

50 POINTS

HOMEWORK 11

DUE: 4/14/16

Please save your submission as HW11_[your last name].ipynb (for example, HW11_Smith.ipynb) and email it to the instructor or send a link to it on GitHub.

1. (50 points) Solve for the flow around a NACA 2510 airfoil at $\alpha = 2^\circ$, and plot the pressure coefficient as a function of the x-coordinate, comparing the theoretical solution (found using the complex potential and the Joukowski transformation) to your panel method.

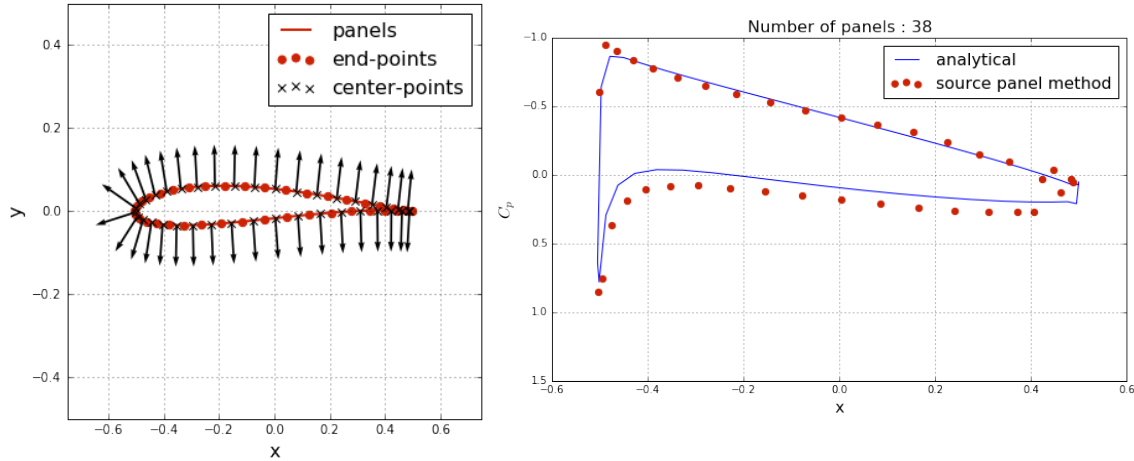


Figure 1

Because of numerical issues due to the linear system being nearly singular, I have found the following adjustments to be helpful in increasing the accuracy of the solution:

- a. Multiply the diagonal entries of A by 1.001 before solving for the unknown doublet strengths. This helps with the fact that the formula for induced velocity of a panel on itself comes from an indeterminate integral.
- b. Merge the first two panels together and the last two panels together (these are at the trailing edge of the airfoil). The Joukowski transformation makes these panels very small, so their corresponding rows of the A matrix are very similar (almost linearly dependent).