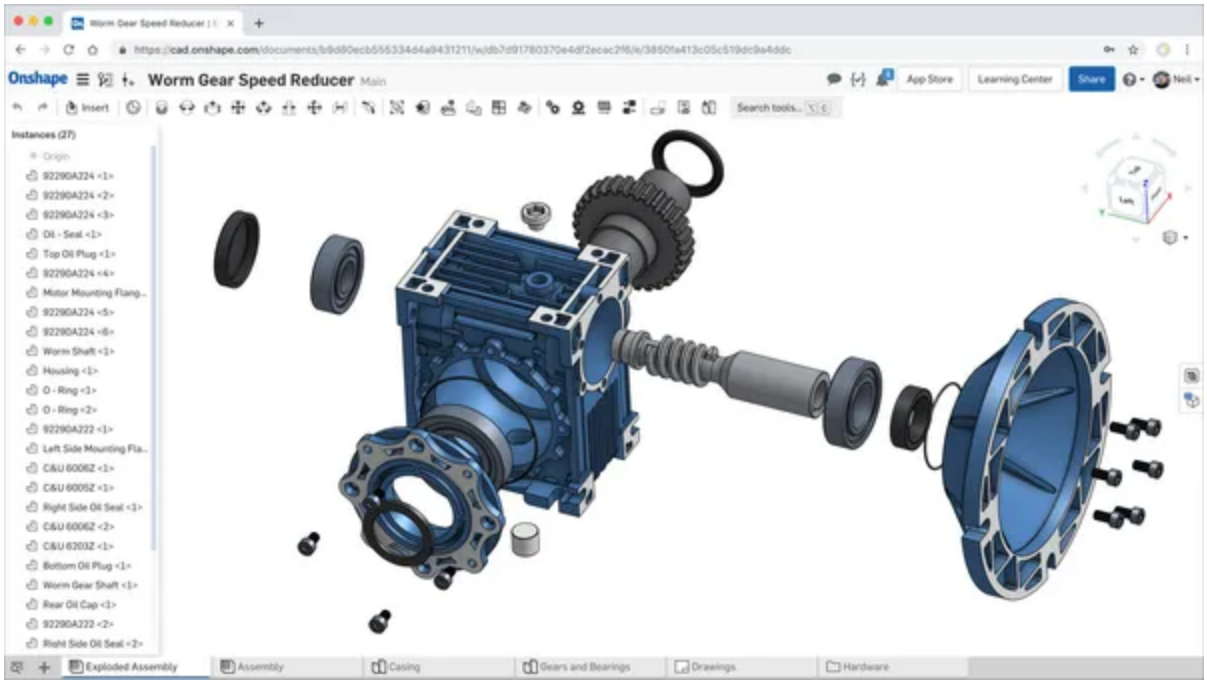

Fig. 1 Example of an assembly on Onshape[1]

Mates are functions that define a geometrical relation between two instances, including degrees of freedom. When we begin with 2 entities (i.e., CAD parts) that are not mated and have no relation to each other, they have ***6 degrees of freedom***:

1. Translation in x plane
2. Translation in y plane
3. Translation in z plane
4. Rotation in x axis
5. Rotation in y axis
6. Rotation in z axis

Here are some common mates on Onshape:

[1] [2]

[1] mates and typical functions
[2] advanced modeling functions

[1] https://www.onshape.com/en/features/assemblies

Types of Mates

 ***Fastened*** - selecting 2 surfaces (one from each entity) will "glue" the 2 entities together by aligning edges and surfaces and effectively restricting any motion. *0 degrees of freedom.*

 ***Revolute*** - 2 entities share the same z axis. One entity *rotates* about the Z. *1 degree of freedom*,

 ***Slider*** - 2 entities share the same z plane. One entity *translates* along the Z. *1 degree of freedom.*

 ***Planar*** - 2 entities share the same X and Y planes, and z axis. One entity *translates* along X and Y, and *rotates* about the Z. *3 degrees of freedom.*

 ***Cylindrical*** - 2 entities share the same Z plane and axis. One entity *rotates* about and *translates* along the Z plane. *2 degrees of freedom.*

 ***Pin Slot*** - 2 entities share the same Z axis and X plane. One entity *rotates* about the Z axis and translates along the X plane. *2 degrees of freedom.*

 ***Ball*** - 2 entities share the same X, Y, and Z axes. One entity *rotates* in X, Y, and Z. *3 degrees of freedom.*

 ***Parallel*** - 2 entities share the same X, Y, and Z axes, and Z plane. One entity *rotates* along X, Y, and Z axes, and *translates* along the Z. *4 degrees of freedom.*

 ***Tangent*** - 2 entities are tangent (i.e., next to) the selected faces, edges, or vertices. This mate removes one degree of linear translation. *5 degrees of freedom* (most degrees of freedom out of all mates!)

**  ***Group*** - this is not a mate, but is a common function used to group multiple parts together.

NOTE #1 In some respects, all CAD softwares have mates similar to that of OnShape; however, their names might be different.

NOTE #2: when the above mentions “share” the same axis, it is the same as saying the 2 entities are being ***constrained*** in that axis.

As illustrated in the tutorial video, multiple mate functions are required to define the motion and restraints needed between 2 parts.

Summary

This week, you learned about how to create an assembly, add parts to the assembly, and apply different mates on parts you’ve created in week 2 using correct mate functions. Next week, you will be tasked to create a model all on your own!

Additional Resources

Assembly tutorials by Onshape (must be signed in to OnShape account)
https://learn.onshape.com/courses/fundamentals-onshape-assemblies