SIEMENS

Creating Templates

This is a procedural lab. Please follow the steps listed below to accomplish the objectives of each activity listed.

Contents

Objective

Practice the method to create and implement templates in FEM and SIM files.

Find the Templates in the Installation Directory

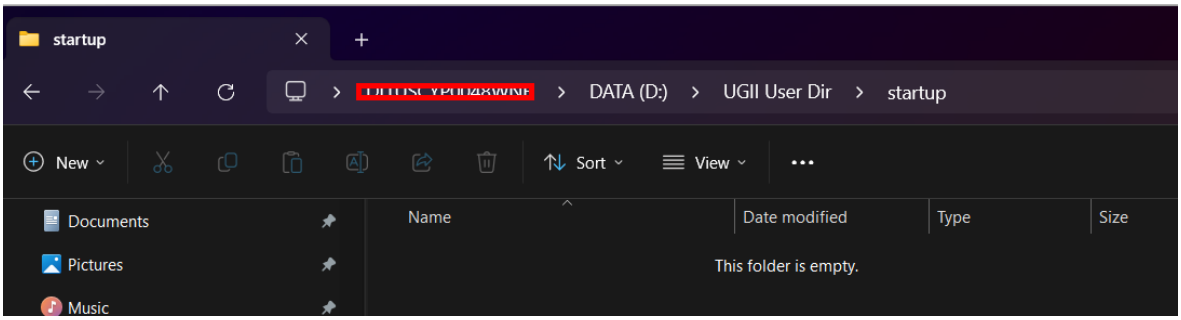
It is important to know where the installation directory is for NX & Simcenter on your local machine. Here we find and investigate the Simulation templates located in the installation directory.

1. In the Local Installation directory on your machine navigate to the **Simulation** folder and open the **templates** folder
    a. The path is most likely something like this **C:\Program Files\Siemens\NX2306\SIMULATION\templates**
2. Examine the contents of the folder, you should see JPG Files, PAX files, FEM files & Sim Files.
3. Leave the **File explorer** opened to this directory

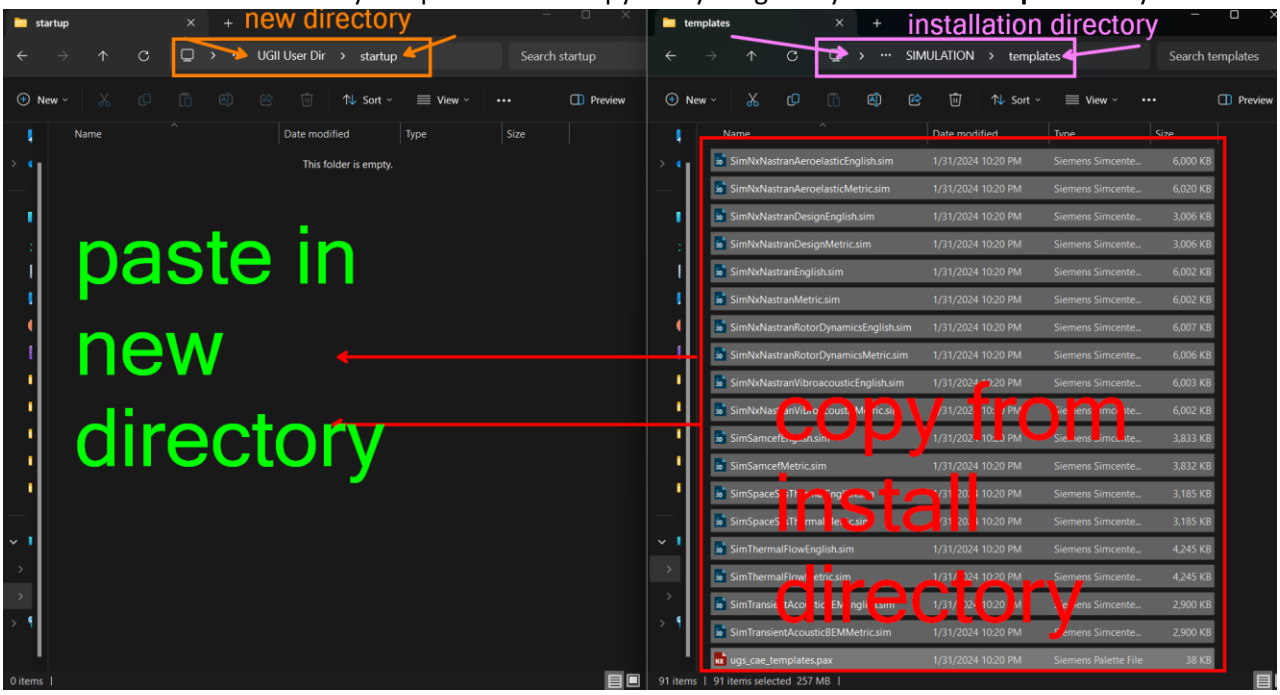
Create the User Directory & Paste Templates

Here we create our own directory to manage the templates. This could be extrapolated out to a shared/network drive so then the templates can be propagated out to everyone who needs to use them.

1. **Open** a new file explorer window
2. In a location of your choice (for example in your user's folder) create a Folder named **UGII User Dir**
3. Inside of the **UGII User Dir** folder create another new folder named **startup**



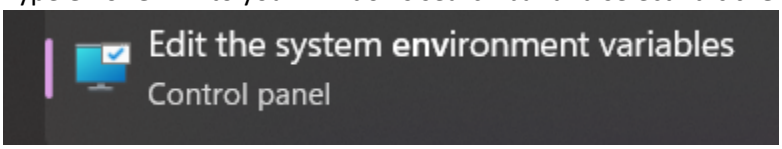
4. From the installation directory templates folder copy everything into your new **startup** directory



