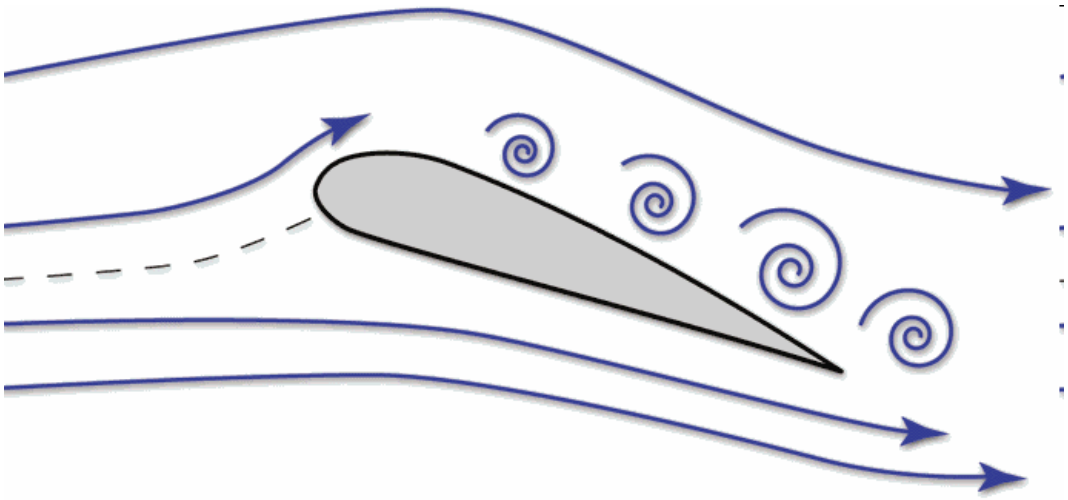
AIRFOIL CAD Design and CFD simulation

document version 0.1



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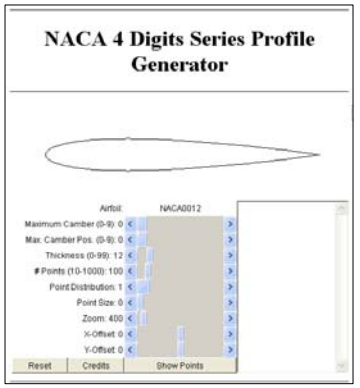
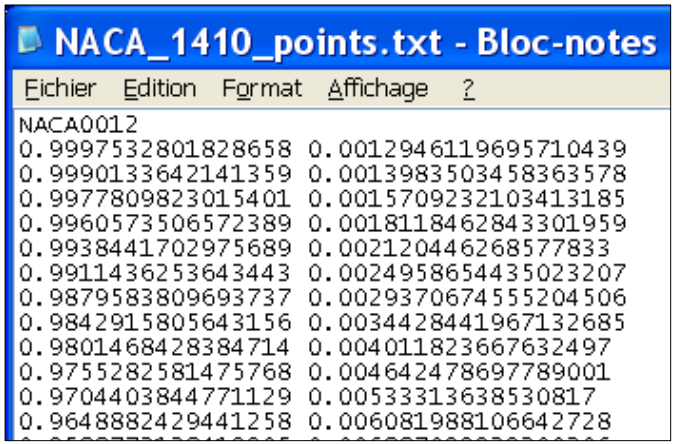
Step 1 : Generating the data points of the airfoil



- Connect to NACA 4 Digits Series Profile Generator

or

- Connect to NACA 5 Digits Series Profile Generator
- Choose a NACA serie, for example **NACA 1410**
- Generate the data points with the « Show points » button
- Copy-paste the points into a TXT file named **naca_1410_points.txt**


NACA_1410_points.txt - Bloc-notes

Fichier Edition Format Affichage ?

```
NACA0012
0.9997532801828658 0.0012946119695710439
0.9990133642141359 0.0013983503458363578
0.9977809823015401 0.0015709232103413185
0.9960573506572389 0.0018118462843301959
0.9938441702975689 0.002120446268577833
0.9911436253643443 0.0024958654435023207
0.9879583809693737 0.0029370674555204506
0.9842915805643156 0.0034428441967132685
0.980146842838471 0.004011823667632497
0.9755282581475768 0.004642478697789001
0.9704403844771129 0.0053331363853081 7
0.9648882429441258 0.006081988106642728
```

