Tutorial: controlling NX with a spreadsheet

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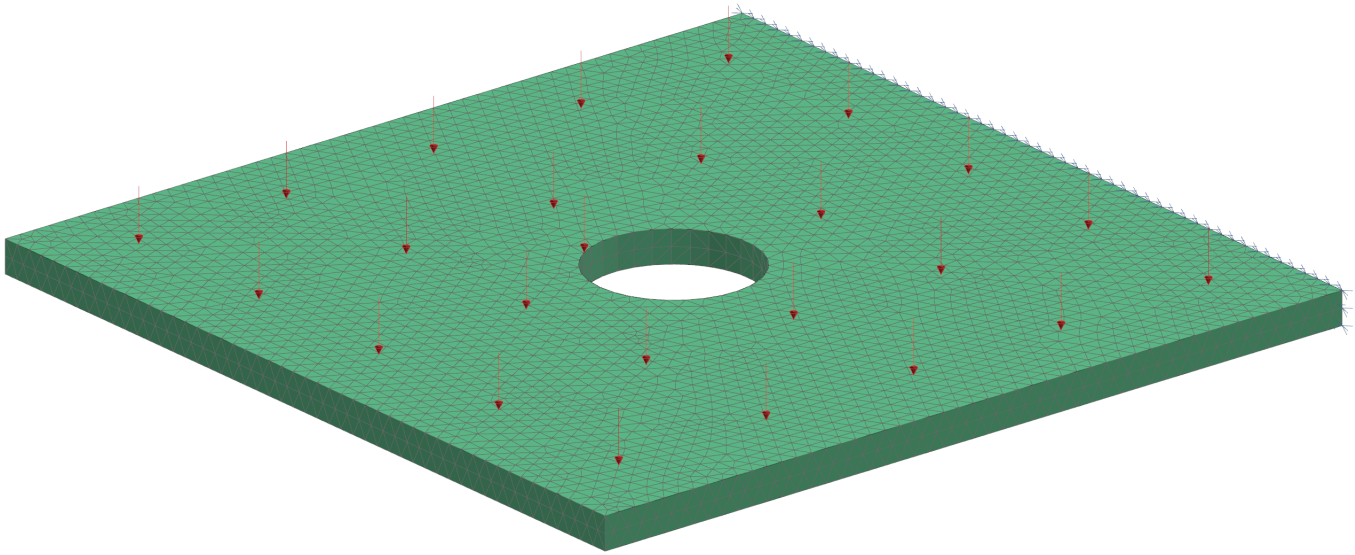

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Geometry				Material properties				Loadings				Mesh		
2	Length	50	[mm]		Density	2000	[kg/m³]		Z Force	1000	[N]		Element size	1	[mm]
3	Height	50	[mm]		Young Modulus	70000	[Mpa]		X Force	0	[N]				
4	Hole diameter	10	[mm]		Poisson Ratio	0.33	[-]		Y Force	0	[N]				
5	Thickness	2	[mm]												
6															

1 Introduction

Every numerical value used in NX can come from an external spreadsheet. The creating of a model from a spreadsheet is a bit more lengthy but it allows to modify the model parameters afterwards really easily. A well presented excel spreadsheet also helps centralizing all the data used in the model by giving a clear picture of its current state.

In this tutorial, you will build a simple plate with a hole in the middle and compute its behavior when one side is clamped and a downward force is applied on the top surface.

2 Creating expressions in NX

2.1 Creating the spreadsheet

In Microsoft Excel, create a spreadsheet with the data you want to use, this tutorial you are given the spreadsheet shown in figure 1.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Geometry				Material properties				Loadings				Mesh		
2	Length	50	[mm]		Density	2000	[kg/m³]		Z Force	1000	[N]		Element size	1	[mm]
3	Height	50	[mm]		Young Modulus	70000	[Mpa]		X Force	0	[N]				
4	Hole diameter	10	[mm]		Poisson Ratio	0.33	[-]		Y Force	0	[N]				
5	Thickness	2	[mm]												
6															

Figure 1: Excel data

2.2 Create the expressions in NX

In NX, open the file *tuto_spreadsheet.prt* and go to **Tools** ⇒ **expressions**. Then follow these steps (figure 2):