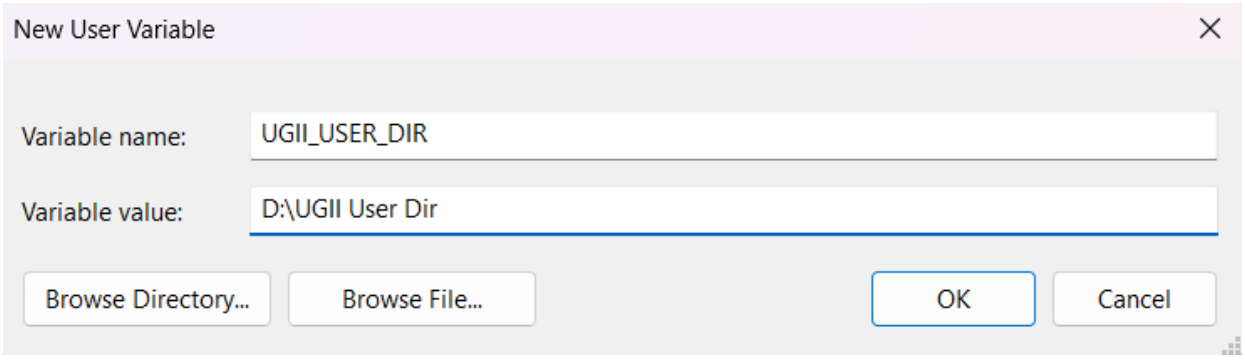
Create the Environment Variable

Now we must tell Simcenter to take our new directory for the templates. To do this we will create an environment variable which points to the directory that we just created.

5. Type **en** or **env** into your Windows search bar and select **Edit the system environment variables**



6. Select **Environment Variables** from the bottom right of the windows pop up.
7. **Create** a new user variable and name it **UGII_USER_DIR** and give it the path to our startup folder



8. Click **Ok** to create the New User Variable
9. Click **Ok** out of the rest of the windows

Open NX/Simcenter and the Part

1. Open **Nx/Simcenter** if it is not already opened
2. From the template activity Start Files Folder open **01_stg3_bld_disk.prt**
3. Examine the part

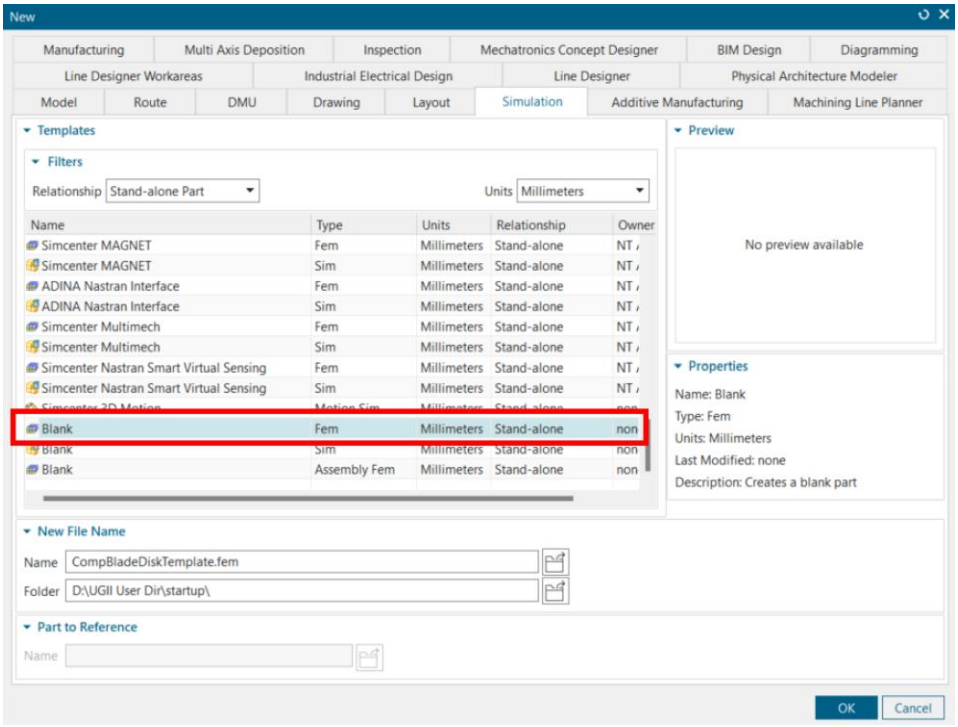
Create FEM Template

FEM Templates allow us to automate meshing, mesh control, creation of mesh collectors and more. Once we build out a robust FEM template, we will be able to use it and update it for our further analysis needs.

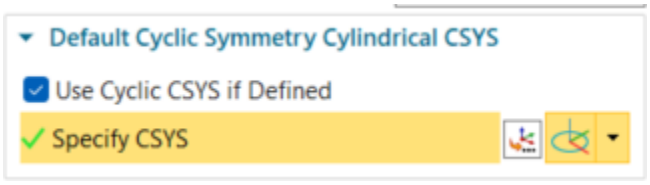
1. From the current NX/Simcenter session, right click on the part **01_stg3_bld_disk.prt** from the **Simulation Navigator** and choose **New Fem**
2. Select the **Blank** template from the existing templates.

   We are using the units of Millimeters in this instance, but the inches blank template could be used as well.

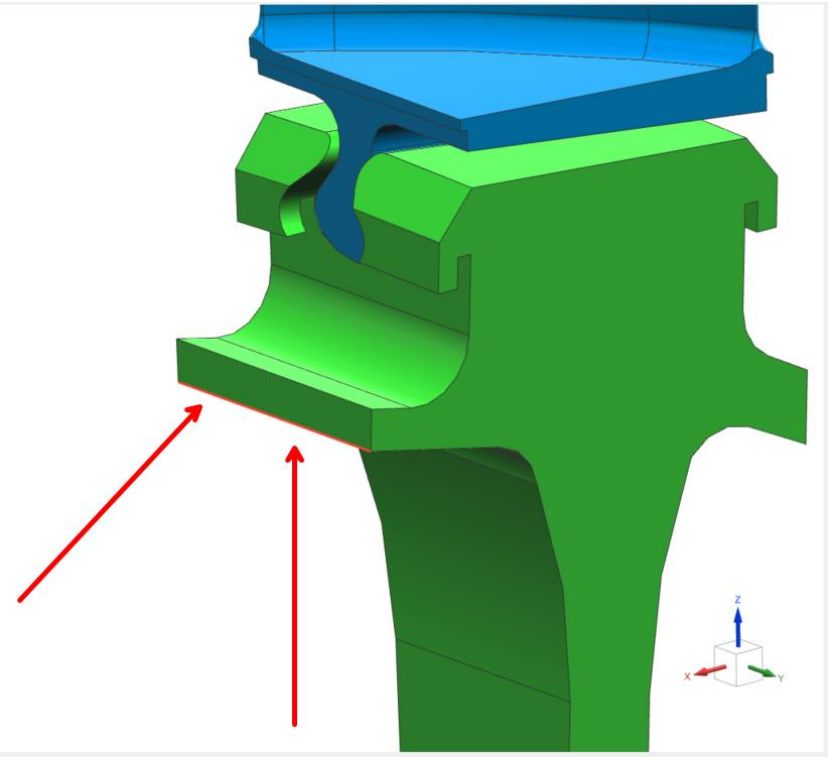
Templates are units specific so be sure to choose the correct units when creating the template.



