AEM 313 Aerodynamics I
Fall 2017
Time: MWF 11:00 - 11:50 am
Location: Lloyd 132

Objectives: Introduction to subsonic aerodynamics, including properties of the atmosphere; aerodynamic characteristics of airfoils, wings, and other components; lift and drag phenomena; and topics of current interest.

Professor: Dr. Charles O'Neill, AEM, 222 Hardaway
Email: croneill@eng.ua.edu Phone: (205) 348-5161

Office Hours: Open door policy or by appointment.

Class Website: http://charles-oneill.com/aem313/

Required Book: *Aerodynamics for Engineers*, Bertin and Cummings, Pearson, 6th ed, 2014,
ISBN-13 978-0-13-283288-5

Prerequisites: AEM 311 and AEM 264

Goals:

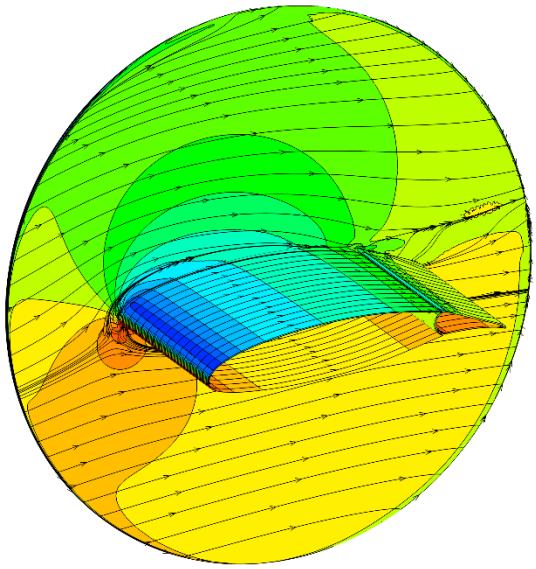
By the end of the course, students should be able to:

- Understand aerodynamics terminology and nomenclature.
- Determine aerodynamic forces and moments over airfoils based on pressure and shear stress distributions,
- Apply control volume techniques to estimate external forces.
- Apply potential flow theory to basic two dimensional shapes to determine the velocity field, surface pressure and resultant force.
- Apply thin-airfoil and lifting-line theory to estimate airfoil and wing characteristics.
- Calculate and assess the characteristics of laminar and turbulent boundary layers, and
- Understand the limits of incompressible flow theory and apply subsonic compressible flow corrections when necessary.

Topics:

We will cover subsonic and transonic topics in the textbook. Selected topics and sources supplement the text.

- Conservation Equations
- Similarity Parameters
- Flow Kinematics
- Euler and Bernoulli Equation
- Velocity Potential and Stream Function
- Elementary Potential Flows
- Laminar and Turbulent Boundary Layers
- Airfoil and Wing Geometry
- Thin Airfoil Theory
- Lifting Line Theory
- Lift, Drag and Pitching Moment
- Low-Re and High-Alpha Effects
- Subsonic Compressible Flow
- Transonic and Supercritical Airfoils
- Aircraft Aerodynamic Design Project



Additional Resources and References:

You may wish to consult or browse the following resources for additional insight into aerodynamics. These are completely optional.

- *Fluid Dynamic Lift* and *Fluid Dynamic Drag*, Hoerner. 1960s. (available in the library)
- *Fundamentals of Aerodynamics*, John Anderson, McGraw-Hill. Any edition.
- *Aerodynamics for Engineers*, Bertin and Smith.
- *Theory of Wing Sections,* Abbott and von Doenhoff.
- *XFOIL and AVL (subsonic airfoil and aircraft design),* Drela, MIT. (free)

Grades:
Your final score is the sum of 3 exams and 2 projects for a total of 500 pts. $Score = Exams + Projects$
The guaranteed-maximum letter grade cutoffs are:

Grade	Score
A+	97
A	93
A-	90

Grade	Score
B+	87
B	83
B-	80

Grade	Score
C+	77
C	73
C-	70

Grade	Score
D+	67
D	63
D-	60

Additionally, your time rate of change will be tracked. Consistent improvement **always** increases your grade.

Homework Policy:
You are strongly encouraged to solve the assigned homework. Reference solutions will be posted. You are responsible for ensuring that your solution matches the posted solution; you are encouraged to discuss your solutions during class or during office hours. Homework is not collected or graded.

Exam and Assignment Schedule:

- Two equally weighted [100 pt] midterm exams (tentative: 5th week, 10th week)
- One [100 pt] final exam (16th week)
- One computational simulation project [100 pts total]
- One aircraft design and flight test project [100 pts total]

Attendance Policy:
Students are strongly encouraged to participate in class. Please interrupt the lecture to ask questions. Formal attendance records are never kept.

Missed/Late Coursework Policy:
Late work is graded at a step discount of 10% per day. Inform me ASAP if your job (e.g. military, industry, off-campus research, etc.) has unpredictable schedules or out-of-contact duties. I **will** work with you.

Additional University Policies:
For a comprehensive list of University policies (e.g. Disability, Severe Weather, etc.), visit the AEM 313 page at http://syllabi.ua.edu

Syllabus Modifications:
Every feasible effort will be taken to follow this syllabus. In the event of changes or corrections, I will consult with the class and notify the entire class immediately via email or a written document.