- Choose a name for your expression (corresponding to the ones in the spreadsheet for clarity)
- Right click in the formula square and click on **edit**
- Choose **function** in the edit window
- Specify the spreadsheet you want to use
- Give the number of the cell you want to take the value from
- click on OK for the two last windows

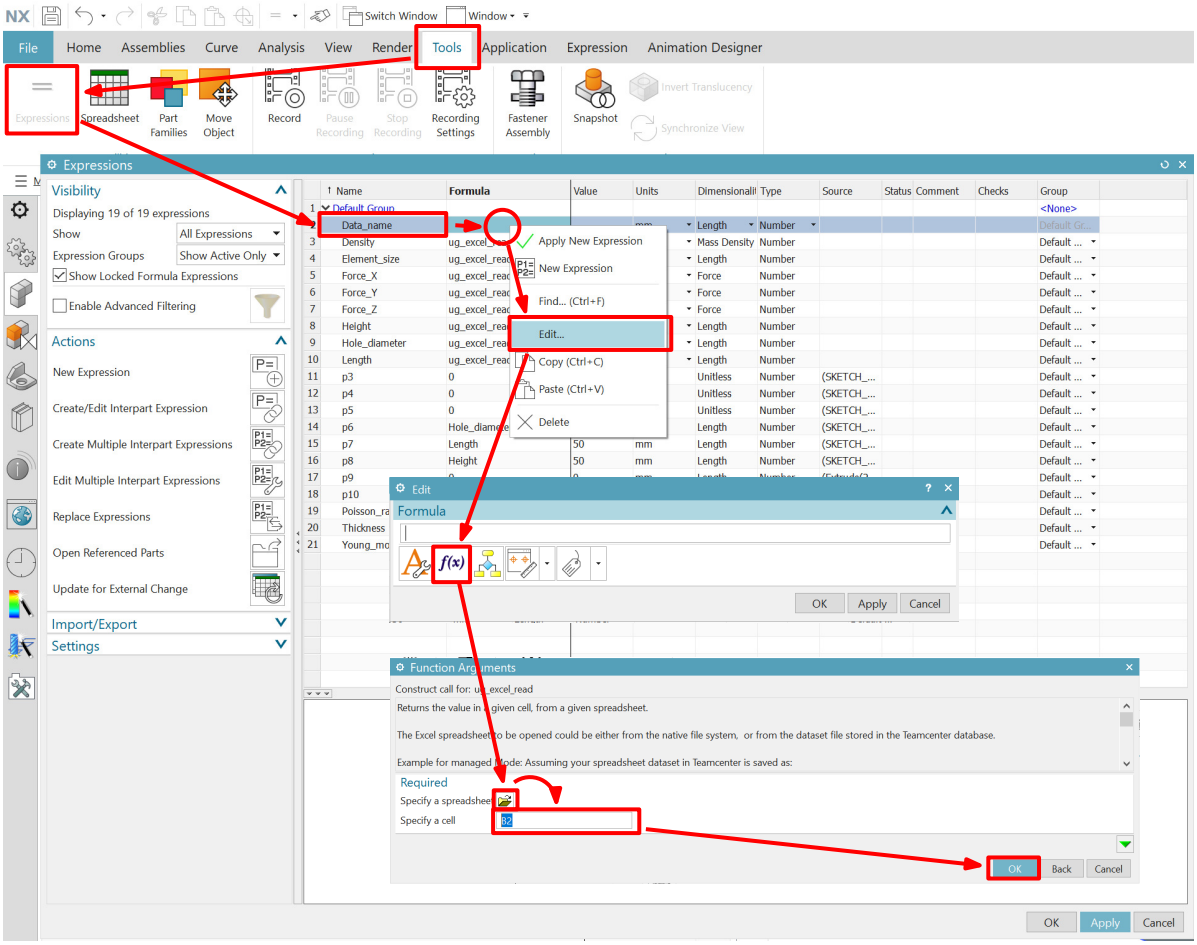

Figure 2: Creating an expression from a spreadsheet

Important: don't forget to specify the units and dimensionality of the value (for example: "length" in "mm" or "Mass density" in "kg/m³").

Repeat that process for each of the value in the spreadsheet.

2.3 Use an expression in excel

Once you defined all your values, you can now use them very easily. You can drax a whole sketch based on these expressions.

