Thermal Characterization of a Radiating-Conducting System With and Without Non-Fourier Effects

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- **Time:** 11.00 am
- **Venue:**

ABSTRACT: Nothing is devoid of temperature, and no process is instantaneous. Heat is an entity, and depending on the conditions to which the medium is subjected, it takes some finite time to propagate from one location to the other. Thus, the establishment of any kind of thermal field in a medium, by any mode of heat transfer (conduction, convection and radiation) or the combined effect of the two or all three, **as an instantaneous process**, depends on the temporal and the spatial dimensions (scales) that one deals with. For example, radiation, an electromagnetic wave, travels with the speed of light $c = 3.0 \times 10^8 \text{ ms}^{-1}$. In most of the transient conduction and/or convection processes involving radiation, radiative transport is instantaneous, but it is not so, when one deals with the time scale as low as a nano-second 1.0×10^{-9} sec . Similarly, in the classical Fourier's law of heat conduction, the assumption that the effects of the thermal perturbation is felt instantaneously does not hold true in many situations. A finite propagation speed of conduction wave, which is not there in Fourier's law, needs to be accounted. This consideration, in one hand, gives correct results, but brings additional difficulties. Mathematically, from parabolic, the governing energy equation turns to be a hyperbolic one.

This talk will discuss **transient** and **instantaneous** aspects with regard to propagation of heat by conduction with and without volumetric radiation. The increase in difficulty levels with Fourier to non-Fourier aspects will be addressed for different geometries. Dependence of the distinct thermal wave front on various parameters, and what they mean, will be addressed. **In real life, when and where, this work finds applications will be elaborated, and how best this can be a deterministic thermal tool in characterizing a thermal system will be discussed.**

THE SPEAKER: With BSc (Engg.) in 1989 from BIT Sindri (http://www.bitsindri.ac.in), MTech in 1992 and PhD in 1997 from IIT Kanpur (http://www.iitk.ac.in), Prof. Mishra joined IIT Guwahati (http://www.iitg.ac.in) as a Senior Lecturer in Dec 1996. He became Assistant Professor in April 1997, Associate in May 2000 and Professor in October 2004. He was Faculty In-charge, Training and Placement from April 2003 - April 2005 and Dean of Academic Affairs of IIT Guwahati from March 2006 - July 2008.

An author of about 200 research publications, Prof. Mishra has guided about 100 students. Apart from his main research in the area of radiative heat transfer, currently his research involves porous media combustion, bio-heat transfer and on applications of the lattice Boltzmann method to thermal problems. Post PhD, on fellowships, for about 3 years, Prof. Mishra has done collaborative research in premier academic institutions in Germany, Japan and Italy. He is one of the four vice presidents of the Indian Society for Heat and Mass Transfer. He is a fellow of Indian National Academy of Engineering and Institution of Engineers' India.

Prof. Mishra has remained actively involved with the organization of many conferences/symposia/workshops. Prominent among such events have been the 18th National & 7th ISHMT-ASME Heat and Mass Transfer Conference held at IIT Guwahati in January 2006 and Indo-German Winter Academies in December 2003 and 2007. He is one of the Coordinating Professors of the Indo-German Winter Academy series which is held in India every year since December 2002.