3. Set the name to **CompBladeDiskTemplate**
4. Set the Folder location to be the **startup** folder that was previously defined
5. Click **Ok** on the New FEM Dialog to create and open the blank FEM
6. Click **Use Cyclic CSYS if Defined** and in the pop up on the right side choose **CSYS of Object.**



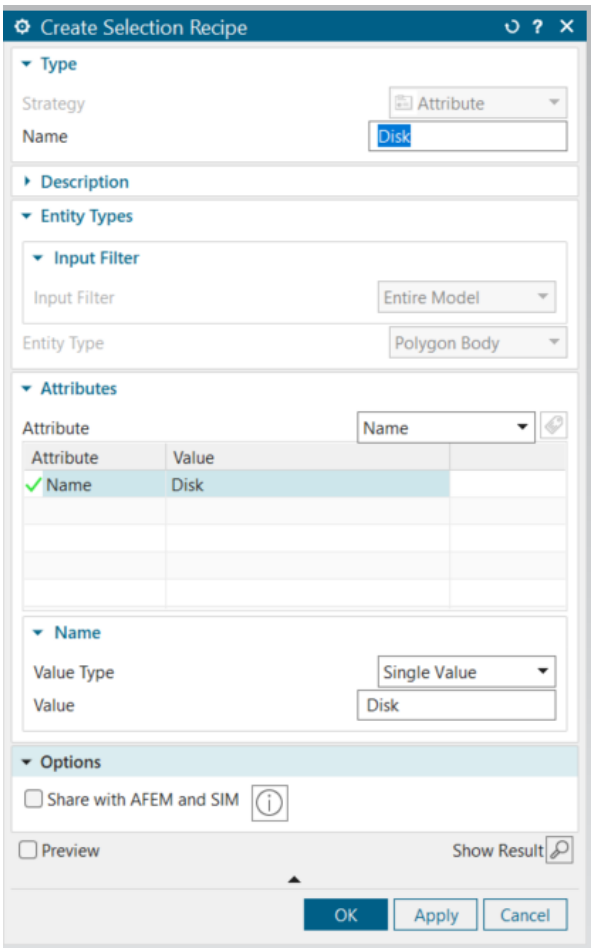
7. Drag to enlarge the **CAD Part** pop up window in the bottom right corner of the screen. Choose an edge of the disk to make the global cyclic analysis coordinate system.



8. Uncheck the box for create idealized part. There is no need for an idealized part for the template creation.
9. Click **Ok** to create the Fem

Create FEM Selection Recipes and Mesh Recipes

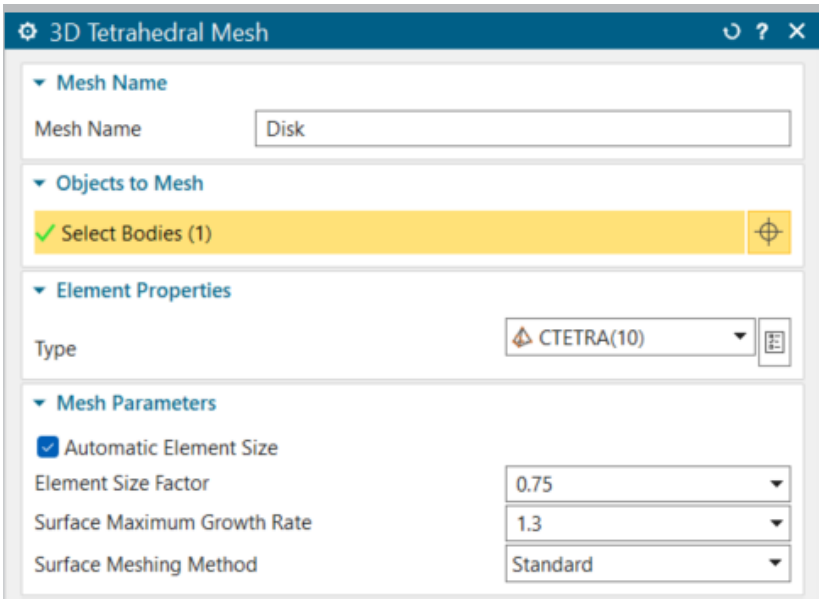
1. Right Click **Selection Recipes** and choose **New Selection Recipe**
2. Create a selection recipe that Selects and polygon body with Disk in its name. Set the name of the selection recipe to be **Disk**



If we want these selection recipes to be seen by an AFEM or SIM we can check the box in the options group at the bottom of the dialog to share with AFEM and SIM.

