# 2.23 Hydrofoils & Propellers
# Homework Assignment #4

Assigned: Monday Mar. 19, 2007
Due: Friday Apr. 6, 2007

1) A two-dimensional section has a parabolic mean line with fmax/C = 0.08 and an angle of attack $\alpha$= ideal angle of attack. Assume rho = 1000 kg/m3 , Chord = 0.5m and Uo=10 m/s

   a) Find the Lift on the section
   b) Find the moment about the leading edge of the foil x/C=-0.5 ( $M(x) = \rho U_o \int_x \gamma(x)dx$)
   c) Find the location of the center of Lift ( place about which moment = 0)

2) A two-dimensional section has a parabolic mean line, and is to develop a lift coefficient of Cl=0.25 at its ideal angle of attack. The foil runs at a cavitation number $\sigma$= 0.6.

   a) Find the camber height to achieve this lift coef. (at ideal angle of attack).
   b) Plot the pressure coefficient on the upper and lower surface (Plot –Cp vs x/C) .
   c) Find the maximum angle of attack before the foil cavitates at the quarter-chord point (x = -c/4)

3) Given a 2D foil geometry defined as follows:
   i. $f(x)/c = 0.3\,(x/c)^3 - 0.12(x/c)^2 - 0.18(x/c)$
   ii. Angle of attack = 2 degrees
   iii. Elliptical thickness form w/ to/c = 0.02 (note: leading edge radius for elliptical thickness is given by $Rl=0.5((to/c)^2)$)

   Find the following assuming linear foil theory(given x=0 is midchord, -c/2 is leading edge, c/2 is the trailing edge:

   a) Lift Coefficient Cl

   b) Ideal angle of attack

   c) u/U on the upper surface at x=0 (midchord)

   d) q/U at the leading edge (using Lighthill correction)

4) Using linearized 2D foil theory for a foil with the following geometry:

i. Parabolic meanline fo/c=0.07
ii. Angle of attack = 3 degrees
iii. Elliptical Thickness to/c = 0.04

a). Find the Lift coefficient and the value of $\Upsilon(x)$ at x/c=0.25

b) Plot CPmin vs x/C and find the location and value of Cpmin on this foil