COMBUSTION POUR LA PROPULSION

COMBUSTION

Lecturers: Alexis GIAUQUE

| Lecturers : 16.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : AN

Objectives

Combustion is a phenomenon that transforms the chemical potential energy contained in the fuel into thermal energy. The objective of this course is to understand the phenomena of combustion. A particularly targeted point of application concerns aeronautical turbojets. We will see what are the essential kinetic mechanisms of combustion, we will try to understand the physics of premix and diffusion flames, and how to stabilize these flames. We will focus on the turbulent regimes of these flames. Then we will discuss the acoustics in the aeronautical chambers. We will also study the physics of combustion of sprays. The simulation in the aeronautical chambers is the final goal.

Keywords : Combustion, Fluid Mechanics and Transfers, Explosions, Turbulent Mixing, Sprays, Chemical Kinetics, Energetics

Programme

1. Introduction to aeronautical combustion
2. Essential kinetic mechanisms of combustion and the formation of polluting emissions
3. 0-D approach - perfectly and partially premixed reactors (PSR and PaSR) - transport / chemistry interaction, turbulent mixing / chemistry
4. Propagation of laminar and turbulent premix flames
5. Laminar and turbulent diffusion flames, flame stabilization
6. Formation, dynamics, combustion of sprays, models and experimental observation
7. Linear acoustics in combustion chambers, instabilities in combustion
8. Numerical modeling of combustion for an aeronautical engineer.

Learning outcomes

- Know how to use mass and energy balances in practical reactive cases
- Know how to express (i) the kinetic terms in the local fluid mechanics balance equations, and (ii) the applicable simplifying assumptions
- Know the peculiarities of turbulent, diffusion and premixing flames
- Know how to analyze the stability of a turbulent flame in a turbojet

Independent study

Objectifs : Several Numerical Design Sessions (BE) will be given and involve a part of group work and autonomy.

Méhodes :

Core texts

R. Borghi et M. destriau, *LA COMBUSTION ET LES FLAMMES*, Editions Technip, 1995
K.K. Kuo *PRINCIPLES OF COMBUSTION*, Wiley-Interscience Publication, 2005
C K. Law*COMBUSTION PHYSICS*, Cambridge University Press, 2006

Assessment

Final mark = 50% Knowledge + 50% Know-how
Knowledge = 100% Final exam
Know-how = 100% continuous assessment