3. Repeat this process for the **Blade**

4. Create a **3D Tetrahedral Mesh** that utilizes the **Disk** selection recipe for the objects to mesh. Set the **Mesh Parameters** to turn on **Automatic Element Size** and set the **Element Size Factor** to **0.75**. Set the **Name** to **Disk.**



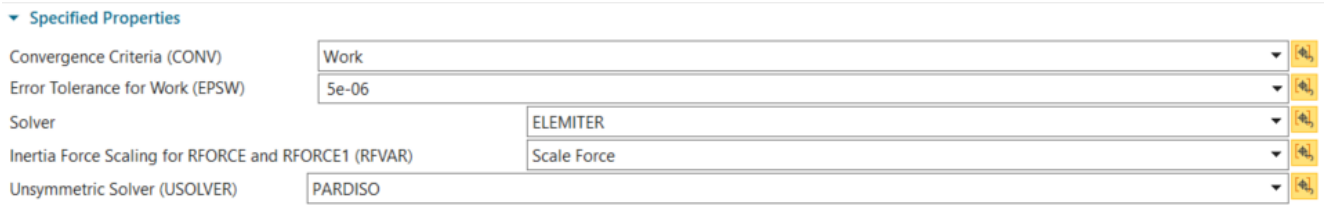
5. Create a **Mesh Collector.** Create a **Physical Property.** Select a reasonable material to use for the Disk mesh (Titanium) or leave it as **Inherited** if the material will be assigned in modeling on the .prt. Give appropriate names to the respective entities (for example a name of Disk)
6. Repeat this process for the **Blade Mesh** and **Blade Mesh Collector**
7. **Save** the Fem File

Challenge: Set up selection recipes and mesh controls for any desired mesh controls on the geometry. The fillets of the blade have been named BLADE FILLET and could be used for a mesh control.

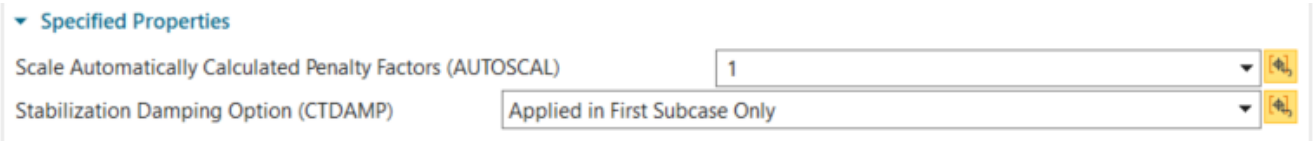
Create Sim Template & Solution

1. Right click on the FEM file and choose **New Simulation**
2. In the **New Part File** Dialog set the Template as **Blank**
3. Confirm the Name and Folder are correct and click **Ok**
4. Click **Ok** in the new Simulation Dialog
5. In the **Solution Dialog** set the name to be **Solution 401** and set the Solution Type to **SOL 401 Multi-Step Nonlinear**
6. Click **Create Solution**
7. In the **Case Control** tab edit the output requests to enable Strain and Contact results.

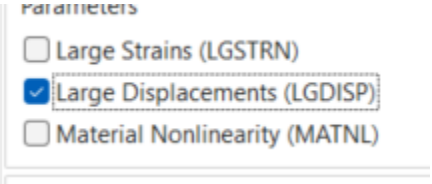
8. In the **Nonlinear Control Parameters** set the Convergence Criteria, error Tolerance for Work, Solver, Inertia Force Scaling for RFORCE and RFORCE1 & Unsymmetric Solver. Set the name to **Nonlinear Control Parameters**



9. In the **Global Contact Parameters** set the Scale Automatically Calculated Penalty Factors & Stabilization Damping Option. Set the name to **Nonlinear Contact Parameters**



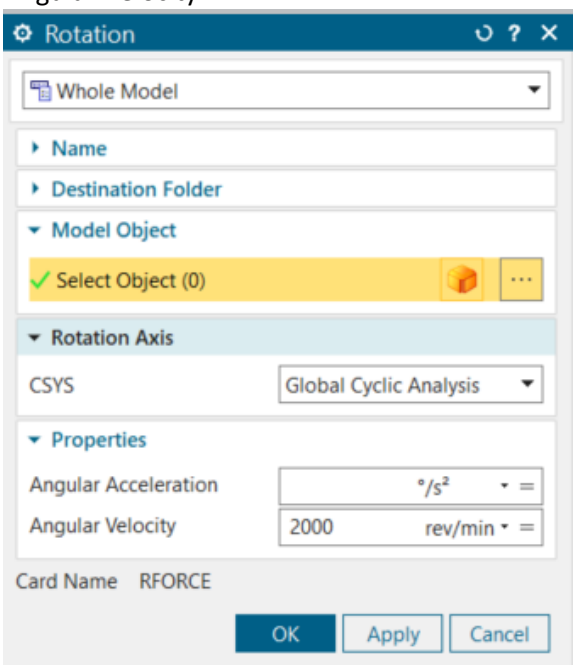
10. In **Bulk Data** turn on **Large Displacements**



11. Click **Ok** in the **Solution** dialog to create the solution.
12. In the **Solution Step** dialog click **Create step**
13. Click **Ok** in the Solution Step Dialog

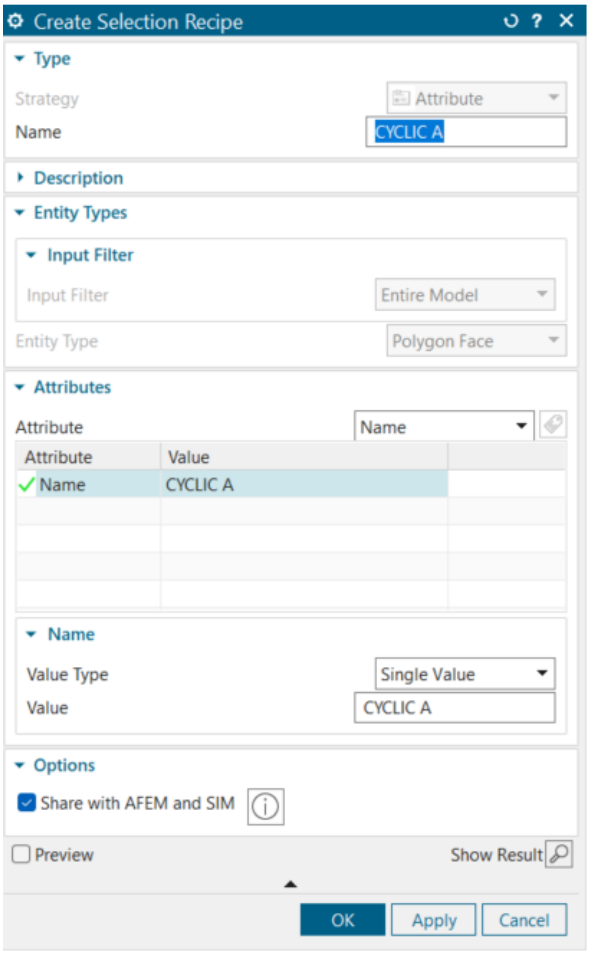
Create Boundary Conditions in Sim File

1. Create a **Rotational Load** that uses the Global cyclic Analysis coordinate system and have **2000 Rev/min** as the Angular Velocity