Step 2 : Preparing the data for SPACECLAIM – 1/3

To import points into SPACECLAIM, you have to use a text file which contains these lines :

Polyline = true
n x_coord y_coord
n x_coord y_coord
…/…

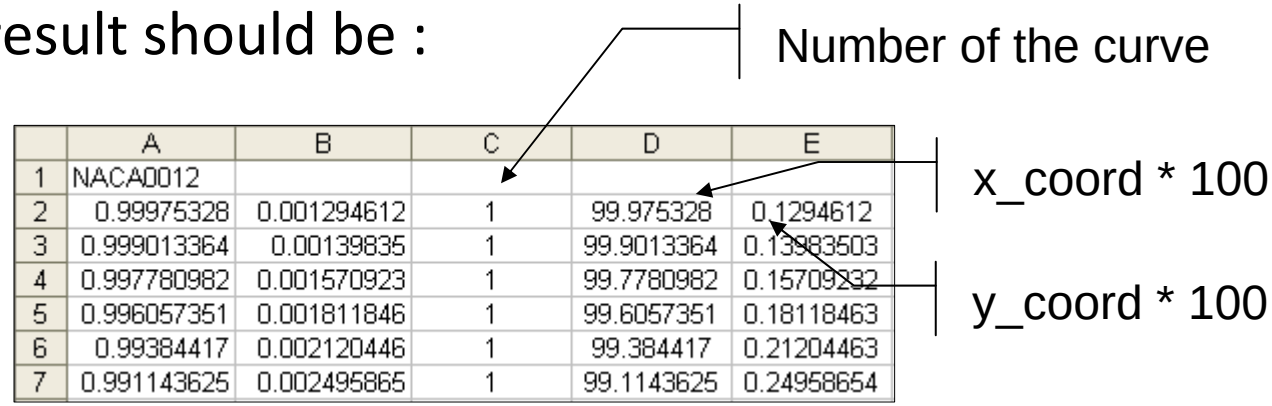
*Where **n** is the number of the considered curves and **x_coord**, **y_coord** the coordinates of a point. For example*

Polyline = true
1 10 12
1 20 22
1 25 30
…/…

*NB : You can import more than one curve with a single text file; **n** can equal to 1, 2, 3 etc …*

Step 2 : Preparing the data for SPACECLAIM – 2/3

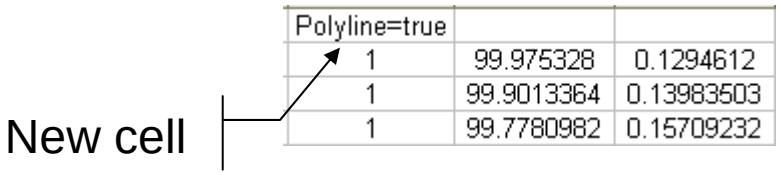
- Import the naca_1410_points.txt into excel
- Create a column which contains « 1 » (one curve will be only created)
- Create a new column and place a formula to multiply the original x coordinate by a factor : this is required because a too smaller coordinates will be not well imported into a CAD system. For example you can multiply **x** by 100
- Do the same thing for the y coordinate
- The result should be :



	A	B	C	D	E
1	NACA0012				
2	0.99975328	0.001294612	1	99.975328	0.1294612
3	0.999013364	0.00139835	1	99.9013364	0.13983503
4	0.997780982	0.001570923	1	99.7780982	0.15709232
5	0.996057351	0.001811846	1	99.6057351	0.18118463
6	0.99384417	0.002120446	1	99.384417	0.21204463
7	0.991143625	0.002495865	1	99.1143625	0.24958654

