Practical info on XFOIL

November 2025

1 Commands and Environments

In standard mode (profile analysis):

- *?*, list of available commands.
- *NACA i*, creates a NACA profile, using as input the integer number with 4 or 5 digits that identifies it.
- *PPAR*, creates a visualization the geometry and its discretization, and open an environment where it is possible to, *e.g.*, modify the panel distribution (command N).
- *OPER*, enters the environment for simulations (*"operative point"*). The default environment is *OPERi*, which is the inviscid mode.
- *GDES*, enters the environment for design.

In *OPERi*:

- *ALFA r*, simulation for the selected profile and one angle of attack, r, which is a real number.
- *ASEQ rrr*, simulations for a sequence of angle of attacks, staring from r_1 and ending to r_2, with step r_3.
- *PACC*, enters *accumulation point* and requires name of a text file and a binary file where simulation data will be saved from now on. Using *PACC* again exits this environment.
- *CPWR*, writes $c_p(x)$ obtained with a simulation.
- *CPV*, after a simulation has been run, creates a visualization of the forces acting on the profile.
- *DUMP*, after a simulation has been run, saves data on file.

- *VISC*, enter in the environment for simulations with viscosity *OPERv*, and requires the Reynolds number. Using it again brings back to the inviscid environment.

In *OPERv*:

- *INIT*, (also in *OPERi*), reset the initial condition (useful in *OPERv* that uses an iterative procedure, possibly dependent on the initial condition.
- *ITER*, changes the maximum number of iteration.
- *VPAR*, enters the environment *VPAR*, where it is possible to modify simulation parameters, such as the transition points for pressure and suction sides (*Xtr rr*), and the turbulent intensity *N r*.
- *BL*, shows some velocity profiles on the airfoil.
- *VPLO*, enters the environment *VPLO*

In *VPLO*:

- *CF*, shows the skin friction coefficient, c_f.
- *RT*, shows the Reynolds number defined using the momentum thickness, Re_θ.
- *DUMP*, saves the data used in the current plot.

Alternative to the operative point(s), the environment *GDES* is used to modify the geometry:

- *EXEC*, all modification are done on a temporary geometry (*buffer airfoil*). This command copies the *buffer airfoil* in the working *airfoil*.
- *GSET*, copy working airfoil in the buffer airfoil (overwriting any modification).
- *FLAP*, add a flap to the existing geometries.

2 Possible exercises

2.1 Profile width and lift

Examine three symmetric 4-digits NACA profiles and discuss the effects of width on the lift coefficient c_l, comparing with the prediction form the thin airfoil theory.

2.2 Profile width and pressure distribution

Compare c_p for profiles with different thickness, changing the angle of attack. What is the kind of profile that is more affected by moving far from the design angle? When the separation risk is higher?

2.3 Resolution effects

Study resolution effects on the c_l prediction. Do we expect a strong dependency on resolution in this method?