Section 3 Problem

In this problem, you will make a publication-quality plot commonly found in the transonic aerodynamic shape optimization literature. You will plot pressure coefficient variation (C_p) along the surface of the airfoil as well as the airfoil profile on the same plot for both the initial and optimized airfoil configurations.

The file `pressure_displacement_profiles.mat` contains the airfoil profile and C_p distribution over the airfoil. This file contains two variabes, initial and optimal, which each have three fields: `x, cp, disp` which are vectors defining the x coordinates, C_p profile, and shape profile, respectively.

The code in Task 1 shows how to load and plot the pressure coefficient and shape.

Task 1

Run the starter code and observe what it produces.

```
% Plot profiles
load pressure_displacement_profiles

% Plot initial -Cp and shape
fig1=figure;
plot(initial.x,-initial.cp,'b-'); hold on;
plot(initial.x,initial.disp,'k-');
legend('cp','disp');

% Plot optimal -Cp and shape
fig2=figure;
plot(optimal.x,-optimal.cp,'b-'); hold on;
plot(optimal.x,optimal.disp,'k-');
legend('cp','disp');

% Save to eps
print(fig1,'-depsc2','Hwk1Prob3_starter1');
print(fig2,'-depsc2','Hwk1Prob3_starter2');
```

Task 2

Modify the starter code to generate everything in the same plot.

Several points to keep in mind:

- Plot the negative of C_p instead of C_p to generate the plots.
- Use solid lines for the initial C_p and shape profiles and dotted (not dashed) for the optimal C_p and shape profiles.
- All lines should be thick (at least linewidth of 2).
- Generate a legend with the entries "Initial (C_p)", "Initial (Shape)","Optimal (C_p)", "Optimal (Shape)".
- Use the y-tick labels for "$-C_p$" from -1.2 to 1 with 0.2 spacing on the left hand side.
- Use the y-tick labels for "Distance transverse to airfoil" from -0.1 to 0.6 with 0.1 spacing on the right hand side.
- Label x as "Distance along airfoil"

- Write all labels with LATEX interpreter.

Checkpoint

Please answer the following questions and put the answers in the EdX page:

(A) Which is the correct description of the figure from Task 1?

1. The left plot shows the coefficents only, while the right plot shows the profiles only.

2. The left plot shows the initial configuration only, while the right plot shows the optimal configuration only.

(B) Which plotting function would be best to create the described plot in Task 2?

(C) Which graphics handle should be modified to increase the linewidth of the curves?

(D) Which graphics handle should be modified to label x as "Distance along airfoil" with the LATEX interpreter?

(E) Which property should be modified in Task 2 so that it has correct spacing for "Distance transverse to airfoil" axis? Type in the proper name.

(F) Which graphics handle should be modified to save the plot in the same format as seen in the MATLAB?

(G) Name the function from the MATLAB File Exchange that will fix the dashed lines when the figure is saved to file.

(H) From the plot in Task 2, which configuration has a bigger cross-section area of the airfoil? Initial or optimal?