Step 2 : Preparing the data for SPACECLAIM – 3/3

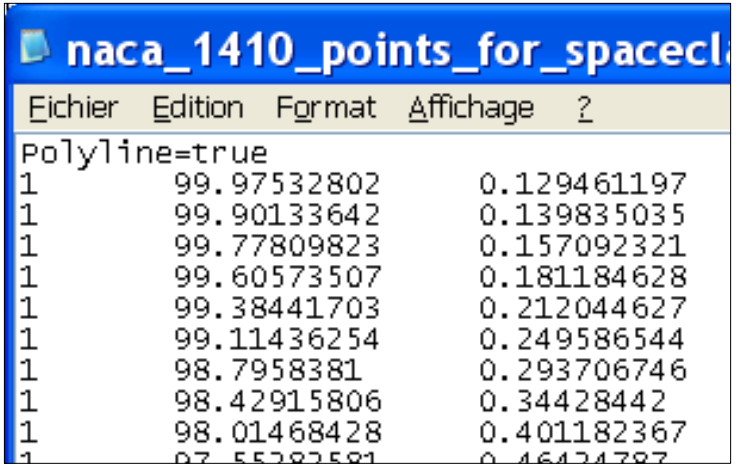
- You can add a cell containing « Polyline=true »



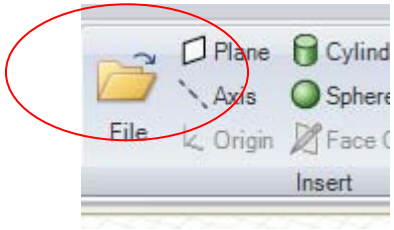
Polyline=true		
1	99.975328	0.1294612
1	99.9013364	0.13983503
1	99.7780982	0.15709232

- Copy-Paste the 3 columns into a new text file named **naca_1410_points_for_sc.txt**

- The file should look like that :

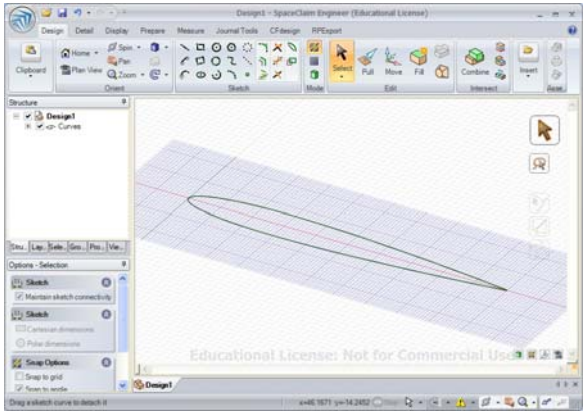


Step 3 : Importing the points into SPACECLAIM

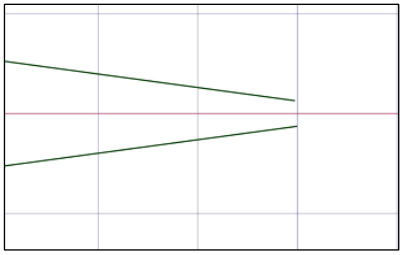


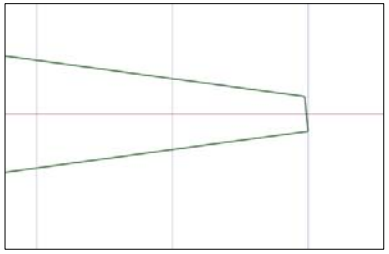
- Start a new design and lauch the **INSERT / File** command

- The curve is now imported into SPACECLAIM :



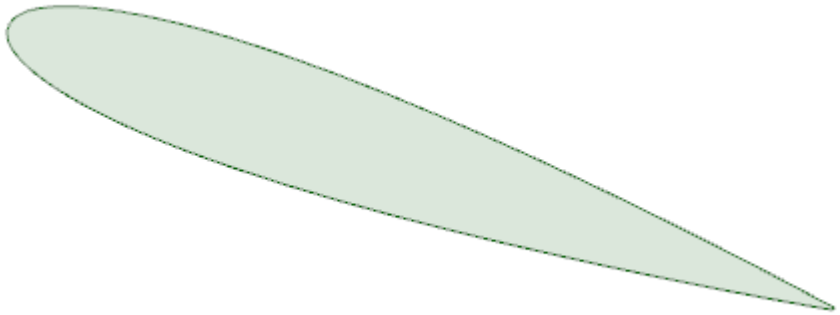
- But the curve is not closed; we have to close it with an arc or a segment …



