

Test rig design for validation of novel sonic thermometer in hot flow

Introduction

With search to cleaner combustion, real-time monitoring of the operation and health of industrial combustion systems is becoming increasingly important.

These combustion systems, such as gas turbines (ground-based or aero) or industrial furnaces and boilers, are faced by ever tightening rules on emissions. This leads to combustion systems that operate close to the limits of what is possible. For the next generation of combustion systems, there will be a shift to carbon-free fuels, such as hydrogen or ammonia. The relative novelty of these fuels augments the need for accurate monitoring of the flame, to ensure correct operation of the system.

Nowadays, temperature monitoring is done using thermocouples that are placed near the walls of the system. Drawbacks of these sensors are that 1) they disturb the flow, 2) they cannot be placed directly in the flame or they will melt and 3) they do not actually measure the temperature of the surrounding medium but that of the sensor material. Both are equal only if medium and sensor are in thermal equilibrium.

The Sonic Thermometer

The sonic thermometer can get rid of all three drawbacks. This sensor actually measures the speed of sound through the time it takes for a pulse to go from one end of the combustion chamber to the other. The components do not have to be placed in the flow, and therefore do not experience the extreme temperatures. Moreover, as the measured property is a property of the medium, the obtained temperature is the true temperature of the medium

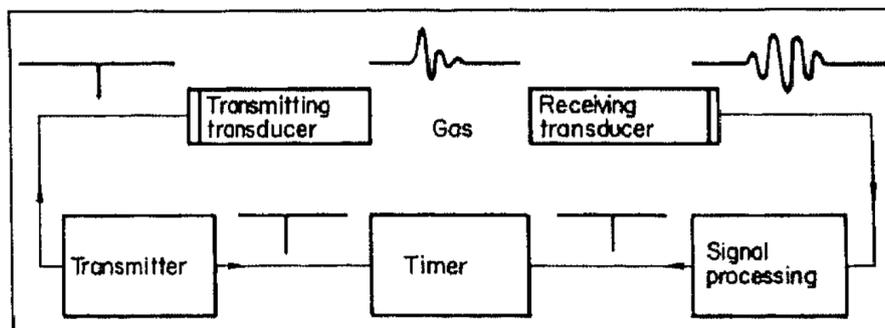


Figure 1: General setup for a sonic thermometer.

Your Contribution

In this project you will design a test rig to validate the sonic thermometer in the Thermal Engineering lab. This test rig will involve a uniform heated flow through a pipe of a given diameter. The sonic thermometer measurement will be validated using thermocouples, CFD analysis or laser-based temperature measurement.

Are you interested or do you have any questions? Feel free to come by the office or send us an email.

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