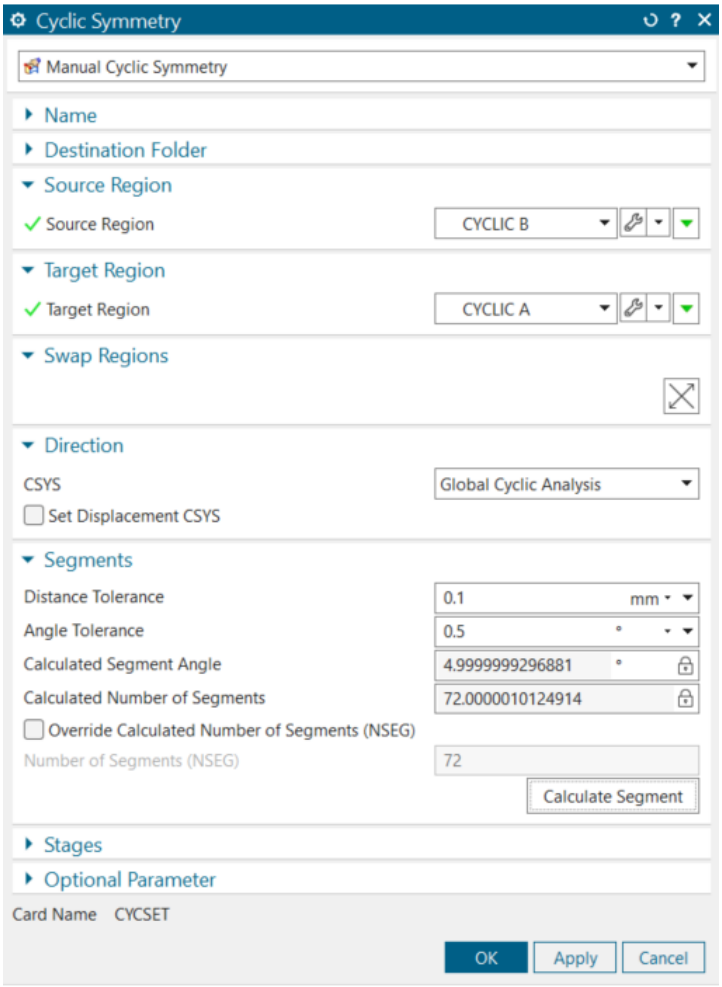


2. Right Click **Selection Recipes** and choose **New Selection Recipe**

3. Create a selection recipe that Selects and **polygon face** with **Cyclic A** as its name. Set the name of the selection recipe to be **CYCLIC A**



4. Create a selection recipe that Selects and **polygon face** with **Cyclic B** as its name. Set the name of the selection recipe to be **CYCLIC B**
5. Create a **Region** that uses Selection Recipe **CYCLIC A**
6. Create a **Region** that uses Selection Recipe **CYCLIC B**
7. Create a **Cyclic Symmetry** Simulation Object and use the previously created regions. Set the **Segment** settings to Distance Tolerance as 0.1, Angle tolerance as 0.5 and then click **Calculate Segment** to have Simcenter calculate the number of segments. If you get an error that the angle is above 180 degrees, click Swap **Regions**.



