

Analysis of Combined Mode Conduction and Radiation Heat Transfer Using the Lattice Boltzmann Method

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- **Time:** 14.00 hrs.
- **Venue:**

ABSTRACT: In the recent past, the lattice Boltzmann method (LBM) has received much attention in science and engineering as a potential computational tool for solving a large class of problems. Among many other types of problems, the LBM has been successfully used to simulate a wide range of fluid flow and heat transfer problems. Owing to its mesoscopic origin, the LBM is emerging as a versatile computational method that has many advantages. In comparison to the conventional CFD solvers like the finite difference method, the finite element method and the finite volume method, the advantages of the LBM comprise of a clear physical meaning, a simple calculation procedure, simple and more efficient implementation for parallel computation, straightforward and efficient handling of complex geometries and boundary conditions, high computational performance with regard to stability and precision, etc.

This lecture will focus on implementation of the LBM to solve energy equations of heat transfer problems involving thermal radiation in which radiative information can be computed using any of the numerical radiative transfer methods like the discrete transfer method, the discrete ordinate method, the finite volume method and the LBM. Some example problems dealing with conduction, convection and radiation heat transfer in rectangular, cylindrical and spherical geometry will be taken up to show the workability of the LBM. Implementation of the LBM on non-uniform lattices and for non-Fourier conduction cases will also be discussed.

THE SPEAKER: With BSc (Engineering) in 1989 from BIT Sindri, MTech in 1992 and PhD in 1997 from IIT Kanpur, Prof. Mishra joined IIT Guwahati as a Senior Lecturer in December 1996. He became Assistant Professor in April 1997, Associate in May 2000, Professor in Oct. 2004 and Professor (Higher academic grade) in Nov 2010. He was Faculty In-charge, T&P from April 2003 - April 2005, and Dean, Academic Affairs from March 2006 - July 2008. Currently, he is the Dean of Alumni Affairs and External Relations. An author of about 250 research publications, Prof. Mishra has guided about 100 BTech, MTech and PhD students. Apart from his main research in the area of radiative heat transfer, currently his research involves porous media combustion, bio-heat transfer and applications of the lattice Boltzmann method to thermal problems. Post PhD, on fellowships of Alexander von Humboldt Foundation, Japan Society for Promotion of Science and Politecnico di Torino, Torino, Italy, for about 3 years, Prof. Mishra has done collaborative research in premier academic institutions in Germany, Japan and Italy. He has been the vice president of the Indian Society for Heat and Mass Transfer. He is a fellow of Indian National Academy of Engineering, American Society of Mechanical Engineers and Institution of Engineers' India. He is also the Chair Professor of Indian National Academy of Engineering. He has delivered about 100 invited/keynote/plenary talks in India and abroad. He is in the scientific committee of many international conferences. Prof. Mishra is the reviewer of about 40 journals in the area of heat transfer, fluid mechanics and energy.

Prof. Mishra has remained actively involved with the organization of 26 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-European Winter Academies in December 2003, 2007 and 2013. He is one of the Coordinating Professors of the Indo-German Winter Academy series which is held in India every year since December 2002. For the holistic growth of the young generation by understanding science and spirituality in proper perspectives, and to see a harmonious society through synthesis of science and spirituality, since 2007, Prof. Mishra is also associated with the organization of the conference series - All India Students' Conference on Science and Spiritual Quest, and since 2007, he has been the Chairman of the conference series.