The steps to use an expression are shown in figure 3 for a sketch.

- double click on the dimension you want to change
- Click on the **Formula** option for the value
- Choose the expression you previously defined
- Click on OK

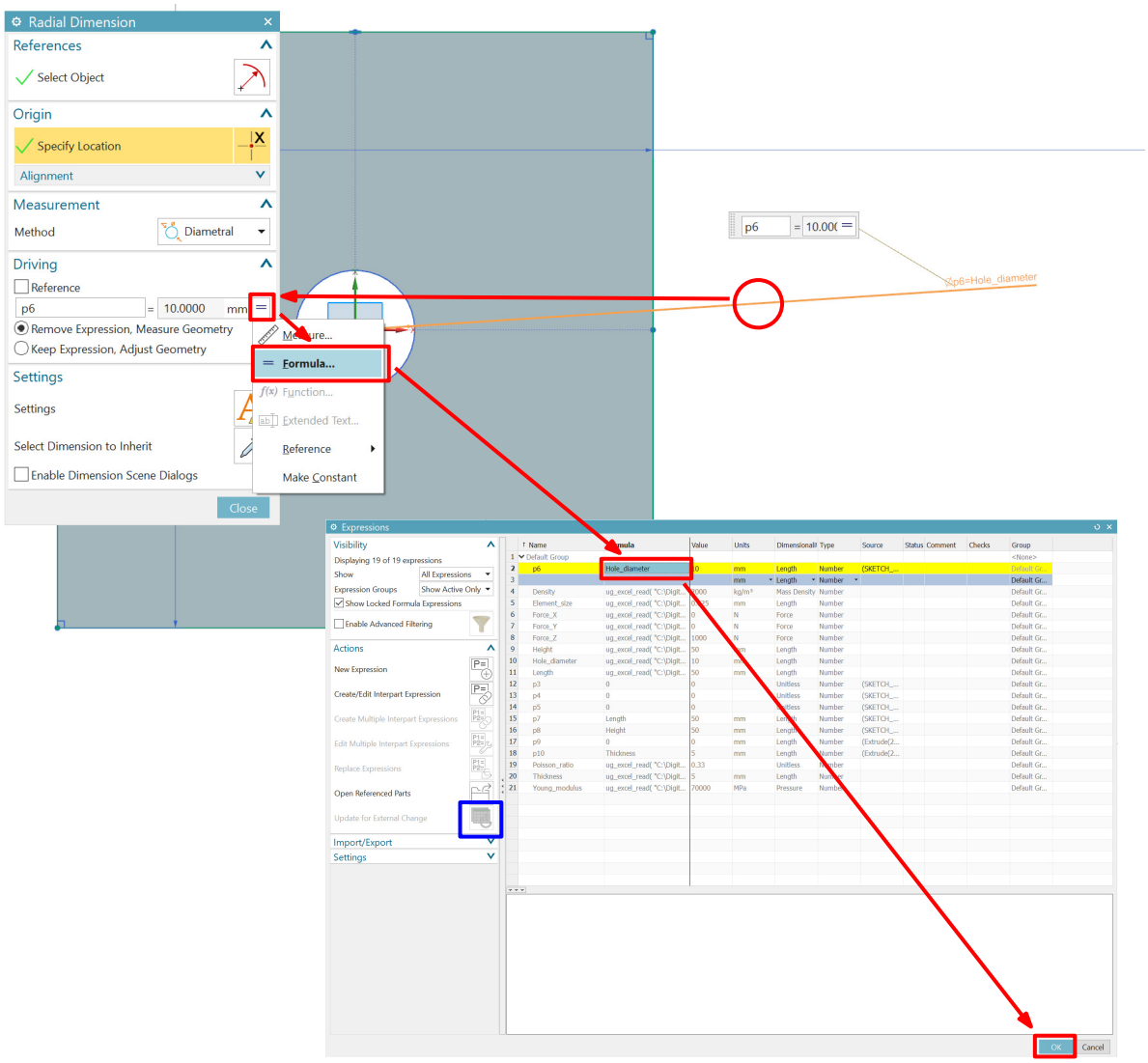

Figure 3: Using an expression from a spreadsheet

You can repeat those steps for any dimension. If you change the value in the spreadsheet, simply click on **Update for External Change** (surrounded in blue in the last picture). That will update everything and the model will change automatically.

