

Working with Assemblies

NX Workshop 4

Kyle Twarog

But First: Some Math

- There are three basic coordinate transformations used in CAD:
 - Translation
 - Rotation
 - Scaling

Translation

- Linear movement of a point or transformation of a point's coordinates from one coordinate system to another with the same planar orientation and a different origin point

$$\begin{pmatrix} x' \\ y' \\ 1 \end{pmatrix} = \begin{bmatrix} 1 & 0 & d_x \\ 0 & 1 & d_y \\ 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} x \\ y \\ 1 \end{pmatrix} = \begin{pmatrix} x + d_x \\ y + d_y \\ 1 \end{pmatrix}$$

Rotation

- Rotational movement of a point or transformation of a point's coordinates from one coordinate system to another with a different planar orientation and the same origin point

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Scaling

- Expansion/contraction of the points of an object without changing their coordinate system

$$\begin{pmatrix} x' \\ y' \\ 1 \end{pmatrix} = \begin{bmatrix} s_x & 0 & 0 \\ 0 & s_y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} x \\ y \\ 1 \end{pmatrix}$$

Why Do You Care?

While it is true that you can absolutely model complete assemblies without giving a thought to their coordinate systems, this practice will make life difficult when you attempt the following:

- Complex assemblies with many duplicated parts
 - It can be more time efficient to constrain components via their coordinates vs with explicit constraints
- Exportation to CFD or CAM
 - Most geometry import tools use the coordinate system of the original CAD file
- Exportation of files to other CAD systems
 - Keep in mind that while your company may use a single CAD system or family of systems, clients and subcontractors may or may not use the same software

Best Practices

- Keep origin points of your parts and assemblies in useful, meaningful positions
 - Often this means the center of the ‘top/bottom’ faces of parts files or the center of mounting points for assemblies
- When constraining parts in assemblies, think about the logical relationships for that component rather than simply choosing arbitrary constraints
- When dealing with systems that contain many individual sup-assemblies, model those sub-assemblies before creating the top level model

How Do Assemblies Work?

- Assembly files load existing part files into their global coordinate system as rigid bodies. These rigid bodies can then be oriented and constrained in relation to the global coordinate system and each other.
- Every time an assembly is opened, NX must reload the parts into the assembly
 - This means that if a part file is deleted or is moved from its original directory, it cannot be loaded into the assembly

Working with Assemblies: Single User

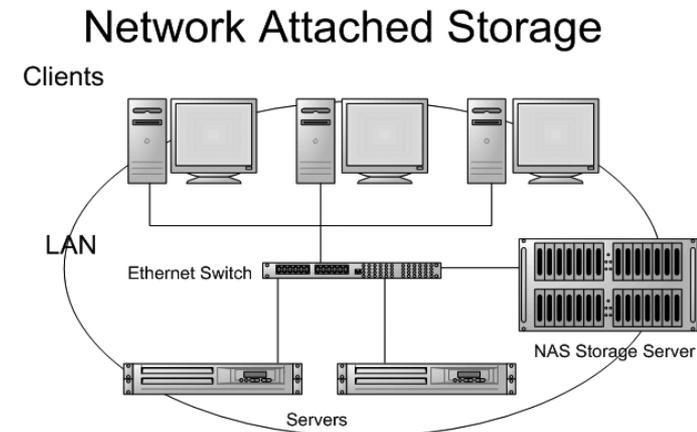
- As a single user, assemblies can simply be saved in any location immediately available to you.
- Parts can be added to your assembly in any order you choose, however they must constantly be available to you either on your local machine or on a constantly connected remote storage location
- Keep in mind that when transferring assemblies to another user you must also transfer the part files with them

Working with Assemblies: As a Group

Working with assemblies as a group is more complicated than doing so as a single user:

- Only a single user can open/edit a given part or assembly at a time
- All parts and assemblies must be saved in a central location allowing them to be accessed by any user at any time
 - This is usually done via a NAS device or Network Attached Storage
- Users must coordinate their work so as to allow each user to complete their work without effecting others
- Parts must be saved using a naming and revision scheme that is meaningful to all users
- Edits and revisions must be clearly documented so that all users are aware of the status of the project and its components

These complications can be handled in software via project solutions such as Vault, however these programs are outside of the scope of this course and vary widely from company to company. It should also be noted that not all companies use these packages, and one should have a good idea of how to manage files 'the old way'.



Revision Control

- When revising parts, it is vital that two things happen:
 - The original part be maintained in an archive
 - The new part be used in any further work
- This can be done using the following method:
 - When saving parts, save two versions:
 - 'part.prt' and 'part-working.prt'
 - The 'part-working.prt' will be used in all assemblies
 - When revising a part, save it in two ways:
 - Save 'part-Rev-A.prt' for archive use
 - Overwrite 'part-working.prt' for use in assemblies
- This allows work to continue fluidly, while maintaining an archive of revisions