

40 POINTS

HOMEWORK 4

DUE: 2/11/15

Please save your submission as HW04\_[your last name].ipynb (for example, HW04\_Smith.ipynb) and email it to the instructor or send a link to it on GitHub.

1. (15 points)

a. (10 points) Derive the formula for the radius of the circle generated by a doublet with strength  $\kappa$  in a uniform flow with velocity  $U_\infty$ .

b. (5 points) Show that this formula holds by plotting the flow around a unit circle in a unit velocity uniform flow.

2. (25 points)

a. (10 points) Derive the following formula for the coefficient of pressure on the surface of a circle (doublet + free stream):

$$C_p = 1 - 4\sin^2 \theta$$

b. (10 points) Using a polar grid, as opposed to the Cartesian grids we have been using, plot the filled coefficient of pressure contours around a unit circle in a unit free stream, i.e. create a plot similar to the one shown in Figure 1 but on a polar grid and for a unit circle.

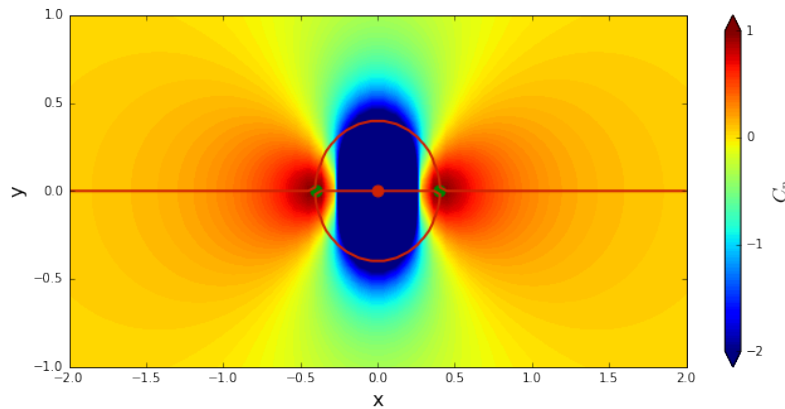


Figure 1

b. (5 points) From your grid in part b, extract the pressure coefficients on the surface of the circle. Plot these alongside the theoretical result from part a for the range  $\theta \in [-\pi, \pi]$ .