

ME 1020 Engineering Programming with MATLAB

Problem 2.44:

44. The lift-to-drag ratio is an indication of the effectiveness of an airfoil. Referring to Problem 43, the equations for lift and drag are

$$L = \frac{1}{2} \rho C_L S V^2$$
$$D = \frac{1}{2} \rho C_D S V^2$$

where, for a particular airfoil, the lift and drag coefficients versus angle of attack α are given by

$$C_L = 4.47 \times 10^{-5} \alpha^3 + 1.15 \times 10^{-3} \alpha^2 + 6.66 \times 10^{-2} \alpha + 1.02 \times 10^{-1}$$

$$C_D = 5.75 \times 10^{-6} \alpha^3 + 5.09 \times 10^{-4} \alpha^2 + 1.81 \times 10^{-4} \alpha + 1.25 \times 10^{-2}$$

Using the first two equations, we see that the lift-to-drag ratio is given simply by the ratio C_L/C_D .

$$\frac{L}{D} = \frac{\frac{1}{2} \rho C_L S V^2}{\frac{1}{2} \rho C_D S V^2} = \frac{C_L}{C_D}$$

Plot L/D versus α for $-2^\circ \leq \alpha \leq 22^\circ$. Determine the angle of attack that maximizes L/D .

```
% Problem 2.44
clear
clc
disp('Problem 2.44: Scott Thomas')

v = linspace(0,220,100); %ft/sec
rho = 0.002378; %slug/ft^3
alpha = linspace(-2,22,100); %degrees
s = 36; %ft

format short e
CL = [4.47E-5 1.15E-3 6.66E-2 1.02E-1];

CD = [5.75E-6 5.09E-4 1.81E-4 1.25E-2];

LoverD = polyval(CL,alpha)./polyval(CD,alpha);

plot(alpha,LoverD,'r'),xlabel('Angle of attack alpha (degrees)'),...
      ylabel('Lift/Drag L/D'),grid;
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