2.4 Create interpart expressions

The expressions that are created in the .prt file are not automatically shared with .fem and .sim files, you need to specify which expressions to use in which files. The other way is to do the defining process of the variables in each file, both method work well but the first one allows to have one expression list with everything, which might be clearer.

To specify which expressions are to be shared, follow these steps (figure 4):

- Click on **Create Multiple Interpart Expressions**
- Choose the .prt file where you described all the expressions
- Choose the expressions you want to transfer
- Click on the arrow to transfer them
- Click on OK

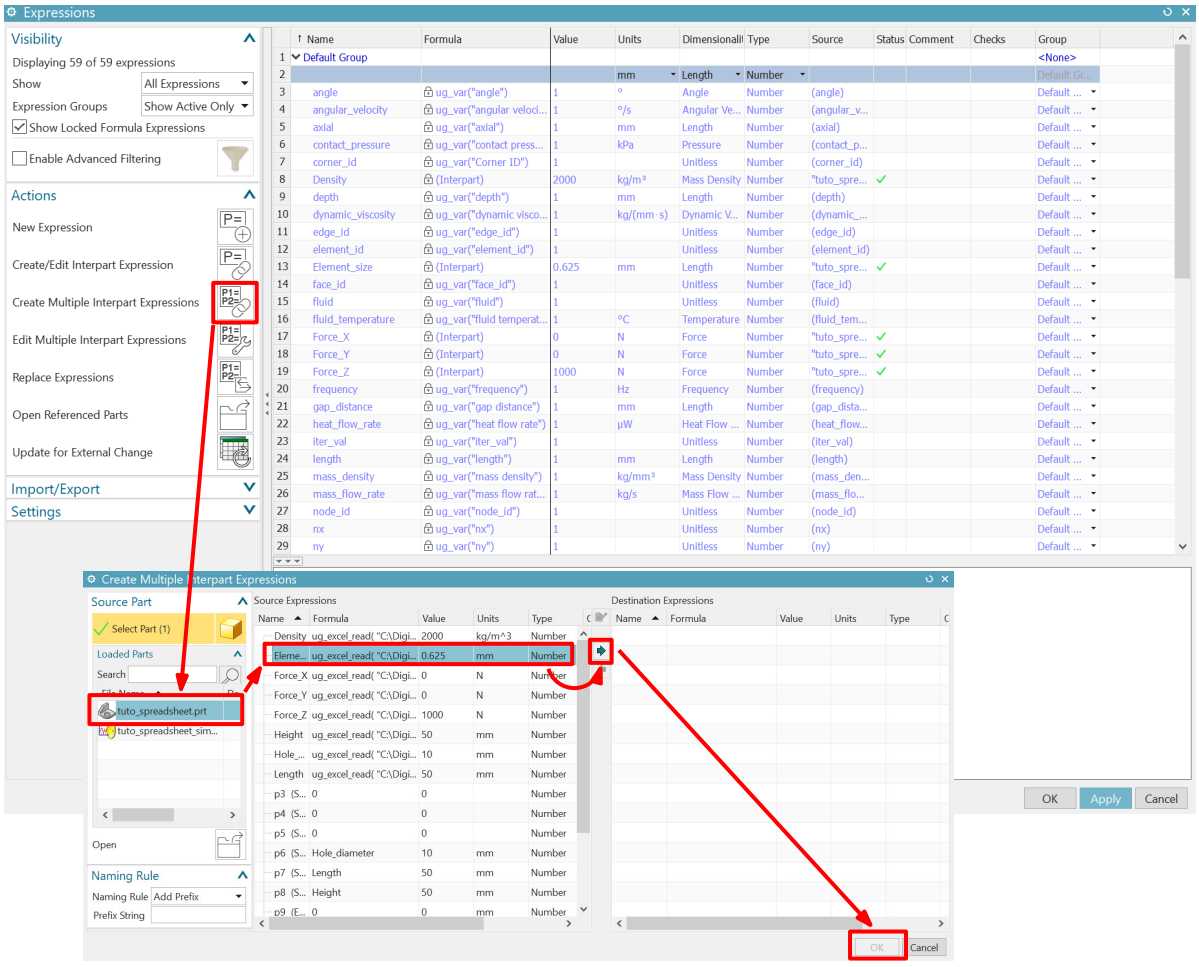

Figure 4: Creating interpart expressions

That way, your expressions will be available to use in the current file you're working in.

