



**AE 262 – Advanced Aerodynamics**

**Course Learning Objectives:** Students completing the course will be able to:

- Use thin airfoil analysis to calculate the lift and pitching moment for a flapped airfoil.
- Use the source panel method to calculate the coefficient of pressure around a cylinder.
- Use Prandtl lifting line theory to calculate the lift distribution of a wing.
- Use computer programs implementing these panel methods to compare the accuracy of different methods and the effect of changing the number of panels.
- Calculate the aerodynamic characteristics of low aspect ratio wings at high angles of attack using the R.T. Jones (attached flow), Brown & Michael (single line vortex), Pohlhamus (leading edge suction analogy), and Smith (rolled-up core) models.
- Predict laminar and turbulent boundary layer separation on airfoils and nozzles using the Stratford criteria
- Calculate the flow characteristics of laminar boundary layers on flat surfaces using the Blasius solution.
- Calculate the flow characteristics of laminar boundary layers on curved surfaces using the Falkner-Skan solution.
- Apply appropriate panel spacing to airfoils for XFOIL analysis.
- Use XFOIL for both inviscid and viscous analyses of airfoils.
- Use XFOIL for detailed analysis of boundary layers.
- Use XFOIL to modify airfoil geometry.
- Create aircraft geometry files for AVL.
- Use AVL to find the wing lift distribution and total aircraft induced drag.
- Interpret the Trefftz plane plot for AVL.
- Use AVL to analyze the stability modes of a given configuration.

**Approximate Weekly Schedule**

Week	Topics
1	Introduction, Source panels
2	Thin airfoil theory
3	Panel methods
4	Panel methods
5	Vortex lattice
6	AVL
7	AVL
8	Boundary layers

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<b>Week</b>	<b>Topics</b>
9	Boundary layers
10	XFOIL
11	XFOIL
12	High AoA
13	High AoA
14	Projects
15	Projects
16	Project presentations
Final Exam	Project reports due

**Grading:** 10% Attendance  
 10% Quizzes  
 20% Workouts  
 20% Homework  
 20% Program  
 20% Project

Standard grading scale except A+ grades are reserved for those students who demonstrate exceptional mastery of the course material and/or go beyond the material covered in class.

**Late Assignments:** Late assignments will not be accepted! As long as the assignment was originally submitted on time, students may correct their work and resubmit the assignment again at any time for re-grading without penalty. The purpose of this policy is to reward students who fix their mistakes, but not to reward students who do not do the assignment until after the solution has been posted.

**AE 262 – Advanced Aerodynamics****Program:**

To earn an A- or better in the class, students will have to write their own airfoil analysis program from scratch using the vortex panel method and submit it by the required deadline. Students who work together will have their program grade modified by the formula:  $\frac{5-n}{4} \times \text{grade}$  where  $n$  is the number of students. This results in the following:

Number of students working together	Grade modification
1	100%
2	75%
3	50%

Students who work together are expected to submit their program together. Any programs submitted separately that contain similar code will be graded as if the students worked together and the above formula will be applied. Any programs that contain code that is very similar to vortex panel method codes available online will either not be graded or will be severely penalized.

In short, if you submit a program, I expect you to create it from scratch using only the materials from class as a reference (not by searching for examples online), and with minimal help from other students.

**Project:**

Students will have the entire semester to do a project related to the material covered in the course. The project requirements are deliberately very open so that students have ample freedom to pursue their interests. Students may either work independently or in a group of up to 3 students. Larger groups must do more work than smaller groups or individuals. Groups must submit a description of how work was divided among the group members. A formal project proposal is not required, but students must discuss their idea with the instructor and get their project approved. Students will give a 10 minute presentation on their project on the final day of class. A written report will be due before the end of the semester.