

Ultrasonic Sensor for Non-Invasive Temperature Measurements

Summary

An apparatus for measuring the temperature and heat flux of materials through the use of an ultrasonic sensor has been developed at Vanderbilt University. The sensor uses acoustic measurement techniques to determine the heat flux and temperature of material surfaces otherwise inaccessible to enhance monitoring capabilities and reduce unsafe or impaired function due to extreme temperatures.

Challenges in Temperature and Heat Flux Measurements

- » Monitoring conditions in industrial/commercial applications is crucial to maintaining proper/safe operation
- » Temperature affects the performance of machines/structures, impairing function if elevated or uncontrolled
- » During operation, some materials cannot be directly measured due to inaccessibility
- » In industry the greatest risk of uncontrolled temperature results from continuous operation/repeated use
- » The military also experiences risk of unsafe structures due to extreme temperature such as
 - outer surfaces of high speed vehicles including those at hypersonic flight due to friction
 - inner surfaces of chambers such as combustion chambers of a liquid rocket motor

Technology Description

The invention describes an apparatus and method for determining heat flux and temperature of a surface without optical or direct physical access. A monitoring sensor consisting of a temperature sensor and ultrasonic transducer is mounted to the structure in order to measure the inaccessible portion. The ultrasonic transducer may take a variety of forms such as piezoelectric, capacitive, electromagnetic, or laser. The propagation time of the ultrasonic signal in the structure is measured and used to determine temperatures and heat flux associated with the system. Additionally, the data acquired may be stored in a processing system in order to create a historical database for long-term analysis.

Commercial Applications

- » Monitoring material conditions that cannot be directly measured during operation to maintain safe and proper system operation
- » Commercial/industry and military applications especially during continuous/repeated use machinery or systems subject to extreme temperatures

Competitive Advantages

- » Ability to monitor otherwise inaccessible surfaces to ensure proper and safe operation of systems
- » Establishes a database for long-term analysis of performance, maintenance, etc.
- » Known efficacy of reactions due to temperatures reached, rate of temperature change, etc.

Intellectual Property Status

- » Utility patent [12/262,758](#) was issued September 4, 2012.
- » Click for [Inventor Bio](#).
- » Research & publications: <http://tplab.vuse.vanderbilt.edu/>

CTTC CONTACT:

Ashok Choudhury, Ph.D.
Phone: (615) 322-2503
ashok.choudhury@vanderbilt.edu

VANDERBILT LEAD INVENTOR:

Greg Walker, Ph.D.

VU REFERENCE: VU08112

Link to Vanderbilt technologies available for licensing

