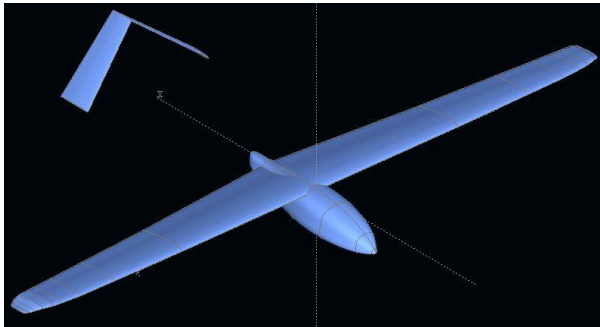
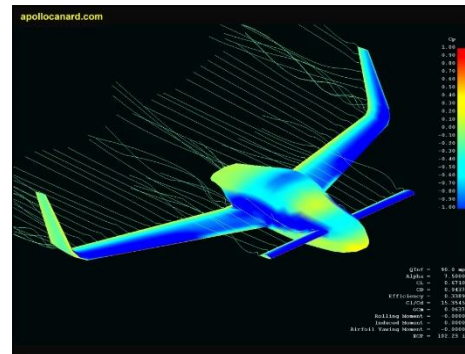
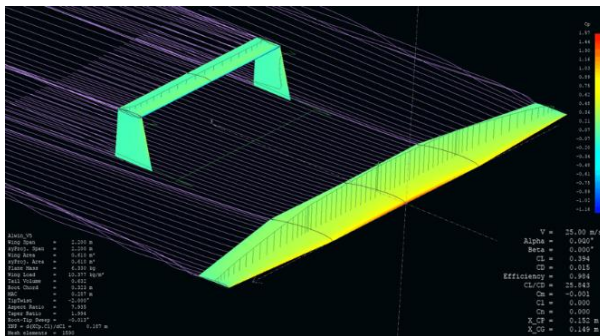


# Masterclass: XFLR5 Software



Useful links:

XFLR5 for dummies guide: <https://github.com/JamesAnthonyColeman/Masterclass-XFLR5>

Video demonstration: <https://github.com/JamesAnthonyColeman/Masterclass-XFLR5>

XFLR5 website (includes interesting guides and information): <http://www.xflr5.tech/xflr5.htm>

Airfoil tools: <http://www.airfoiltools.com/>

Aim:

By the end of your session, you will have used the XFLR5 software to recreate your Gertie or a custom aircraft of your choice in XFLR5 and complete aerodynamic analysis and stability analysis.

You'll be able to then use the software to design your own aircraft. Especially for BMFA.

## Tasks:

1. Download the software and open it.
2. Complete the 'Direct Foil design' stage. This is done by importing the airfoils shown in figure 1 from XFLR5 itself and from airfoiltools.com. (Information found from the video and guide)

