DEPARTMENT OF ENGINEERING

UNIVERSITY OF CAMBRIDGE

Module 5R10:

Turbulent Reacting Flows

Leader: Professor Epaminondas Mastorakos & Professor Stewart Cant

Timing: Michaelmas Term

Prerequisites: None

Structure: 8 two-hour lectures, one per week

Mode of Assessment: Coursework

AIMS

Turbulent reacting flows are present in power generation, in the atmospheric dispersion of pollutants, and in chemical engineering. The course will emphasize the main theoretical difficulties involved in describing turbulent flows with reactions and the present state of our knowledge of this topic will be described with reference to practical applications. Topics include: governing equations and the problem of the chemical source term; moment methods; probability density function approaches; models for turbulent premixed and non-premixed combustion; numerical methods for turbulent reacting flows.

TOPICS

Basic concepts and the closure problem:
- Governing equations
- Main applications

Some basic features of turbulence:
- The “turbulence syndrome”
- Correlations, spectra, PDFs
- Turbulent mixing (phenomenology, PDFs, scalar dissipation rate)

Turbulent flows with non-premixed reactants:
- Conserved scalars
- Moment, flamelet, CMC, PDF methods
- Applications

Turbulent flows with premixed reactants:
- Premixed flames, Borghi diagram
- BML, G-equation, surface density methods
- Applications

Numerical methods
- RANS, LES, DNS, commercial codes
- Stiff systems

COURSEWORK

A 5000-word report on a project based on experimental or numerical work or comprising a literature review.