# Shock Tubes and Its Applications

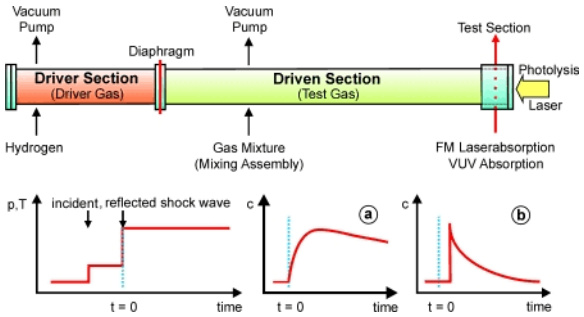
Kalidas K.[1] Bibin Sanjeev L.[2] Buvanesh M.[3] Jaya Prakash M.[4] Jeevaprasad M.[5]
(1) Associate professor, Department of Mechanical Engineering,
Hindusthan Institute of Technology, Coimbatore-641032, Tamil Nadu, India.
(2, 3, 4, 5) UG-Bachelor, Department of Mechanical Engineering,
Hindusthan Institute of Technology, Coimbatore-641032, Tamil Nadu, India.

***Abstract*:- Shock tube is one of the simple laboratory apparatus that can generate various flow speeds at different flow regimes. The shock tube performance is based entirely upon the pressure ratio and speed of sound in driver and driven section. The strength of shock increases in the ratio of speed of sound. Considering a shock tube where, the shock wave is generated by rupturing thin diaphragms instantly with appropriate pressure ratios across the driver and driven section of the shock tube. The pressure rises across the across primary and reflected shock is measured by high frequency pressure transducers located towards end of driven section. All necessary shock tube parameters are calculated through one- dimensional shock tube relations and are validated with experimental data.**

## INTRODUCTION

For context of comparison, in supersonic flows, additional increased expansion may be achieved through an expansion fan, also known as a Prandtl-Meyer expansion fan. Moreover, the accompanying expansion wave may approach and eventually collide and recombine with the shock wave, which is a process of destructive interfere. In physics, a shock wave (also spelled shockwave), or shock, is a type of propagating disturbance. When a wave moves faster than the local speed of sound in a fluid, it is a shock wave. Like an ordinary wave, a shock wave carries energy and can propagate through a medium; however, it is characterized by an abrupt, nearly discontinuous change in pressure, temperature and density of the medium. Thus, the sonic boom associated with the passage of a supersonic aircraft is a type of sound wave produced by constructive interference.

Unlike solutions (another kind of nonlinear wave), the energy and speed of a shock wave alone dissipates relatively quickly with distance. Hence, when a shock wave passes through matter, energy is preserved but entropy increases. This change in the matter's properties manifests itself as a decrease in the energy which can be extracted as work, and as a drag force on supersonic objects; shock waves are strongly irreversible processes.




2D-View of shock Tube

## MACH NUMBER

$$\text{Mach Number} = \frac{\text{Velocity of Fluid}}{\text{Velocity of Sound}}$$

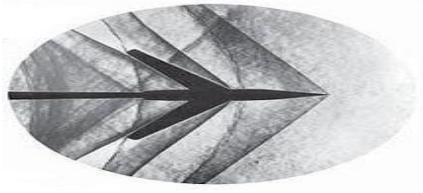
## SHOCK TYPES

Shock waves can be:

- Normal: at 90° (perpendicular) to the shock medium's flow direction.
- Oblique: at an angle to the direction of flow.
- Bow: Occurs upstream of the front (bow) of a blunt object when the upstream flow velocity exceeds Mach.1

Some other terms Shock Front: The boundary over which the physical conditions undergo an abrupt change because of a shock wave.

- Contact Front: in a shock wave caused by a driver gas (for example the "impact" of a high explosive on the surrounding air), the boundary between the driver (explosive products) and the driven (air) gases. The Contact Front trails the Shock Front.



Moving Shock

**SHOCK TUBE**

Shock Tube is an instrument used to replicate and direct blast waves at a sensor or a model in order to simulate actual explosions and their effects usually on a smaller scale.

Shock tubes can also be used to study aerodynamic flow under a wide range of temperatures and pressures that are difficult to obtain in other types oftesting facilities.

Shock tubes are used to investigate compressible flow phenomenon and gas phase combustion reactions.

More recently shock tubes have been used in bio medical research to study how biological specimens are affected by blast waves.

Shock Tube Experiment

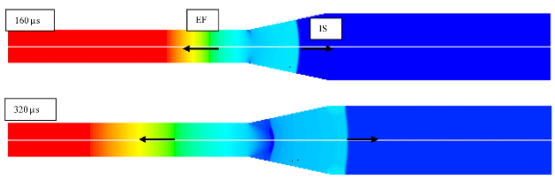
WORKING PRINCIPLE:

A Shock wave inside a shock tube may be generates by a small explosion (blast-driven) or by the buildup of high pressures which cause diaphragm to burst and a shock wave to propagate down the shock tube (compressed gas driven)

INNOVATION

The shock can be used in various applications and we have used few of our ideas and are listed below

- Using the spiral tube analysis
- Increase in the area of the driven tube and driver tube.
- By using the various materials to produce shock.




Analysis model of Shock Tube

APPLICATIONS

- Bio medical research like inserting of medicine
- Military applications like missile launching
- Mining purposes
- Blockage removal in Sewage plant

REFERENCE

1. https://en.m.wikipedia.org/wiki/sh ock_tube
2. nptel.ac.in/courses/112103021/35
3. www1.phc.uni-kiel.de
4. www.thermopedia.com/content/11 24/
5. https://arc.aiaa.org/doi/abs/10.251 4/8.7091?journalcode=jjp