3 Using a model created from a spreadsheet

The set up of a model doesn't have to completely built from a spreadsheet. It is important to first identify which parameters will have to be modified along your project. You could have a model where the geometry is fixed but you want to easily observe the influence of the mesh density or use different load cases.
Each time the spreadsheet is modified, you have to update the expressions but also update the model in the **.fem** file! If you don't, NX will return an error message when a simulation is launched.
You can also add all the different parameters in your spreadsheet and change them depending on what you want to compute by simply changing the parameters in the cases that are read by NX. Don't hesitate to highlight those cases in the spreadsheet, it also adds to the clarity of the model.

4 Exporting results directly to a spreadsheet

It is possible to use C++ codes in NX. For example, one can write a code that takes the maximum stress in a finite element simulation and directly writes it in a spreadsheet.

The way to write and use such codes is by using the **journal**. That functionality is found by going to menu ⇒ Tools ⇒ Journal ⇒ Edit... .

It is then possible to write a code. An example of a code that sends the maximum nodal stress to the previously used spreadsheet is given in the file *Write_MaxStress_to_excel.txt*
In which it is necessary to modify the following lines:

- Specify the path to your spreadsheet:

  ```
  Dim theExcelFile As String = "PATH_TO_YOUR_FILE"
  ```

- Specify the coordinates of the cell the code writes to (value/1000 is to correct the unit to MPa)

  ```
  objExcel.Cells(COORDINATE1, COORDINATE2).value = value/1000
  ```

One could also then use that cell to compute additional values (in a matlab code for example).

The primary use of journalling is to record manual operations and let NX generate a code by itself. This is done by clicking on **Record**, performing your operations (example: create a graph for the stress on an edge) and then click **Stop Recording**. The created code can then be played to automatically create a graph at that location, even if the simulation is modified.

5 Tips and tricks for Siemens NX

5.1 Creating shortcuts in NX

Some options are sometime hidden behind menus and it can become tedious when they have to be used often. It is possible to create shortcut in NX to make some buttons easily accessible. To do this, follow these steps (figure 5):

- Right click in the top part of the window
- Click on **customize**
- Click on the blue cross to add a new section
- Search for the name of the command you want to access through the shortcut
- Drag and drop the command in the new section you just created

