

# Microsoft Foundation Class Aircraft Stability Calculator

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# Purpose

- Ease computations of basic stability analysis for an aircraft
- Represent how airspeed affects stability
- Use actual airfoil data to see effect on stability
- Assumptions made

# Assumptions

- Only looked at longitudinal static stability
- Aircraft is trimmable
- Aircraft in steady-level flight
- Propulsion and flap effects are negligible
- No effect from the trim tab
- Rectangular wing

# Function

- Calculate control force, elevator deflection, angle-of-attack to trim
- Calculate pitching moment, pitch stiffness, lift-slope of aircraft
- Key components
  - Dialog file read-in
  - Dynamic airspeed adjustment
- Live Demo

# Dialog file read-in

- Imports XFOIL .txt file into GUI
- Reads file line-by-line
- Each line stored in CString vector
- Skips to line at first alpha
- Parses each line of CString vector
- Assigns corresponding piece of the line to alpha, CL, or CM
- Repeats until the end of the file
- Sets scroll range for alpha

```
NACA0009_3e6 - Notepad
File Edit Format View Help

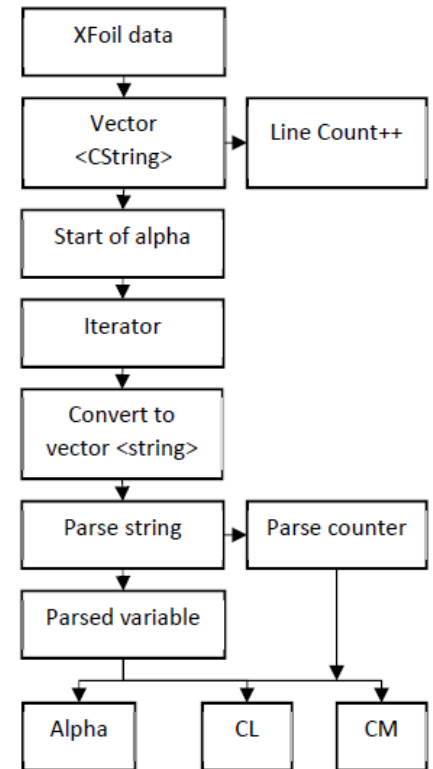
XFOIL Version 6.99

Calculated polar for: NACA 0009

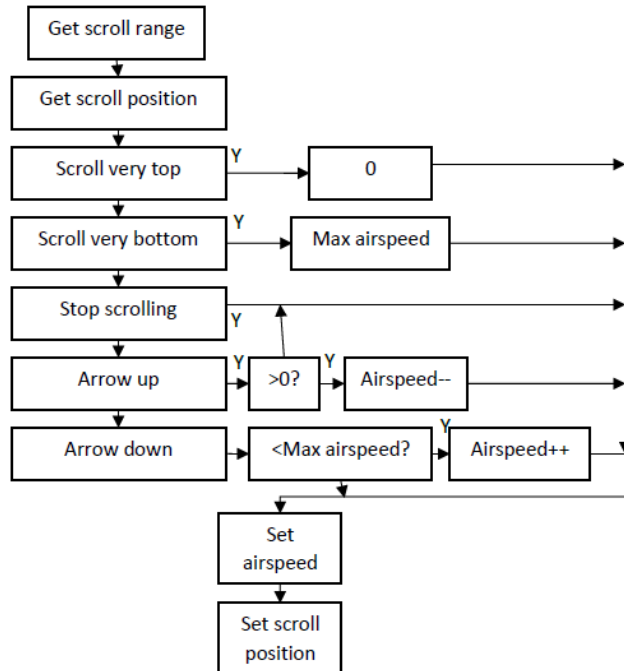
1 1 Reynolds number fixed Mach number fixed

xtrf = 1.000 (top) 1.000 (bottom)
Mach = 0.000 Re = 3.000 e 6 Ncrit = 9.000

-----
alpha CL CD CDp CM Top_Xtr Bot_Xtr
-----
-10.000 -1.0922 0.01223 0.00759 -0.0028 1.0000 0.0072
-9.750 -1.0672 0.01186 0.00718 -0.0025 1.0000 0.0074
-9.500 -1.0431 0.01130 0.00656 -0.0019 1.0000 0.0080
```



# Dynamic airspeed adjustment



- Atmosphere sets airspeed max
- Scroll bar syntax to set range and position
- Switch statement to determine position
- Adjustments in arrow or thumb indicate incrementing or decrementing airspeed
- Scroll to very top represents 0
- Scroll to very bottom represent max airspeed
- Thumb repositioned as airspeed changes

# Importance

- Saves time with completing calculations
- Accurate representation of aircraft in trimmed conditions
- Ability to input actual airfoil data
- Use in further dynamic calculations
- Drawback: many assumed parameters

The screenshot displays the 'Aircraft Stability Analysis' software interface, which is organized into several functional panels. The 'Output' panel on the left shows calculated values for control force to trim, elevator deflection, angle of attack, and pitching moment. The 'Aircraft Properties' panel in the center allows for input of weight, planform area, span, and other geometric and mass characteristics. The 'Wing Input' panel on the right is used for defining airfoil data, including lift and drag coefficients and pitching moments. The 'Atmospheric Properties' panel at the bottom center handles altitude, temperature, and density inputs. The 'Tail and Elevator Input' panel on the far right defines tail geometry and elevator characteristics. A 'Fly' button is located at the bottom center, and a 'Generate' button is at the bottom right. The interface uses a standard Windows-style layout with text boxes, buttons, and a clear hierarchical organization of related parameters.

# Questions?