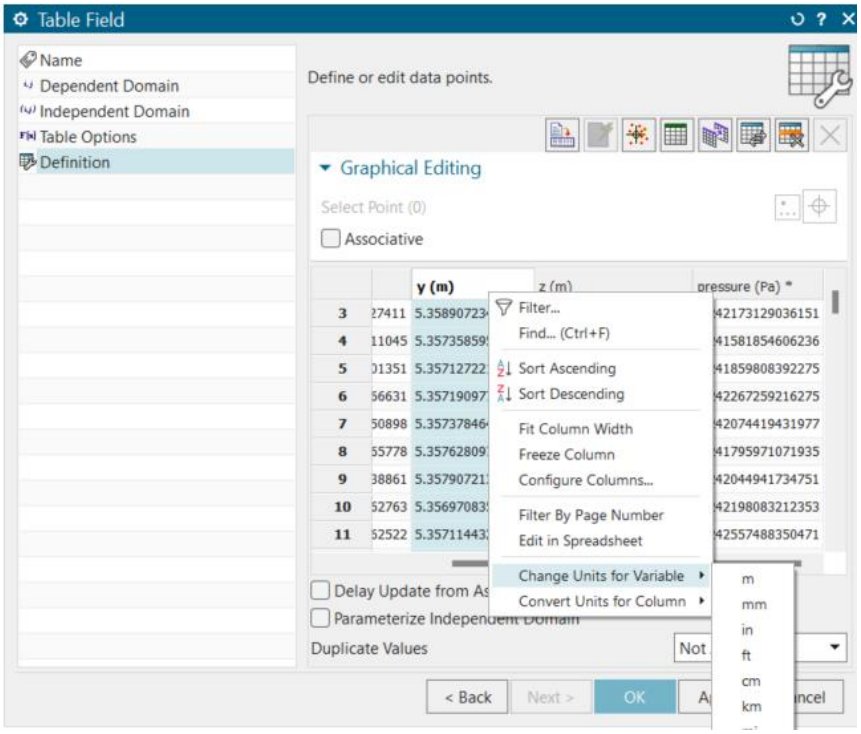
Click **Ok**

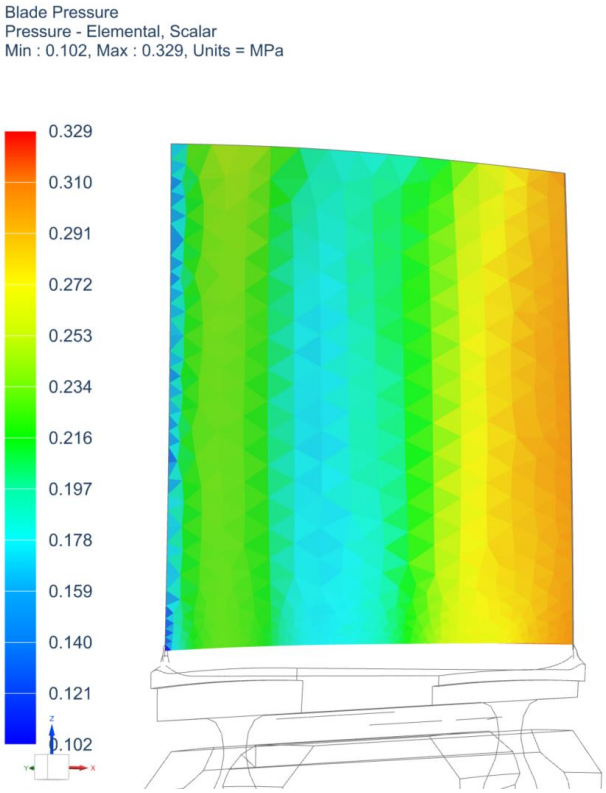
8. Create a selection recipe that Selects and **polygon face** with **Constraint Axial** as its name. Set the name of the selection recipe to be **CONSTRAINT AXIAL**
9. Create a **User Defined Constraint** that references the Constraint Axial Selection Recipe & Global Cyclic Analysis Coordinate System. Set DOF3 to fixed
10. Create a selection recipe that Selects and **polygon face** with **Constraint Tangential** as its name. Set the name of the selection recipe to be **CONSTRAINT TANGENTIAL**
11. Create a **User Defined Constraint** that references the Constraint Tangential Selection Recipe & Global Cyclic Analysis Coordinate System. Set DOF2 to fixed

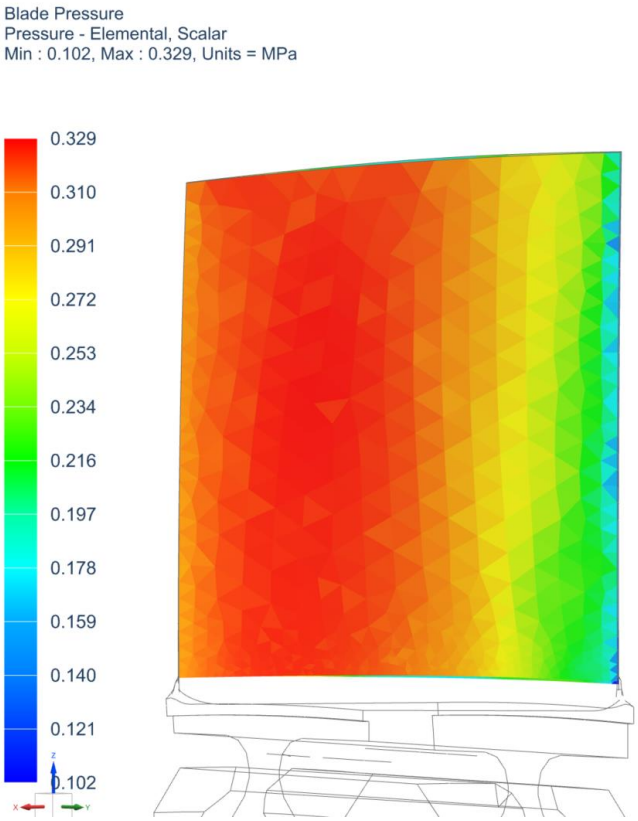
Challenge: Create Selection Recipes and Entities to templatize the other Boundary Conditions for the model.

Contact faces have been named CONTACT DISK and CONTACT BLADE for each solid body. Create Recipes for each and use those recipes to define regions, similar to the cyclic symmetry above. Finally, create the contact with an appropriate coefficient of friction (0.2).

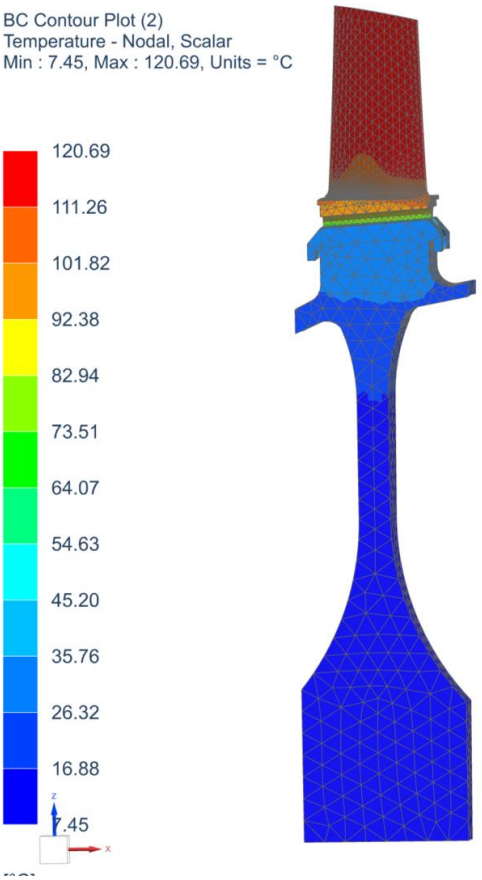
Pressure faces of the blade have been named SUCTION and PRESSURE respectively and a .csv of pressure data (table_static_pressure_all.csv) has been provided in the start files folder. The units are meters and Pa so be sure to set the correct units in the field.
In order to change the units when creating a table field, you must right click the variable, when in the definition tab, and choose Change Units for Variable.







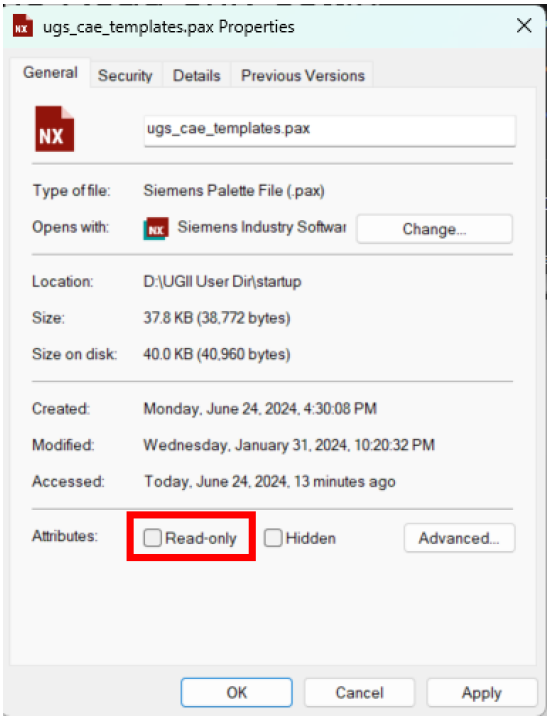
Temperature .fld files have been provided in the as well. Import each of the field files by right clicking on Fields in the simulation navigator and selecting import. Create a temperature load set and then create two different temperature loads, one using the blade only temperatures and the other using the disk on temperatures. Each of the temperature loads should apply to one body, the blade and the disk, utilizing the corresponding field.



