UCL Mechanical Engineering 2020/2021

MECH0011 Final Coursework

NCWT3

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1 Question 1

1.1 a

The data was imported into MATLAB and the shape of the hydrofoil, the chord line and the mean camber line were plotted for all four hydrofoils.

```
clc
clear
close all

%define vars
i = ["EPPLER 818 Hydrofoil", "NACA 63-412 Aifoil", "RG 8 Airfoil", "YS
    930 Hydrofoil"]; %index hydrofoils from sheets
data = zeros(122,2,4); %initialise matrix
counter = 0; %initialise counter
x = linspace(0,1,100); %interpolation range initialisation

%import data
for j = 1:4 %index all data for plots
    counter = counter + 1; %increment counter
    data(:,:,counter) = readmatrix('suppFiles.xlsx','Sheet',i(j),'Range',
        'A3:B124'); %loop through sheets and pull data
end

%camber line calculation
%pull positive and negative coordinate points
%eppler
dataPos1 = readmatrix('suppFiles.xlsx','Sheet',i(1),'Range','A3:B37');
dataNeg1 = readmatrix('suppFiles.xlsx','Sheet',i(1),'Range','A38:B70');
```

```
22
23 %naca
24 dataPos2 = readmatrix('suppFiles.xlsx','Sheet',i(2),'Range','A3:B28');
25 dataNeg2 = readmatrix('suppFiles.xlsx','Sheet',i(2),'Range','A29:B54');
26
27 %rg
28 dataPos3 = readmatrix('suppFiles.xlsx','Sheet',i(3),'Range','A3:B34');
29 dataNeg3 = readmatrix('suppFiles.xlsx','Sheet',i(3),'Range','A35:B64');
30
31 %ys
32 dataPos4 = readmatrix('suppFiles.xlsx','Sheet',i(4),'Range','A3:B65');
33 dataNeg4 = readmatrix('suppFiles.xlsx','Sheet',i(4),'Range','A66:B124');
34
35 %interpolate airfoil shape with 100 data points from 0 to 1
36 %eppler
37 dataIntPos1 = interp1(dataPos1(:,1), dataPos1(:,2), x);
38 dataIntNeg1 = interp1(dataNeg1(:,1), dataNeg1(:,2), x);
39
40 %naca
41 dataIntPos2 = interp1(dataPos2(:,1), dataPos2(:,2), x);
42 dataIntNeg2 = interp1(dataNeg2(:,1), dataNeg2(:,2), x);
43
44 %rg
45 dataIntPos3 = interp1(dataPos3(:,1), dataPos3(:,2), x);
46 dataIntNeg3 = interp1(dataNeg3(:,1), dataNeg3(:,2), x);
47
48 %ys
49 dataIntPos4 = interp1(dataPos4(:,1), dataPos4(:,2), x);
50 dataIntNeg4 = interp1(dataNeg4(:,1), dataNeg4(:,2), x);
51
52 %calculate camber line
53 %eppler
54 camber1 = (dataIntPos1 + dataIntNeg1)./2;
55
56 %naca
57 camber2 = (dataIntPos2 + dataIntNeg2)./2;
58
59 %rg
60 camber3 = (dataIntPos3 + dataIntNeg3)./2;
61
62 %ys
63 camber4 = (dataIntPos4 + dataIntNeg4)./2;
64
65 %plot data
66 subplot(4,1,1)
67 plot(data(:,1,1), data(:,2,1), x, camber1)
68 axis image
69 grid on
70 xlabel('Chord')
71 ylabel('Z(x)')
72 title('Plot of ' + i(1))
73 xlim([-0.05 1.05])
74 ylim([-0.05 0.1])
```

```
75 legend('Hydrofoil profile and chord line','Mean camber line')
76
77 subplot(4,1,2)
78 plot(data(:,1,2), data(:,2,2), x, camber2)
79 axis image
80 grid on
81 xlabel('Chord')
82 ylabel('Z(x)')
83 title('Plot of ' + i(2))
84 xlim([-0.05 1.05])
85 ylim([-0.05 0.1])
86 legend('Hydrofoil profile and chord line','Mean camber line')
87
88 subplot(4,1,3)
89 plot(data(:,1,3), data(:,2,3), x, camber3)
90 axis image
91 grid on
92 xlabel('Chord')
93 ylabel('Z(x)')
94 title('Plot of ' + i(3))
95 xlim([-0.05 1.05])
96 ylim([-0.05 0.1])
97 legend('Hydrofoil profile and chord line','Mean camber line')
98
99 subplot(4,1,4)
100 plot(data(:,1,4), data(:,2,4), x, camber4)
101 axis image
102 grid on
103 xlabel('Chord')
104 ylabel('Z(x)')
105 title('Plot of ' + i(4))
106 xlim([-0.05 1.05])
107 ylim([-0.05 0.1])
108 legend('Hydrofoil profile and chord line','Mean camber line')
```

