Lance Tan
Homework 1

(1) angle of attack?

$\rho = 1.225\ kg\,m^{-3}$ $v = 61.7\ ms^{-1}$ chord length $= 0.457\ m$ lift distribution $= 934\ Nm^{-1}$

$LD = \frac{1}{2}\rho v^2 c_L (\text{chord length}) \rightarrow c_L = 0.875$

$\alpha = 26.7^\circ$ or $8.4^\circ$ //

(2) $\alpha = 26.7^\circ$, $C_D = 0.493$

$$\text{Drag Dist.} = \frac{1}{2}\rho v^2 C_D \text{ chord}$$
$$= \frac{1}{2}\cdot(1.225)(61.7)^2(0.493)(0.457)$$
$$= 526\ Nm^{-1}$$ //

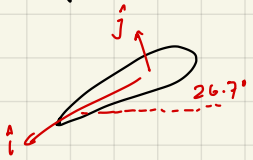
(3)

$\text{Magnitude} = \sqrt{934^2 + 526^2} = 1071\ Nm^{-1}$

$\vec{F} = -526\hat{i} + 934\hat{j}$

$$\begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}\begin{bmatrix} -526 \\ 934 \end{bmatrix} = \begin{bmatrix} -50.2 \\ 1070 \end{bmatrix}$$

Applying $\theta = 26.7^\circ$




$\vec{F} = -50.2\hat{i} + 1070\hat{j}$ //

(4) $\vec{v} = 61.7\hat{i} - 10.2\hat{j}$ $|\vec{v}| = 62.5\ ms^{-1}$

$LD = \frac{1}{2}(1.225)(62.5^2)(0.875)(0.457) = 957\ Nm^{-1}$ //

$DD = \frac{1}{2}(1.225)(62.5^2)(0.493)(0.457) = 539\ Nm^{-1}$ //

(5)

$$934 = \frac{1}{2} \cdot 1.225 \cdot 61.7^2 \cdot C_L \cdot 0.457 \cdot 1.20 \rightarrow C_L = 0.71$$

$$\alpha = 22.3^\circ \text{ or } 6.8^\circ$$ 4

The 20% increase in size would still render the data valid as it depends on the shape and not on scale. If stretched only in one direction, shape would change rendering the data invalid.