Computational Fluid Dynamics
(ME EN 6720) Spring 2016

Lecture Topics*

Chapter 0: Motivation

Chapter 1: Review of basic concepts of fluid flow. (Conservation principles of mass, momentum, and scalars in integral and differential form. Dimensionless form of the equations. Simplified versions of the equations.)

Chapter 2: Introduction to Numerical Methods. (What is CFD? Possibilities and limitations of numerical methods. Steps to reach a numerical solution. Discretization approaches: Finite Differences, Spectral Methods, Finite Volume, Finite Element.)

Chapter 3: Finite Difference Methods (Introduction. Approximation to the first, second and mixed derivatives. Implementation of the boundary conditions. Resolution of the equivalent algebraic equations. Errors.)

Chapter 4: Spectral Methods (Polynomial approximation. Burgers Equation. Strong and weak formulation of differential equations. Spectral approximation of the Burgers equation. Convolution Sums and aliasing issues.)

Chapter 5: Finite Volume Methods (Introduction. Approximation of surface and volume integrals. Interpolation and differentiation practices. Boundary conditions. Resolution of the equivalent equation system.)

Chapter 6: Solution of linear equations and methods to resolve unsteady problems (Direct Methods, Iterative Methods)

Chapter 7: Numerical solution of the Navier-Stokes equations.

Chapter 8: Turbulent Flows (DNS, LES and RANS models)

* *The list of topics here introduced represents a broad overview of the material this course intends to cover. However, the instructor reserves the right to modify and alter the coverage of these topics in accordance to the progress of the class and the predominant interests of the class participants.*