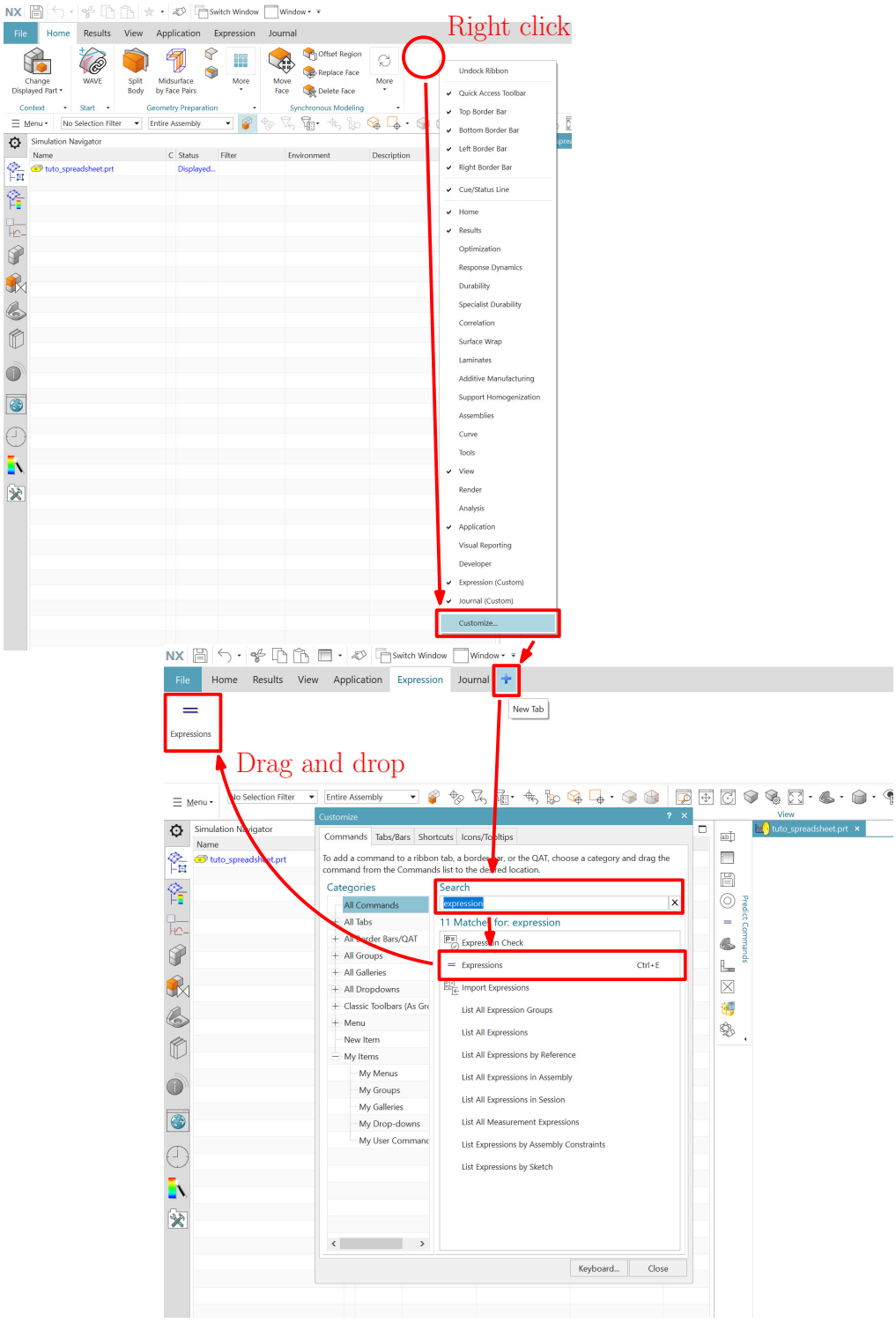

Figure 5: Creating shortcuts in NX

In this tutorial, it can be useful to create a section for the expressions and the journal commands.

5.2 Creating new buttons in NX

Once you create journal codes, you might want to run them quickly and easily with just one click. This can be done by creating a new button linked directly to the journal code. The steps to create a new button are shown below (figure 6):

- Choose **Nex Item** in the customize window
- Drag and drop **New User Command** to a location next to the other buttons
- Right click on the button
- Choose **Edit action**
- Choose the code you want to use
- The different parameters of the button (name, icon, description,...) can also be modified

