

ENME483/656
Physics of Turbulent Flow
Spring 2020

Last updated: September 19, 2019

Course objectives

Turbulent fluid flow is everywhere in engineering, including in the flow around airplanes, cars, and ships; the flow around wind or hydro power turbines; the flow in internal combustion and gas turbine engines; the flow in the atmosphere; and many other cases.

Students are assumed to have taken an introductory course in fluid mechanics (e.g., ENME331). Based on this, the course will introduce the notion of turbulence and why it is so important in a wide range of engineering disciplines. The course will cover turbulence in a general way with a fundamental focus, but with specific appeals to boundary layer flows (airfoils, wind turbines, fans, ships, atmospheric boundary layer, etc) as a very important class of turbulent flows.

Assignments will require both pen-and-paper problem solving and Matlab coding to process realistic turbulence data sets.

Instructor

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Textbook

Students will need a textbook covering the fundamentals of turbulence. Suggested books include:

Turbulent flows by Pope.

Turbulent flow: analysis, measurement and prediction by Bernard and Wallace.

Topics

- What is turbulence? Why is it important?
- Statistical treatment of turbulence; governing equations for the mean flow and the turbulence.
- Channel and pipe flow; the log-law; production, transport and dissipation of turbulence.
- Boundary layers.
- Airfoils and wind turbines.
- Turbulence modeling.