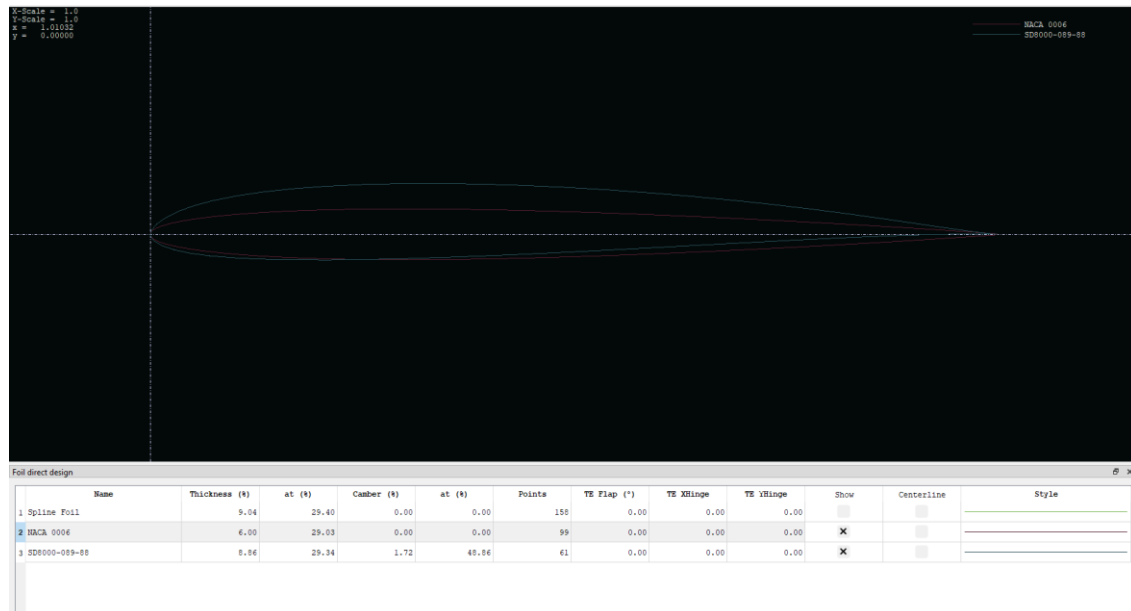


Figure 1: Direct foil design for Gertie

3. Complete either a 'Batch analysis' or a 'multi-threaded batch analyses' for appropriate variables shown in figure 2.

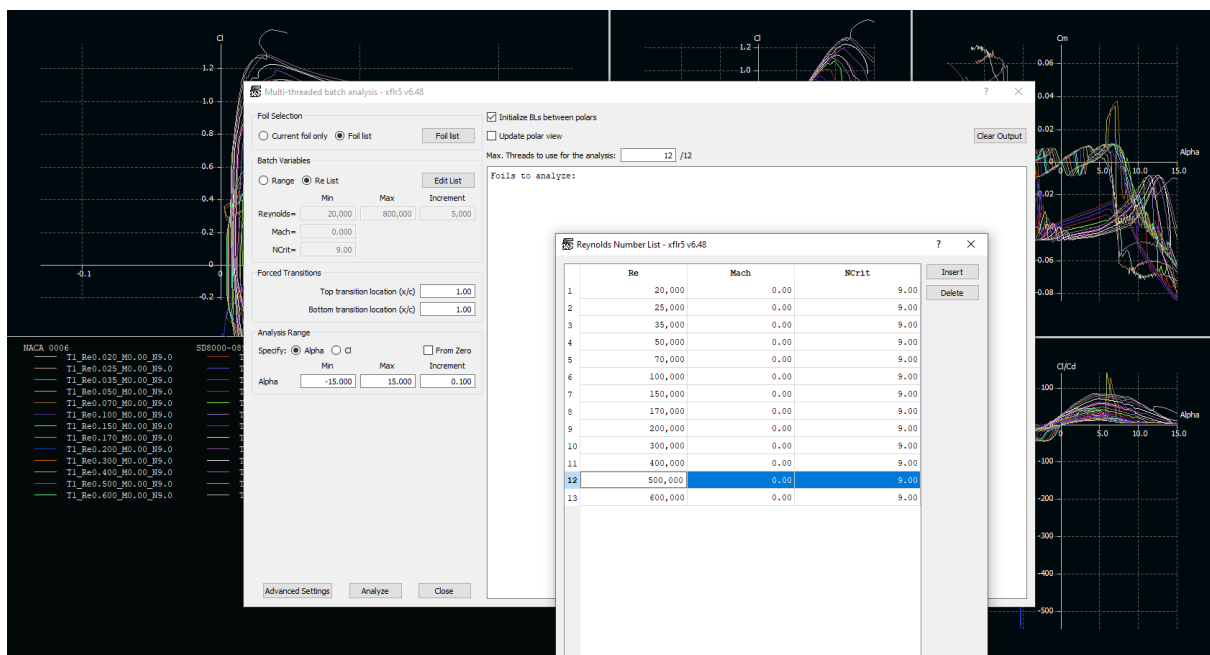


Figure 2 Multi-threaded batch analysis

#### 4. Build Gertie in the 'Plane Editor' tool shown in figures 3 -10.

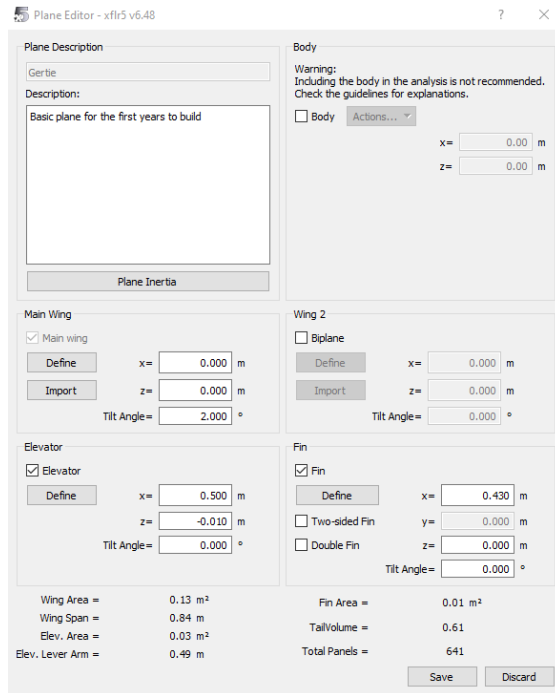


Figure 3 Plane design

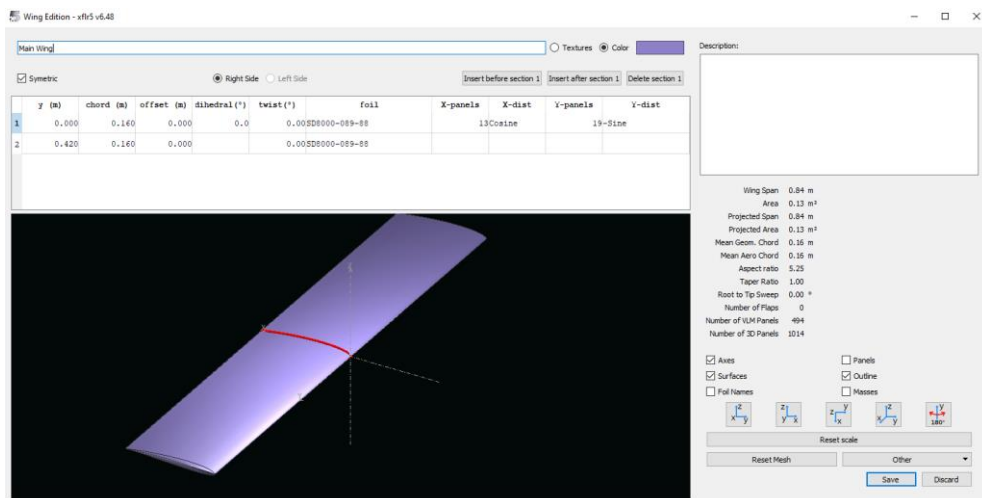


Figure 4 Main wing

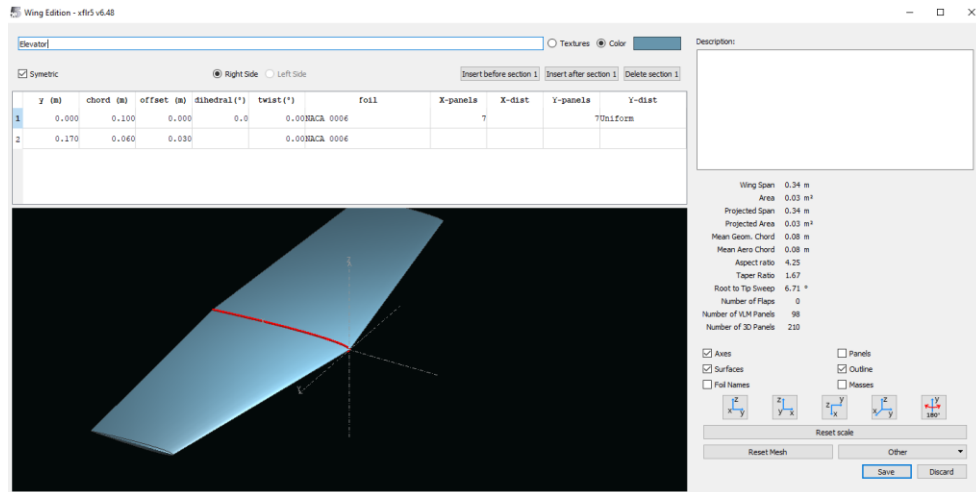


Figure 5 Elevator

