AE250 Aug 3:0

Advanced combustion

Instructor

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Department: Aerospace Engineering

Course Time: T-Th, 11:30-1:00

Lecture venue:

Detailed Course Page:

Announcements

Brief description of the course

The course aims to expose students to aspects of chemical kinetics of fuels relevant to combustion systems, the influence of flame stretch and the significance of Karlovitz number and an introduction to a special topic of the students choice like combustion dynamics, turbulent combustion etc.

Prerequisites

Any preliminary course in combustion that exposes students to fundamental concepts in chemical thermodynamics and 1D premixed and non-premixed combustion.

Syllabus

Introduction; review of chemical equilibrium, heat of combustion, adiabatic flame temperature, kinetics. Review of Reynolds transport theorem and conservation equations. Non-premixed flames: mixture fraction, coupling functions. Burke Schumann flame and droplet combustion. Premixed flames: Thermodynamical considerations - Rankine Hugoniot relations: deflagration and detonation, flame speed and thickness phenomenology. Adiabatic flame speed and flame speed with heat loss. Flame stretch, flame speed with stretch, experimental techniques to determine laminar flame speed. Chemical structure of a premixed flame.

Introduction to Turbulent Combustion: RANS equations, Favre averaging, length scales, energy spectra, mixing, intermittency. Turbulent Premixed Flames: Regime Diagrams, Turbulent flame speed. Turbulent Non-Premixed Flames: Mixing, scalar dissipation rates, extinction. Introduction to Combustion Instabilities.

Course outcomes

The course involves take home assignments constructed around the open source CANTERA tool which will train students to perform the sort of analysis routinely used in industry to support design and developments of combustion systems. This course would be useful to anyone looking for a career in research or in industry around combustion and related topics

Grading policy

50% 2-3 take home projects 50 % for final

Assignments

Resources