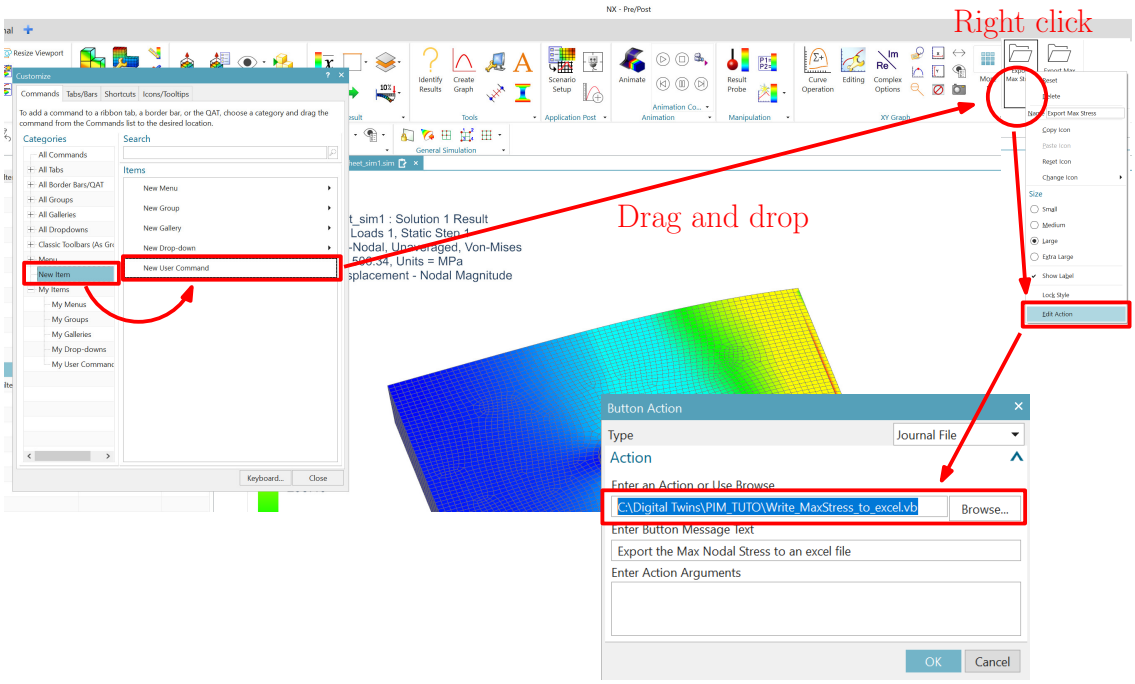

Figure 6: Creating buttons in NX

6 Example of a workflow to test different cases in NX

Here is an example of how one can create a workflow to somehow automate the testing of different NX configurations (geometries, loadings,...). The different elements are the following:

- A spreadsheet containing the geometry, material properties, loadings and mesh parameters, as well as a designated cell to receive the maximum stress
- A NX model (.prt, .fem and .sim) built using the spreadsheet
- A Matlab code reading the value of the thickness and the value of the maximum stress from the spreadsheet and modifying the value of the thickness in the spreadsheet

If one wants to test different thickness until the max stress is below the yield strength of the material, here is how the operations will happen in order:

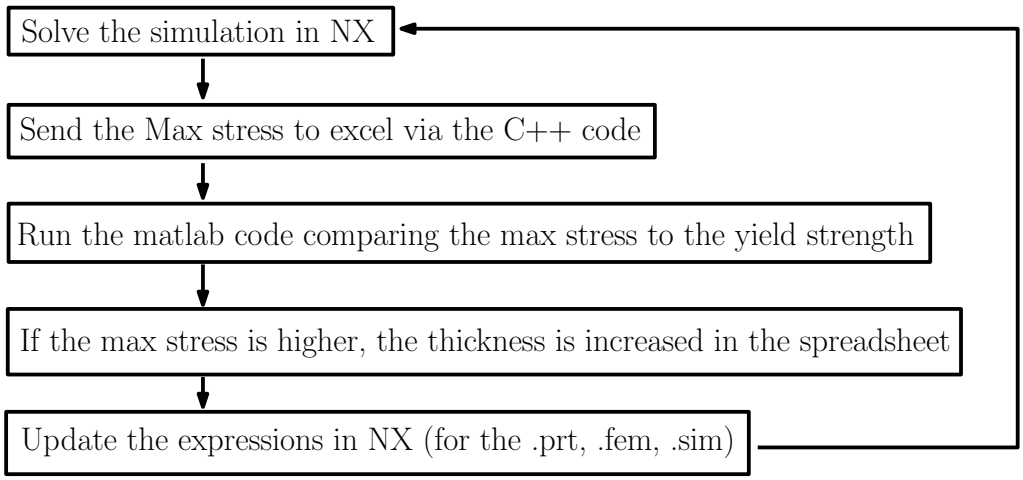

Figure 7: Workflow example

7 Using .csv files instead of Excel files

It is also possible to use .csv files and not need to have access to microsoft excel. The excel spreadsheet used in this tutorial has to be written that way in a text file:

Geometry , , , ,Material properties, , , ,Loadings, , , ,Mesh , ,
Length ,50 ,[mm] , ,Density ,2000 ,[kg/m³], ,Z Force ,5000,[N], ,Element size,0.625,[mm]
Height ,50 ,[mm] , ,Young Modulus ,70000,[Mpa] , ,X Force ,0 ,[N], , , ,
Hole diameter,10 ,[mm] , ,Poisson Ratio ,0.33 ,[-] , ,Y Force ,0 ,[N], , , ,
Thickness ,5 ,[mm] , , , , , , , , , , , , , ,
, , , , , , , , , , , , , , , ,
,506.33675, , , , , , , , , , , , , , ,

Essentially, comas are used to separate columns and jumping a line is used to separate lines.