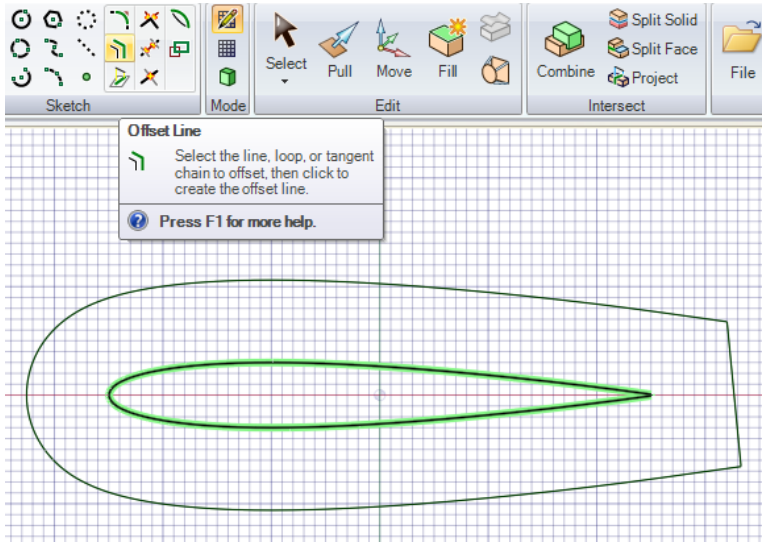


Step 4 : Creating the CFD domains – 1/2

- Save the SPACECLAIM document. In the 3D mode, you can see the surface corresponding to the airfoil :

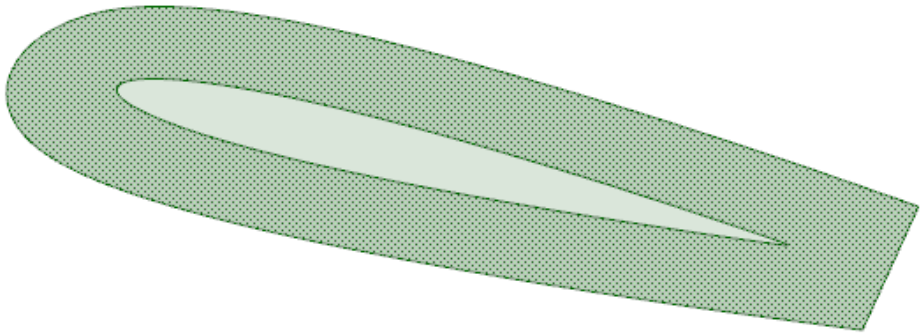


- In sketch mode, create a domain which will be mesh

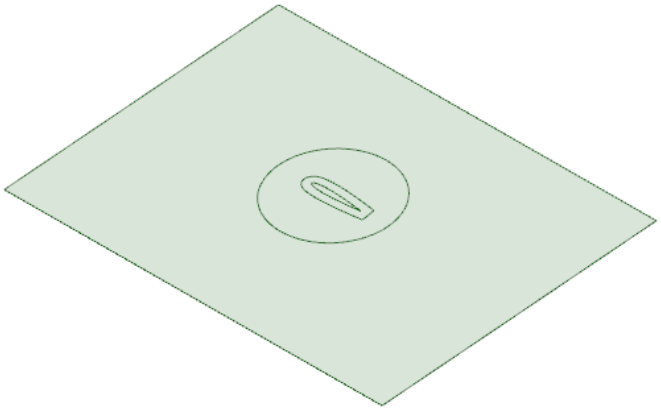


Step 4 : Creating the CFD domains – 2/2

- When you switch to the 3D mode, the surfaces corresponding to the curves sketched are automatically created

