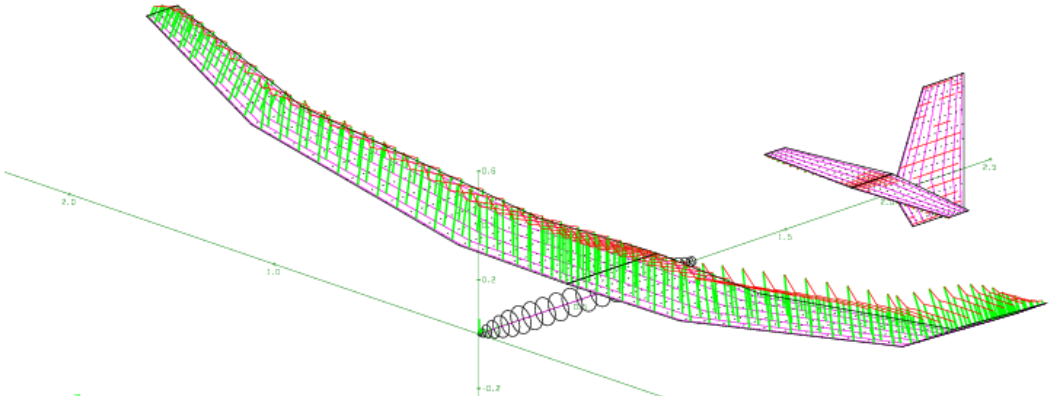
AE 262 – Advanced Aerodynamics



Term	Fall 2021
Instructor Info	Professor Sean Montgomery sean.montgomery@sjsu.edu or sean5montgomery@gmail.com Office Hours: After class, Thursdays 3:00 to 4:00 pm, or by appointment
Credit	3 units
Class Time	Mondays and Wednesdays 7:30 pm – 8:45 pm
Final Exam	Project in place of final exam. Project presentations Wednesday, December 8th 7:45 pm to 10:00 pm
Classroom	Online
Prerequisites	"C-" or better in AE162 or equivalent
Textbook	Fundamentals of Aerodynamics by John D. Anderson, 6th ed. (5th ed. also works)
Course Website	SJSU Canvas <http://www.sjsu.edu/at/ec/canvas/>

Course Description: Thin airfoil theory, source and vortex panel methods, Prandtl lifting line theory, vortex lattice method, high angle of attack flow over a wing, and boundary layer analysis using the Stratford criteria, Blasius solution, and Falkner-Skan solution.

Course Goals: Students will learn the theory behind panel methods and how to use programs that implement these methods. Students will also learn methods to study high angle of attack aerodynamics and advanced boundary layer analysis.

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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.

Grading: 10% Theory Summaries
10% Quizzes
20% Workouts
20% Homework
20% Airfoil Analysis 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.

Theory Summaries: The theories underlying the methods used in this class can be abstract and complex. Students will write summaries of these theories in their own words to demonstrate they understand the material.

Quizzes: Short quizzes will occasionally be given with notice ahead of time.

Workouts: Example problems and solutions will be given in class. Students will often have to complete these assignments at home. Workouts include both calculation problems and problems that use software (XFOIL, AVL).

Homework: Homework problems are usually similar to workout problems and are more involved and require more time.

Late Assignments: Late assignments will not be accepted since homework solutions are posted after the due date. 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.

Airfoil Analysis Program:
Students will work **in pairs** to write their own airfoil analysis program from scratch using the vortex panel method and submit it by the required deadline. Students will have to explain and demonstrate their program to the class.

Each submitted program must be clearly unique and a result of each team's efforts separate from the rest of the class. 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 other words, don't copy other students' programs or from online. You are expected to create your own program from scratch using only the reference materials from class, and with minimal help from other students.

Project:
Students must complete 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 pairs. Team projects must do more work than individual projects. Projects must be approved by the instructor. Teams must submit a description of how work was divided among the group members. 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.

Fall 2021 Online

Zoom
Class will meet online via Zoom. You can find the links to join these meetings under the "Zoom" section on Canvas. They are also posted on the Calendar.

Technology Requirements
Students are required to have an electronic device (laptop, desktop or tablet) with a camera and built-in microphone. SJSU has a free equipment loan program available for students. Students are responsible for ensuring that they have access to reliable Wi-Fi during tests and quizzes. See Learn Anywhere website for current Wi-Fi options on campus.

Connection Issues
If you experience connection issues with the Zoom class session, attempt to rejoin. If you are unable to resolve the issues, you may watch the recording of the class to see what you missed.

Zoom Classroom Etiquette

- Mute Your Microphone: To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.
- Be Mindful of Background Noise and Distractions: Find a quiet place to "attend" class, to the greatest extent possible.
    - Avoid video setups where people may be walking behind you, people talking/making noise, etc.
    - Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- Position Your Camera Properly: Be sure your webcam is in a stable position and focused at eye level.
- Limit Your Distractions/Avoid Multitasking: You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- Use Appropriate Virtual Backgrounds: If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive or demeaning.

Recording Zoom Classes
This course or portions of this course (i.e., lectures, discussions, student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will be deleted at the end of the semester. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off identifying information from the Zoom session, including student name and picture, prior to recording).

Students are not allowed to record without instructor permission Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy (S12-7) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

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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
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