Engineer the physical basis of turbulence as well as its practical implications for engineers; turbulence is a common feature of fluid flows in the atmosphere and the ocean, in aerodynamics and in chemically-reacting flows such as combustion.

- introduce the basic rules of vortex dynamics, which is identified as controlling energy transfers between different scales in a turbulent flow.

Aims

The aims of the course are to:

- be aware of the turbulent nature of most flows of interest to engineers and its influence on the transfer processes involving momentum, heat and mass.
- understand energy transfer between mean flow and turbulent fluctuations (Reynolds stresses).
- understand energy transfer between the different scales of turbulence and the mechanism of dissipation.
- be aware of the more common phenomenological models of turbulence currently used by engineers and of their underlying assumptions and limitations.
• Basic concepts in turbulence theory: Order from chaos - Reynolds decomposition and Reynolds equation. Kinetic energy - Production and Dissipation. Introduction to the different scales in Turbulence, from the integral scale to Kolmogorov's micro-scale. Wall-bounded shear flows. Vortex dynamics at work at the large and small scales (worms).
• Phenomenological models of turbulence: Prandlt's Mixing length and k - e model: their assumptions and limitations. Other models. What can be expected from these turbulence models in terms of velocity and heat transfer.
• Current trends in industrial fluid mechanics.

Booklists

Please see the Booklist for Group A Courses [2] for references for this module.

Examination Guidelines

Please refer to Form & conduct of the examinations [3].

UK-SPEC

The UK Standard for Professional Engineering Competence (UK-SPEC) [4] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the 'Accreditation of Higher Education Programmes' (AHEP) document [5] which sets out the standard for degree accreditation.

The Output Standards Matrices [6] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

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Links
[1] mailto:pad3@cam.ac.uk