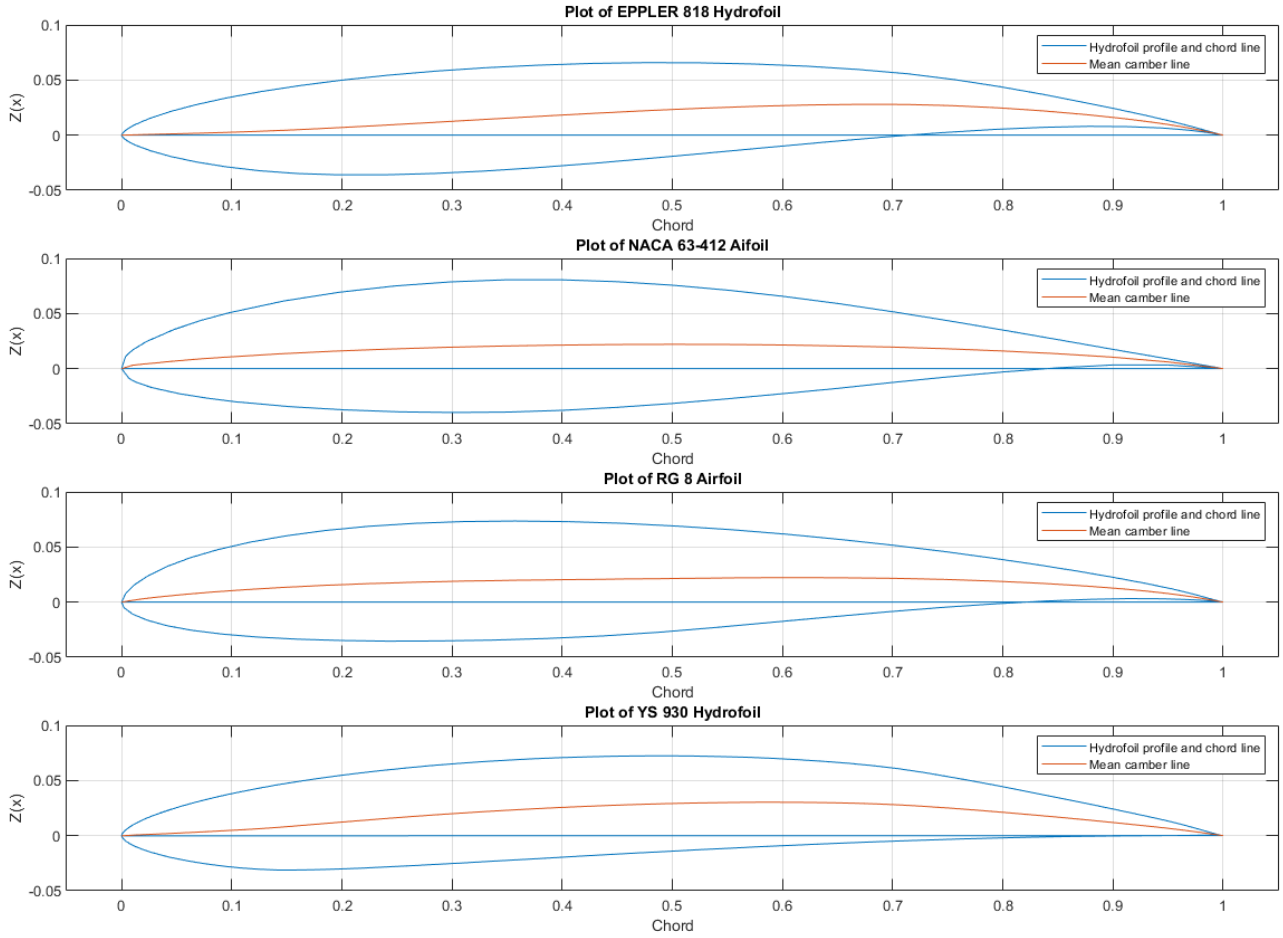

Figure 1: Graphs to show hydrofoil shape, chord line and mean camber line for four different hydrofoils.

1.2 b