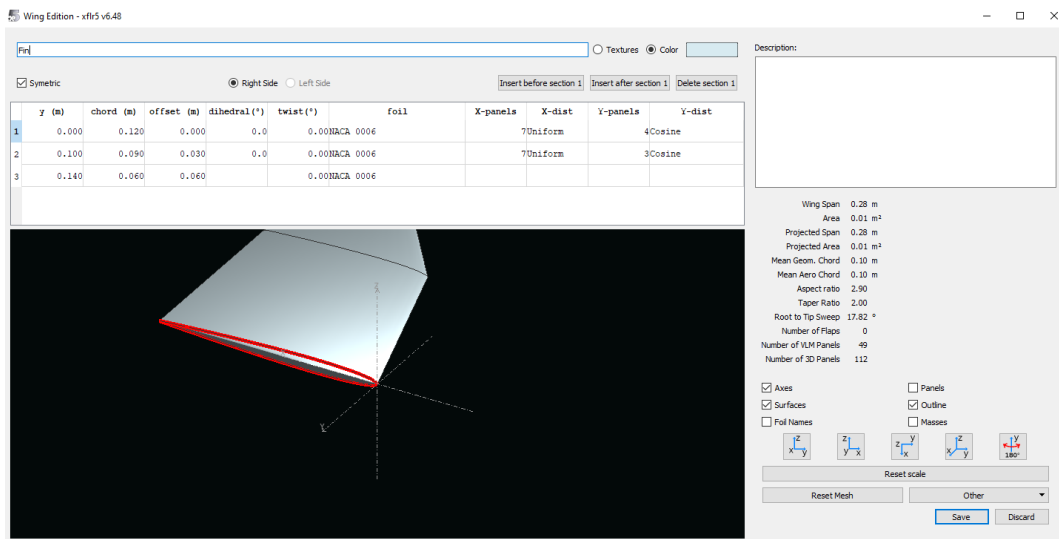


Figure 6 Fin

Inertia properties for Gertie - xflr5 v6.48

This is a calculation form for a rough order of magnitude for the inertia tensor.  
Refer to the Guidelines for explanations.

Component inertias

Main Wing Second Wing

Elevator

Fin

Body

Additional Point Masses

	Mass (kg)	x (m)	y (m)	z (m)	Description
1	0.060	-0.100	0.000	0.010	Motor
2	0.220	-0.040	0.000	0.030	3S 2200mAh Battery
3	0.050	-0.030	0.000	-0.010	ESC
4	0.020	0.070	-0.050	0.000	Left Aileron Servo
5	0.020	0.070	0.050	0.000	Right aileron Servo
6	0.020	0.500	0.000	0.020	Elevator Servo
7	0.000	0.000	0.000	0.000	

Total Mass = Volume + point masses

Center of gravity

Total Mass= 0.540 kg

X\_CoG= 0.054 m

Y\_CoG= -0.000 m

Z\_CoG= 0.015 m

Inertia in CoG Frame

Ixx= 0.00637 kg.m<sup>2</sup>

Iyy= 0.01896 kg.m<sup>2</sup>

Izz= 0.02491 kg.m<sup>2</sup>

Ixz= -0.00002 kg.m<sup>2</sup>

Save Discard Export to AVL

Figure 7 Inertia

Inertia properties for Main Wing - xflr5 v6.48

This is a calculation form for a rough order of magnitude for the inertia tensor.  
Refer to the Guidelines for explanations.

