ECOULEMENTS SUPERSONIQUES

SUPERSONIC FLOW

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| Lecturers : 16.0 | TC : 16.0 | PW : 2.0 | Autonomy : 10.0 | Study : 4 | Project : 0.0 | Language : FR

Objectives

This course is devoted to high velocity compressible flows and to the study of pressure waves, expansion waves and shock waves. It is an extension of the core course Fluids and Energy and aims at deepening the knowledge in gas dynamics. Applications mainly concern external aerodynamics around high speed vehicles.

Keywords : Compressible flow, Supersonic flow, Shock waves, Expansion waves

Programme

-Introduction.
- Conservation laws.
- Quasi-one-dimensional flows.
- Normal shock waves.
- Two-dimensional flows.
- Oblique shock waves and expansion waves.
- Interactions and unsteady waves.
- Linearized flows.

Learning outcomes

- Determine the behavior of a compressible fluid subjected to thermal or mechanical stresses.
- Design a convergent-divergent nozzle under different downstream conditions.
- Determine the flow structures developing around an obstacle in a supersonic flow.
- Perform a comparative and critical analysis of experimental, numerical and analytical results.

Independent study

Objectifs : Apply the theoretical concepts of the course and compare analytical, numerical and experimental results.

Méhodes : Method 1: design a ramjet and perform a parametric study of its performance.
Method 2: analyze and compare the supersonic flow structures around a diamond profile (test performed in a supersonic wind tunnel).

Core texts

J. D. Anderson, *MODERN COMPRESSIBLE FLOW*, McGraw Hill, 2021
A. H. Shapiro *THE DYNAMICS AND THERMODYNAMICS OF COMPRESSIBLE FLUID FLOW*, Ronald Press Company, 1953

Assessment

Final mark = 0.65*Knowledge + 0.35*Know-how
Knowledge = final exam
Know-how = continuous assessment