Computational Solution of Hyperbolic PDEs for Scientists, Engineers and Mathematicians

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Overview

Partial differential equations (PDEs) govern a large body of physical phenomena that are of interest to scientists, engineers and mathematicians. They arise in fields of study that are as diverse as astrophysics, aerospace engineering, mechanical and chemical engineering, space physics and applied mathematics. Unfortunately, the number of problems for which we can find analytical solutions to these highly important PDE systems is limited. Therefore, an ability to find computational solutions to these important classes of PDEs is crucially important for modern day science and technology. Hyperbolic PDEs are, in some sense, the most useful class of PDEs and they are also the PDE systems for which cutting-edge, high-accuracy, time-dependent numerical algorithms have been most recently developed. Fortunately, a significant majority of Indian research institutions have installed powerful highly parallel computer systems for the numerical solution of these PDE systems. Consequently, this course aims to teach cutting-edge computational algorithms for the numerical solution of hyperbolic PDE systems to a wide audience of Indian mathematicians, engineers and scientists, which can be used on massive computers.

The focus of this course would be the numerical solution of hyperbolic PDEs using higher order Godunov-type schemes. The two-week course will cover both basic and advance topics. The contents of the course are: Finite Difference methods for Linear Hyperbolic problems, Nonlinear scalar and system of conservation laws: Riemann Problems, Riemann Solvers, Stability, Higher order WENO schemes. ADER-WENO schemes, Multidimensional Riemann Solvers, Discontinuous Galerkin schemes, Constraint Preservation, Entropy Stable Schemes, Application to Compressible flows, Relativistic MHD, Extended MHD and Rarefied Gases.

Course Details

Course Title	**Computational Solution of Hyperbolic PDEs for Scientists, Engineers and Mathematicians**
Dates	4th December – 16th December, 2017
You Should Attend if…	• You are a student at level B.Tech./M.Sc./M.Tech./PhD level with interest in numerical methods and its applications. • You are a researcher, scientist, engineer or applied mathematician from reputed technical institutes, research institutes, R&D labs or industries, with interest in hyperbolic PDEs and related application. • You are a student or faculty from IIT Delhi interested in hyperbolic PDEs and related applications. The course will be for 2 credits in IIT Delhi Curriculum and can be credited by the students and research scholars.

Fees:	The participation fees for taking the course is as follows: **Research Scholars/Students (Non IIT Delhi): Rs. 7500** **Faculty (Non IIT Delhi): Rs. 15000** **Working Professional (Non IIT Delhi): Rs. 20000** The above fee includes all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hour free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Prof. Balsara has a joint appointment in the physics and applied math departments at the University of Notre Dame. He has been on the forefront of developing WENO, PNPM, DG, ADER, AMR-MHD, universal Riemann solvers and their multidimensional extensions. He has worked on various systems like MHD, RMHD and CED. He has a deep interest in teaching this subject as evinced by his website http://www.nd.edu/~dbalsara/Numerical-PDE-Course .

Prof. Praveen Chandrashekar has been with the highly prestigious TIFR-CAM in Bangalore. His research interests are in numerical solution of PDE using finite volume and element methods, parallel computing and Computational Fluid Dynamics.

Prof. Harish Kumar is an Asst. Prof. at Department of Mathematics, IIT Delhi, New Delhi. His research interests are numerical methods for Hyperbolic PDEs, Compressible flows, Plasma flows and Multiphase Flows.

Course Coordinator:

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