Object Mass - Volume only, excluding point masses

Center of gravity

Wing Mass: 0.100 kg

X\_CoG= 0.065 m

Y\_CoG= -0.000 m

Z\_CoG= -5.077e-05 m

Inertia in CoG Frame

Ixx= 0.006 kg.m<sup>2</sup>

Iyy= 0.0001318 kg.m<sup>2</sup>

Izz= 0.006 kg.m<sup>2</sup>

Ixz= 3.919e-06 kg.m<sup>2</sup>

Additional Point Masses

	Mass (kg)	x (m)	y (m)	z (m)	Description
1	0.000	0.000	0.000	0.000	

Total Mass = Volume + point masses

Center of gravity

Total Mass= 0.100 kg

X\_CoG= 0.065 m

Y\_CoG= -0.000 m

Z\_CoG= -5.077e-05 m

Inertia in CoG Frame

Ixx= 0.00588 kg.m<sup>2</sup>

Iyy= 0.00013 kg.m<sup>2</sup>

Izz= 0.00601 kg.m<sup>2</sup>

Ixz= 3.91898e-06 kg.m<sup>2</sup>

Save Discard Export to AVL

Figure 8 Main wing inertia

Inertia properties for Elevator - xflr5 v6.48

This is a calculation form for a rough order of magnitude for the inertia tensor.  
Refer to the Guidelines for explanations.

Object Mass - Volume only, excluding point masses

Center of gravity		Inertia in CoG Frame	
Wing Mass=	0.025 kg	Ixx=	0.0001828 kg.m <sup>2</sup>
X_CoG=	0.548 m	Iyy=	1.004e-05 kg.m <sup>2</sup>
Y_CoG=	-0.000 m	Izz=	0.0001929 kg.m <sup>2</sup>
Z_CoG=	-0.010 m	Ixz=	0.000 kg.m <sup>2</sup>

Additional Point Masses

	Mass (kg)	x (m)	y (m)	z (m)	Description
1	0.000	0.000	0.000	0.000	

Total Mass = Volume + point masses

Center of gravity		Inertia in CoG Frame	
Total Mass=	0.025 kg	Ixx=	0.00018 kg.m <sup>2</sup>
X_CoG=	0.548 m	Iyy=	0.00001 kg.m <sup>2</sup>
Y_CoG=	-0.000 m	Izz=	0.00019 kg.m <sup>2</sup>
Z_CoG=	-0.010 m	Ixz=	0.00000 kg.m <sup>2</sup>

Save Discard Export to AVL

Figure 9 Elevator inertia

Inertia properties for Fin - xflr5 v6.48

This is a calculation form for a rough order of magnitude for the inertia tensor.  
Refer to the Guidelines for explanations.

Object Mass - Volume only, excluding point masses

Center of gravity		Inertia in CoG Frame	
Wing Mass=	0.025 kg	Ixx=	3.582e-05 kg.m <sup>2</sup>
X_CoG=	0.491 m	Iyy=	5.186e-05 kg.m <sup>2</sup>
Y_CoG=	-0.000 m	Izz=	1.605e-05 kg.m <sup>2</sup>
Z_CoG=	0.058 m	Ixz=	-7.509e-06 kg.m <sup>2</sup>

Additional Point Masses

	Mass (kg)	x (m)	y (m)	z (m)	Description
1	0.000	0.000	0.000	0.000	

Total Mass = Volume + point masses

Center of gravity		Inertia in CoG Frame	
Total Mass=	0.025 kg	Ixx=	0.00004 kg.m <sup>2</sup>
X_CoG=	0.491 m	Iyy=	0.00005 kg.m <sup>2</sup>
Y_CoG=	-0.000 m	Izz=	0.00002 kg.m <sup>2</sup>
Z_CoG=	0.058 m	Ixz=	-7.5092e-06 kg.m <sup>2</sup>

Save Discard Export to AVL

Figure 10 Fin inertia

- Complete 'Define an Analysis'. Information shown in figure 11.

