FLIGHT 2024

MADRAS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF AEROSPACE ENGINEERING
ASSOCIATION OF AERONAUTICAL ENGINEERS

COMBUSTION WORKSHOP

MARCH 16

09:00 AM- 04:00 PM

Description:

Join us for an immersive combustion workshop where participants delve into the science and engineering behind combustion processes. From fundamental principles to cutting-edge advancements, this event offers a comprehensive exploration of combustion mechanisms, emissions control, and energy optimization. Engage in hands-on demonstrations, interactive discussions, and expert-led sessions aimed at enhancing understanding and fostering collaboration within the combustion community. Whether you're a researcher, engineer, or enthusiast, this workshop promises to ignite curiosity, spark innovation, and ignite

meaningful connections. Don't miss this opportunity to deepen your knowledge and contribute to the future of combustion technology.

Workshop overview:

1. Flame types and characteristic:

Premixed Flame: In a premixed flame, fuel and oxidizer are mixed prior to ignition. This uniform mixture combusts simultaneously, resulting in a stable, evenly distributed flame. It typically exhibits fast combustion rates and relatively low emissions.

Partially Premixed Flame: Partially premixed flames involve a mixture of premixed and unmixed regions. This combustion mode often occurs in practical systems where mixing is incomplete. It can offer a balance between stability and combustion efficiency.

Diffusion Flame: In a diffusion flame, fuel and oxidizer mix at the flame front through diffusion. This type of flame is characterized by distinct zones of combustion, with the fuel and oxidizer coming together gradually. Diffusion flames are common in systems where fuel and oxidizer are supplied separately.

Lifted Flame: Lifted flames occur when the flame is lifted away from the burner surface due to factors such as high flow velocities or buoyancy effects. These flames often exhibit unique characteristics and can be important in understanding flame stability and combustion dynamics in practical applications.

2. Thermo- acoustic interaction:

Thermo-acoustic interaction involves the coupling between acoustic waves and heat transfer within a medium, often occurring in systems with temperature gradients. Ruben's tube and Rijke tube are both experimental setups used to demonstrate this phenomenon:

Ruben's Tube: It's a long, perforated metal tube sealed at one end and connected to a source of flammable gas at the other. A speaker at the sealed end produces sound waves that travel through the tube. When the gas is ignited, the flames at the perforations respond to the sound waves, forming patterns corresponding to the acoustic vibrations. This setup visually demonstrates the relationship between sound waves, pressure variations, and heat release.

Rijke Tube: Similar to Ruben's tube, the Rijke tube consists of a sealed tube with a flammable gas supply. However, in this case, there are no perforations. Instead, a flame is established at one end of the tube. When subjected to acoustic waves generated by a speaker, the flame responds by pulsating or even extinguishing periodically. This demonstrates the interaction between sound waves and heat release, with the flame acting as a feedback mechanism for the acoustic oscillations.

3. Bluff Body flame stabilization using V gutter:

Bluff body flame stabilization using a V-gutter involves employing a V-shaped structure positioned downstream of a flame to enhance its stability. The V-gutter serves to manipulate the airflow around the flame, creating a recirculation zone that aids in maintaining the flame's position. This configuration promotes better mixing of fuel and oxidizer, facilitating combustion efficiency. By strategically shaping the airflow,

the V-gutter helps prevent flame extinction and encourages steady combustion, particularly in turbulent environments. This method is utilized in various combustion systems, such as gas turbines and industrial burners, to enhance flame stability and overall performance.

4. Trapped vortex combustion in atmospheric & testing facility:

Trapped vortex combustion is a combustion mechanism that utilizes swirling flows to enhance mixing and combustion efficiency. In atmospheric testing facilities, this concept is employed to investigate combustion processes under realistic conditions. Here's a brief description:

Trapped Vortex Combustion: This approach involves creating a swirling flow pattern within the combustion chamber, typically through the use of specially designed burners or geometries. The swirling motion traps a central recirculation zone or vortex, which enhances mixing between fuel and oxidizer, leading to more efficient combustion and reduced emissions.

Atmospheric Testing Facility: These facilities are designed to replicate combustion processes under ambient atmospheric conditions, providing a controlled environment for research and development. They often feature test rigs or chambers where various combustion technologies, fuels, and operating conditions can be studied.

Conclusion:

In conclusion, the workshop provides a comprehensive exploration of combustion science and technology, covering topics ranging from fundamental principles to advanced applications. Participants will gain valuable insights into flame types, thermo-acoustic interactions, bluff body flame stabilization using V-gutter, trapped vortex combustion, and atmospheric testing facilities. Through interactive discussions, hands-on demonstrations, and expert-led sessions, attendees can deepen their understanding of combustion mechanisms, emissions control, and energy optimization. The workshop fosters collaboration and knowledge exchange among researchers, engineers, and enthusiasts, igniting curiosity and sparking innovation within the combustion community. Moving forward, the insights gained from the workshop will continue to drive advancements in combustion technology, leading to cleaner, more efficient, and sustainable energy solutions.

PARTICIPATION CERTIFICATES WILL BE PROVIDED TO ALL PARTICIPANTS

REGISTRATION FEES: INR 300/- per head

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