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

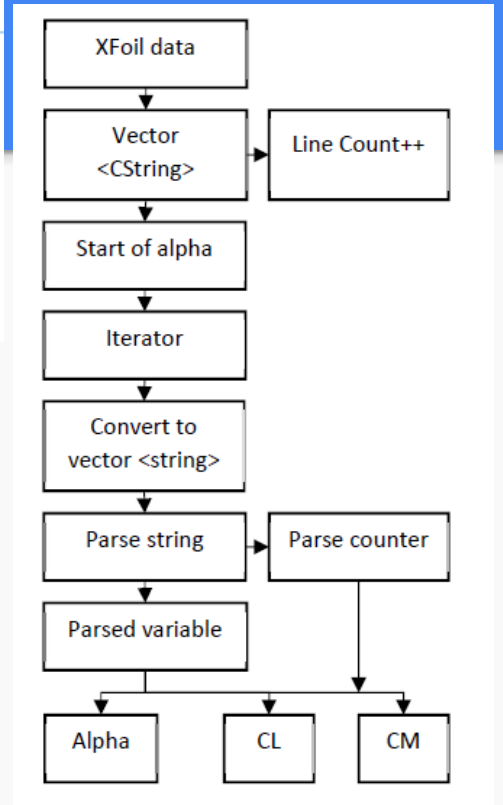
Dialog file read-in

- 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

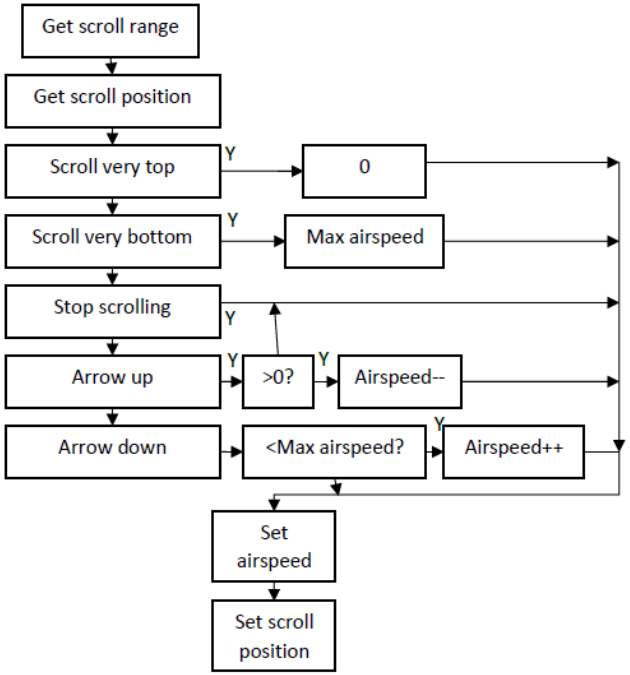
NACA0009_3e6 - Notepad

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

Questions?