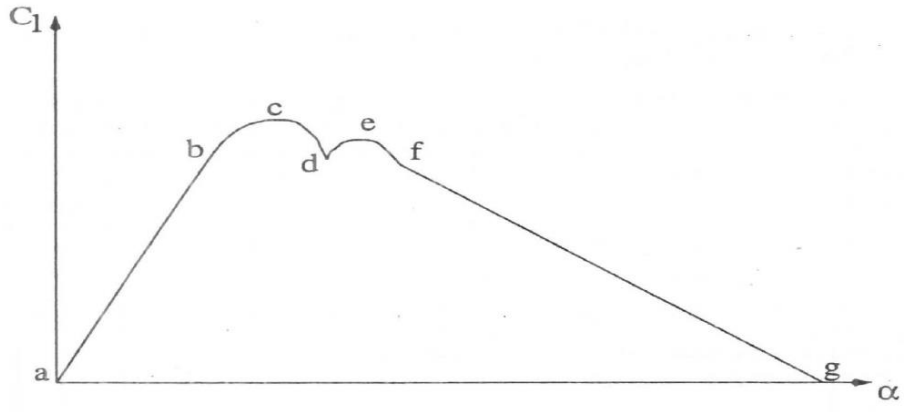
AerE 261 Assignment 3: C_l vs. α Curve Fitting

Due 6:00pm Friday, April 26

1) Problem

A typical C_l vs. α curve looks like:



The coordinates of the points *a* through *g* for a particular airfoil are given in the input file posted on BlackBoard. Write a MATLAB code that will recreate the plot of C_l vs. α for this airfoil over the range $-90° \leq \alpha \leq 90°$, assuming that the straight regions of the curve can be approximated by a linear function, and the curved regions can be approximated by a quadratic function. The graph is symmetric about the zero-lift angle of attack (note that the lift will be negative below the zero-lift angle).

Submit your assignment on BlackBoard Learn with all source code in a zipped folder, and a separate PDF with your results.

2) Program Requirements

Your MATLAB program should include the following features:

- Main program should use separate functions for calculating values for the linear and quadratic regions of the curve.
- All numbers should be read from an input file. **No hardcoded values should appear in the program.**

3) Theory

A linear region can be modeled by:

$$y = \frac{y_1 - y_0}{x_1 - x_0}(x - x_0) + y_0$$

A quadratic region can be modeled by:

$$y = Ax^2 + Bx + C$$

where

$$A = \frac{y_2}{(x_2 - x_0)(x_2 - x_1)} + \frac{y_1}{(x_1 - x_0)(x_1 - x_2)} + \frac{y_0}{(x_0 - x_1)(x_0 - x_2)}$$

$$B = -\frac{y_2(x_0 + x_1)}{(x_2 - x_0)(x_2 - x_1)} - \frac{y_1(x_0 + x_2)}{(x_1 - x_0)(x_1 - x_2)} - \frac{y_0(x_1 + x_2)}{(x_0 - x_1)(x_0 - x_2)}$$

$$C = \frac{y_2 x_0 x_1}{(x_2 - x_0)(x_2 - x_1)} + \frac{y_1 x_0 x_2}{(x_1 - x_0)(x_1 - x_2)} + \frac{y_0 x_1 x_2}{(x_0 - x_1)(x_0 - x_2)}$$