Advanced Gas Dynamics - Video course

COURSE OUTLINE

This course introduces the concepts of the primary differences between an incompressible flow and compressible flow. It draws the connection between compressible flow and speed of sound, Mach Number and thermodynamics. It then builds on the governing equations to derive the commonly known equations and tackles both 2D and 3D problems.

The physical concept of shocks and the resulting changes in the thermodynamic properties of a fluid form a major part of this course. The course concentrates primarily on the understanding of the physical concepts of compressible flow and keeps reference to various numerical methods for solving the governing equations to a minimum.

Contents:

- Introduction:Governing equations of compressible flow.
- 1 D Flow: Introduction - Normal Shock Relations - Hugoniot Equations.
- Oblique Shocks - Supersonic flow over wedges and cones - Interaction of shocks of opposite families - Intersection of shocks of same family.
- 3D Shock Waves - Prandtl-Meyer Expansion waves - Shock expansion theory - Crocco's Theorem.
- Linearized Flow - Linearized velocity potential equation - Linearized pressure coefficient - Linearized Subsonic flow - Improved compressibility corrections - Linearized supersonic flow - Critical Mach Number.
- Unsteady wave motion - Moving normal shock wave - Reflected shock waves - Incident and reflected expansion waves - Shock tube relations - Finite compression waves.
- Method of Characteristics.
- 3D flow - Cones at angle of attack - Blunt-nosed bodies at angle of attack.

COURSE DETAIL

Sl.No	Topics	Hours
1.	Introduction	2
2.	1 D Flow	5
3.	Oblique Shocks	8
4.	3D Shock Waves	8

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Mechanical Engineering

Pre-requisites:

- Fluid Mechanics
- Thermodynamics

Additional Reading:

- Fundamentals of Gas Dynamics, V. Babu
- Dynamics and Thermodynamics of Compressible Fluid Flow (volumes I and II), Ascher H. Shapiro

Hyperlinks:

- http://sites.google.com/site/2009am655/

Coordinators:

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5.	Linearized Flow	6
6.	Unsteady wave motions	10
7.	Method of Characteristics	8
8.	3D flow	8

References:

1. Elements of Gas Dynamics, H. W. Liepmann and A. Roshko
2. Modern Compressible Flow, John D. Anderson, Jr.