

FLUENT - Flow over an Airfoil- Problem 1

Problem Specification

1. Create Geometry in GAMBIT
2. Mesh Geometry in GAMBIT
3. Specify Boundary Types in GAMBIT
4. Set Up Problem in FLUENT
5. Solve!
6. Analyze Results
7. Refine Mesh

Problem 1

Problem 2

Problem 1

Consider the *incompressible, inviscid* airfoil calculation in *FLUENT* presented in class. Recall that the angle of attack, α , was 5° .

Repeat the calculation for the airfoil for $\alpha = 0^\circ$ and $\alpha = 10^\circ$. Save your calculation for each angle of attack as a different case file.

(a) Graph the pressure coefficient (C_p) distribution along the airfoil surface at $\alpha = 5^\circ$ and $\alpha = 10^\circ$ in the manner discussed in class (i.e., follow the aeronautical convention of letting C_p decrease with increasing ordinate (y -axis) values).

What change do you see in the C_p distribution on the upper and lower surfaces as you increase the angle of attack?

Which part of the airfoil surface contributes most to the increase in lift with increasing α ?

Hint: The area under the C_p vs. x curve is approximately equal to C_L .

(b) Make a table of C_L and C_D values obtained for $\alpha = 0^\circ, 5^\circ$, and 10° . Plot C_L vs. α for the three values of α . Make a linear least-squares fit of this data and obtain the slope. Compare your result to that obtained from inviscid, thin-airfoil theory:

$$\frac{dC_L}{d\alpha} = \frac{2\pi^2}{180},$$

where α is in degrees.

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