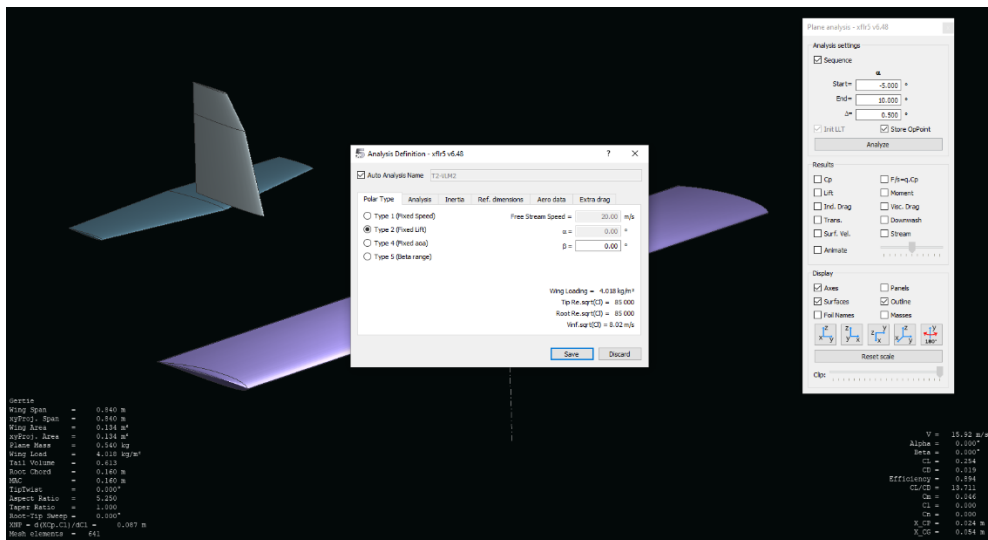


Figure 11 Analysis definition

## 6. Complete 'Define a stability analysis' as shown below.

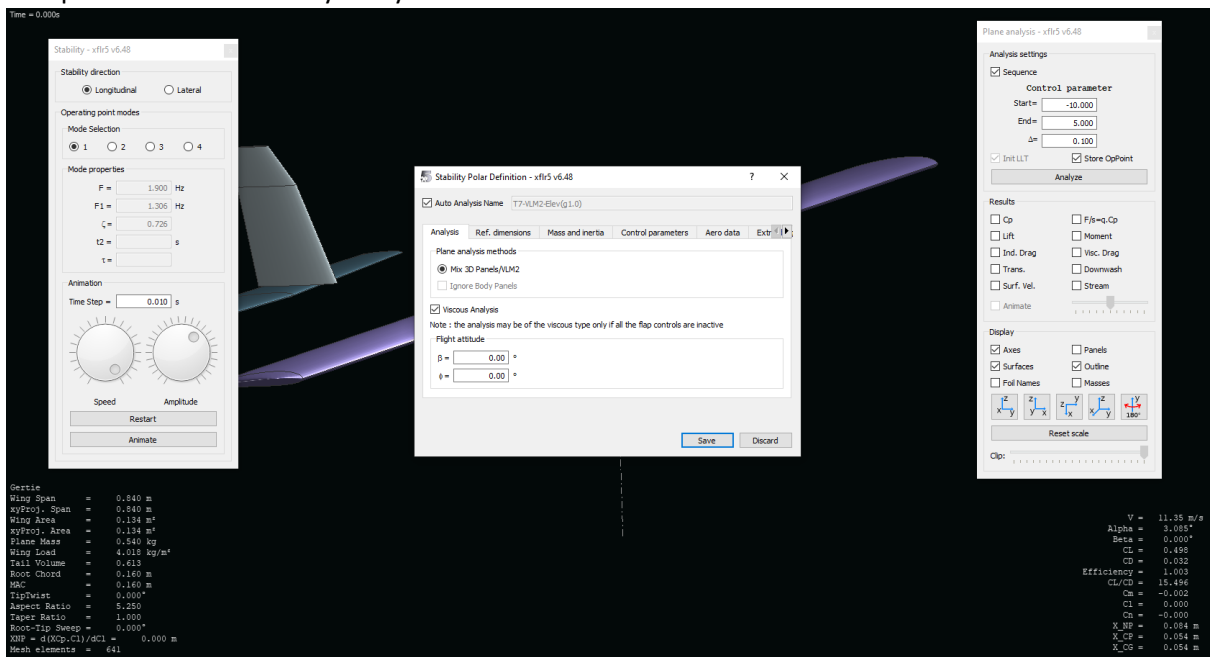


Figure 12 Stability analysis

## The end

Congratulations! This is a key piece of software used by the UAV society and in industry. Hopefully you'll see that this software, although it may look complex in certain areas, is not so difficult to use and you will feel comfortable creating your own aircraft.

The next Masterclasses will be in Aircraft design where you will learn the 'canon' aircraft design method used for all aircraft and all the variations that can be used with pros and cons.

Hope to see you there!