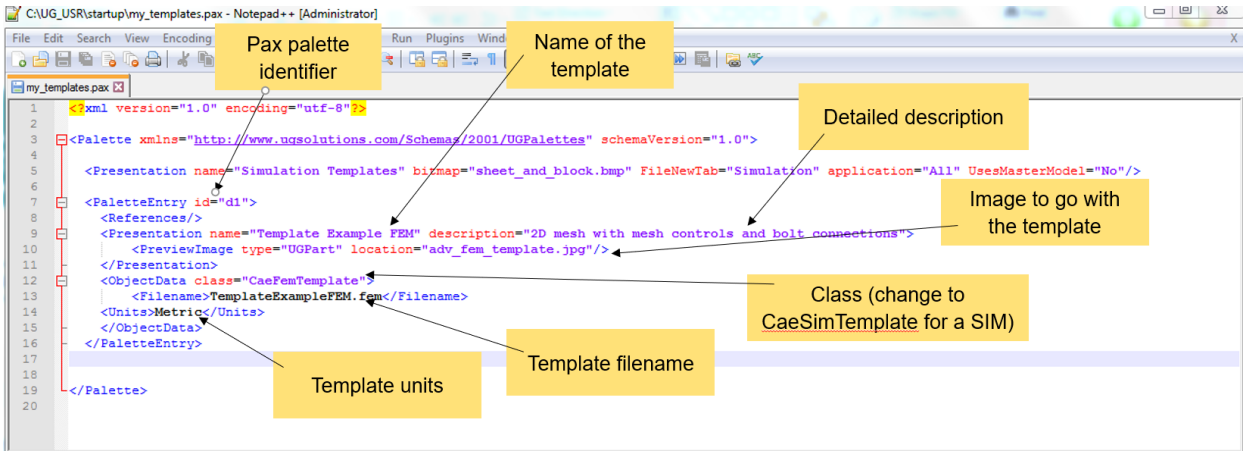
Edit the Pax File

1. In the **startup** directory that was created in the beginning of the lab find the pax file named **ugs_cae_templates.pax** and right click it and choose Properties

2. In the **General** tab uncheck the box for **Read Only** and then click ok



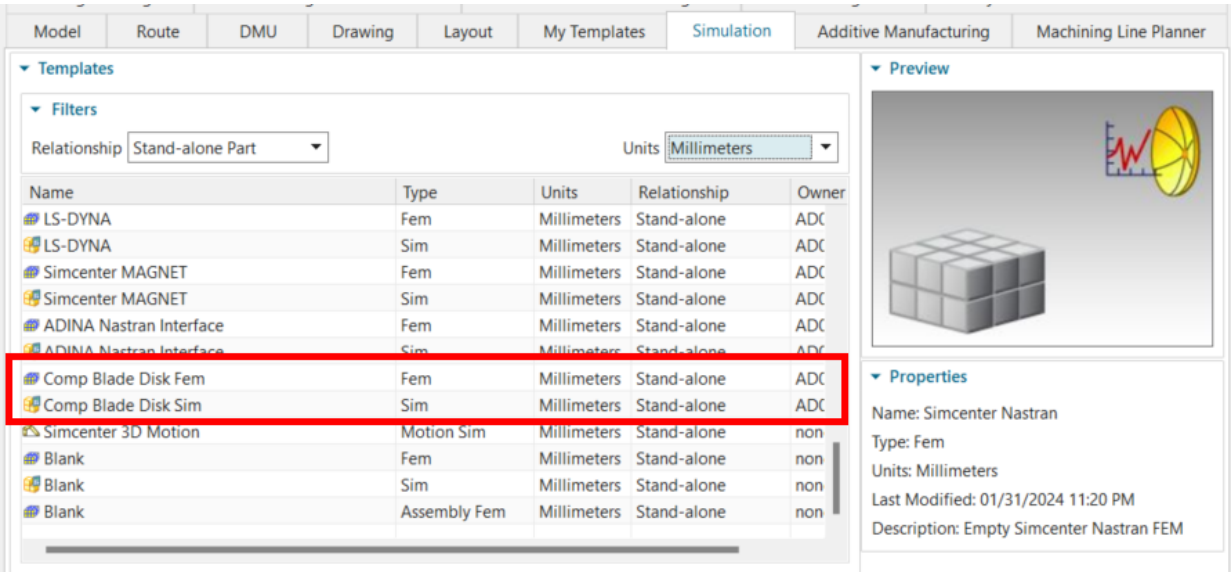
3. Right click the **pax file** and open it with a text editor (notepad++ for example)
4. Scroll to the bottom of the pax file and find the final entries
5. Copy one of the last palette entries and paste it in **twice,** these will be for the new templates we just created. Use the picture guide below to edit the two copied entries.



6. Give each entry a unique identifier, a name, and a description. Make sure the class matches the file type being used and confirm the units are correct. **Optional:** put a .jpg into the **startup** directory and then use it in the entry.
7. Once both entries have been edited to match the newly made templates **Save** the pax file.

Test the Templates

1. For the templates to take effect, Simcenter/NX must be restarted.
2. Exit out of the current session
3. Open NX/Simcenter and choose **New**
4. Select the **Simulation** tab and scroll down to see the custom templates.