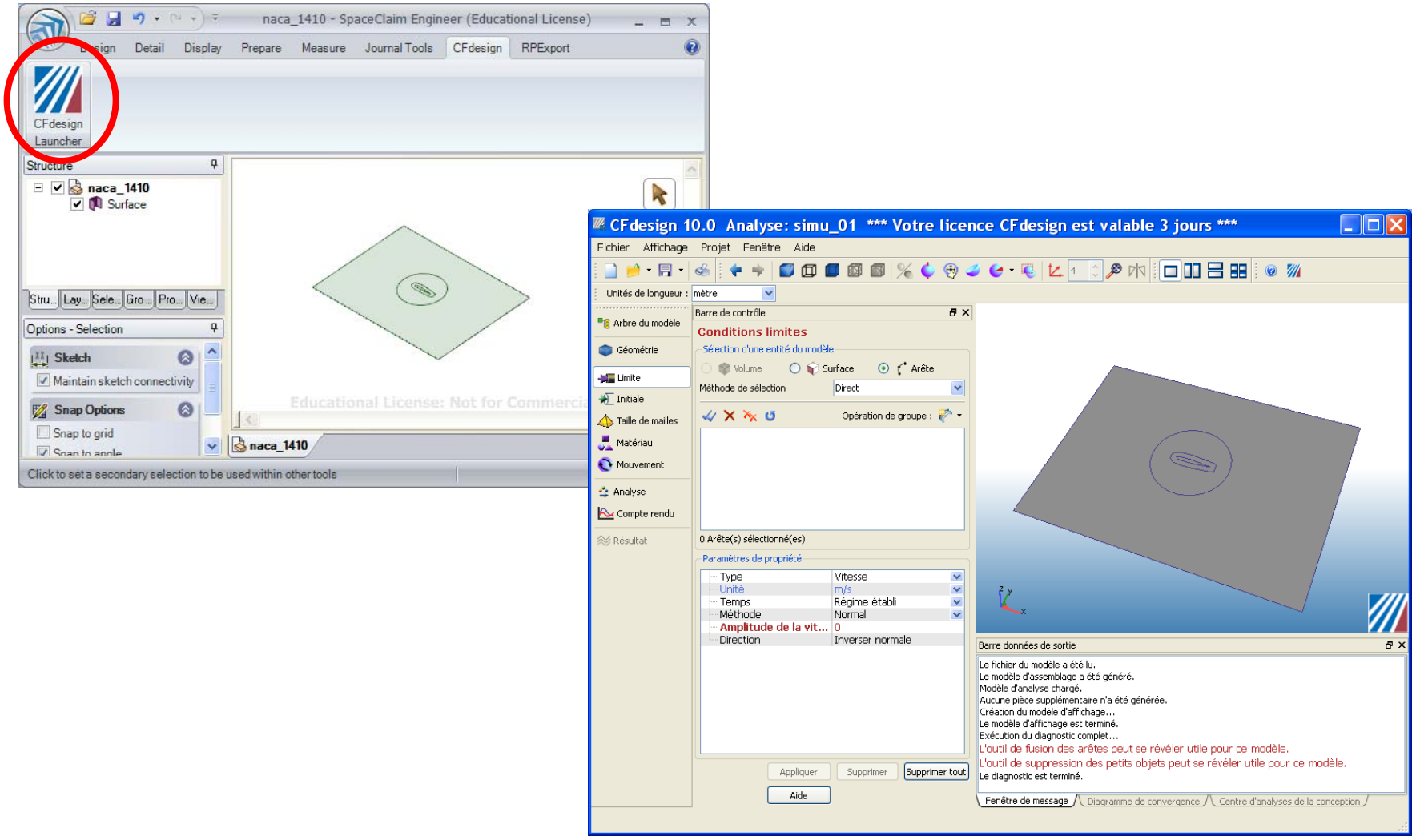


- These domains will allow different sizes of meshs



Step 5 : export to CFDesign

- You can now switch to CFDesign with the **CFDesign launcher**



Step 6 : Making the simulation with CFDesign