AEROSP-527 Unsteady Aerodynamics and Aeroacoustics

3 Credits, Winter 2016, TuThu 1:30-3:00pm, FXB 1012

Instructor:

Karthik Duraisamy, FXB 3009, kdur@umich.edu

Office hours: Tue 10:00am-11:30pm, Thu 11:30am-1:00pm.

Other hours: By appointment.

Course Text:

No text book is required. Handouts will be provided to supplement in-class teaching. Additional reading material and homework will be posted on CTOOLS.

Reference Texts:

1. Low-Speed Aerodynamics, J. Katz & A. Plotkin, Cambridge Aerospace Series, 2001.
2. Principles of Ideal-Fluid Aerodynamics, K. Karamcheti, Krieger Pub, 1980.
3. Fundamentals of Acoustics, M. Bruneau, Wiley, 2013.

Course goals:

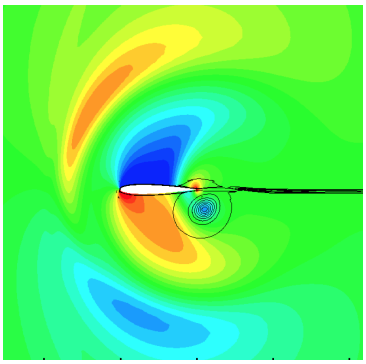
1). Learn the fundamental physical principles of vortex dynamics, unsteady flows and flow-generated sound.

2). Analyze, using theoretical and (simple) numerical methods, practical unsteady flow and noise problems.

3). Gain an understanding of the state-of-the-art in aerodynamics and aeroacoustics research.

Pre-requisites:

Aerodynamics, good level of comfort with calculus, computer programming skills & consent of instructor.



Course contents:

Review:

Fluid flow equations
Potential flow
Vortex dynamics
Thin airfoil theory

Unsteady Aerodynamics:

Unsteady potential flow
Unsteady thin airfoil theory
Indicial response method for imposed motions and gusts
Unsteady compressible flow
Modern computational aerodynamics
Applications in helicopter flight, flapping wings, wind turbines, etc.

Aeroacoustics:

Introduction to physical acoustics
Wave propagation phenomena
Sound generation in quiescent media
Acoustic analogies
Sound generation by moving bodies and turbulence
Aeroacoustics in practice
Applications in combustion noise, helicopter/propeller rotors, jet noise, etc.

Grading:

Homeworks/Projects : 60 %,
Written Mid Term : 20 %,
Oral Final Exam : 20 %