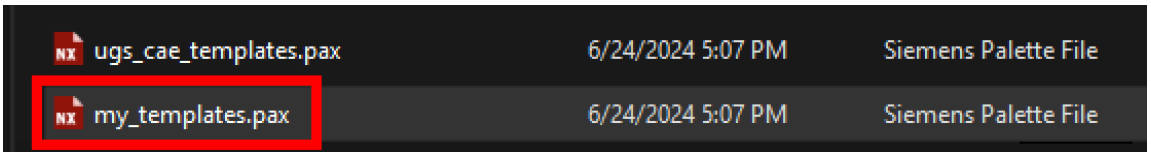


(Make sure the units match the units used in the template, if the units do not match the template will not be shown)

Create a Custom Tab for The New Templates

Besides having custom templates, it is possible to have a custom tab of templates as well.

1. Make a copy of the existing **PAX** file, ugs_cae_template.pax, that we edited previously.



Rename the file to **my_templates.pax.**

2. Right click and edit the **my_templates.pax** inside of notepad ++ or another text editor.
3. Delete all the entries except for our two customer ones

```
    <PaletteEntry id="d1">
    <References/>
    <Presentation name="Comp Blade Disk Fem" description="3D tet mesh and collectors">
      <PreviewImage type="UGPart" location="adv_sim_template.jpg"/>
    </Presentation>
    <ObjectData class="CaeFemTemplate">
      <Filename>CompBladeDiskTemplate.fem</Filename>
      <Units>Metric</Units>
    </ObjectData>
  </PaletteEntry>

    <PaletteEntry id="d2">
    <References/>
    <Presentation name="Comp Blade Disk Sim" description="Boundary Conditions and 401 Sol">
      <PreviewImage type="UGPart" location="adv_sim_template.jpg"/>
    </Presentation>
    <ObjectData class="CaeSimTemplate">
      <Filename>CompBladeDiskTemplateSim.sim</Filename>
      <Units>Metric</Units>
    </ObjectData>
  </PaletteEntry>
```

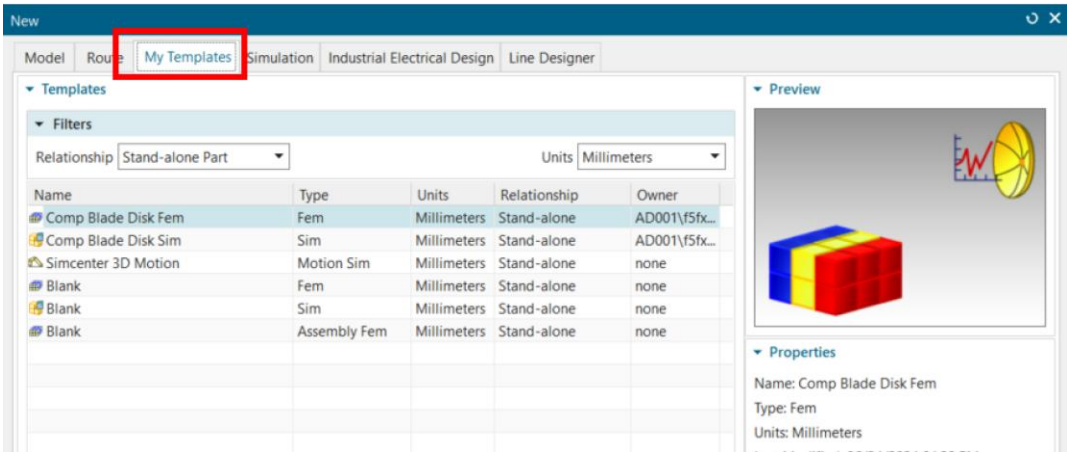
Change the <PaletteEntry id> to be **d1** and **d2** respectively.

4. **Change** the name of the tab to be **My Templates.** This is located in the Presentation line which is above the palette entries

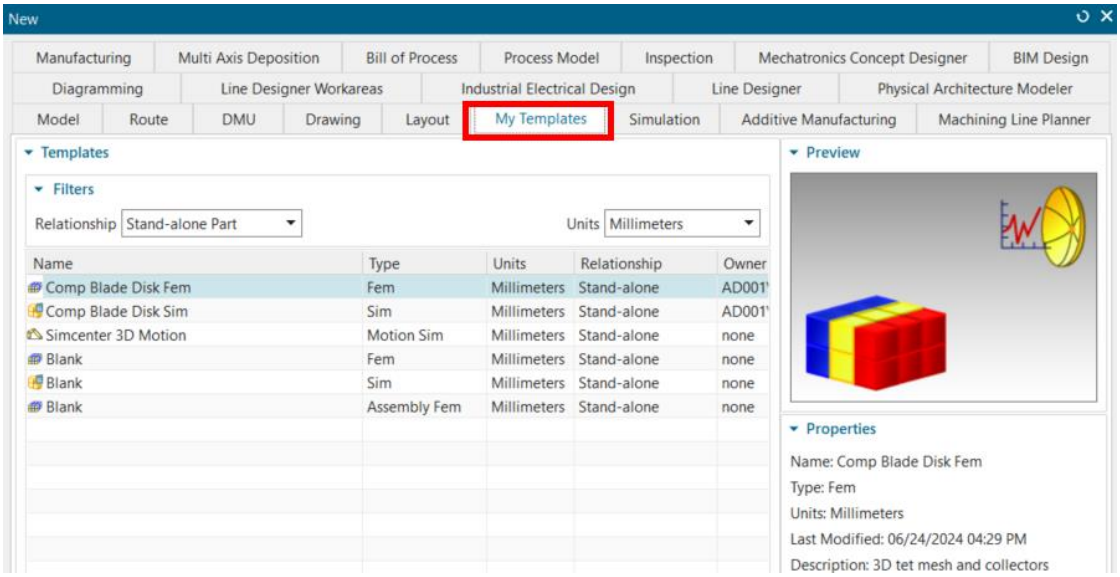
```
<Presentation name="Simulation Templates" bitmap="sheet_and_block.bmp" FileNewTab="My Templates" application="All" UsesMasterModel="No"/>
```

5. **Save** the PAX file and exit out of the text editor
6. **Open** a new Simcenter/NX session (close and reopen if you already have a Simcenter/NX session opened)
7. Select **New** and you should see the new tab with the templates we created

(Screenshot from Simcenter 3D create new file)



(Screenshot from NX create new file)



This concludes the Templates activity.