Indian Institute of Technology Indore

Department of Mathematics

organizes a

7-day High-End Workshop on

Bifurcations and Chaos: Computations and Applications

Dates: July 3 - July 9, 2023

Sponsored by SERB under KARYASHALA scheme

About IIT Indore

IIT Indore, located in Madhya Pradesh, is an institute of national importance established by the Government of India in 2009. IIT Indore has positioned itself as a vibrant centre for outstanding research. Multidisciplinary research at IIT Indore has been recognized internationally with active participation in several international projects and collaborations with foreign institutions.

About the Department

The Department of Mathematics started in 2019 and introduced PhD and M.Sc. programmes in 2010 and 2015, respectively. A B.Tech program in Mathematics & Computing is going to start in the 2023-24 academic year. The department's beauty encourages research and teaching in both Pure and Applied Mathematics. The department is executing several key projects funded by national and international agencies. Well-equipped DST-funded Bhaskaracharya Mathematics Laboratory and Brahmagupta Library play a significant role in teaching and learning. The faculty members are actively conducting several events like weekly seminars, the Ramanujan-Hardy lecture series, and national and international workshops and conferences.

About the Workshop

The KARYASHALA scheme initiated by SERB, Govt. of India is to enhance skill development training on emerging topics essential for scientific research. Of course, the main objective of this workshop is to train PG students and PhD scholars, and to make them well equipped in the field of nonlinear dynamics, modeling, computations, and applications. However, another two important objectives are: (1) to make the participants learn explicit coding mechanism so that the users will be more familiar in writing algorithms as per requirements. (2) to give an opportunity to a significant number of candidates from State Govt. universities/colleges where appropriate expertises/facilities in the field of dynamical systems are not available. Overall the workshop will make the participants aware of the interdisciplinary and multi-disciplinary research approaches.

Course Content

Module 1: One-dimensional flows, Stability, Blow-up phenomenon, Critical slowing down, Saddle node, Transcritical, and Pitchfork bifurcations

Module 2: Classification of linear systems, Nonlinear systems, Periodic solutions, Limit cycles, Oscillators

Module 3: Solving system of ODEs using the Euler and RK4 methods, Inbuilt ode23 and ode45, Plotting phase portraits, Plotting multiple stable and unstable limit cycles, Drawing vector field, Bifurcation diagram

Module 4: Chaos and its identification, Tools for detecting chaos, Lyapunov exponents, Control of Chaos, Applications of chaos

Module 5: Discretization process, Stability of discrete-time systems, Flip and Neimark-Sacker bifurcations in predator-prey systems, Chaos, Dynamical system using Mathematica.

Module 6: Fractional derivative, Maps, Z-transform, Stability region, Complex order, Periodic maps

Module 7: Different phase transitions and bifurcations in Kuramoto oscillators with pairwise couplings and beyond

Speakers

Prof. Binoy Krishna Roy
Department of Electrical Engineering
NIT Silchar

Prof. Sarika Jalan
Department of Physics
IIT Indore

Prof. Sachin Bhalekar
Department of Mathematics and Statistics
University of Hyderabad

Prof. Sandip Banerjee
Department of Mathematics
IIT Roorkee

Prof. Partha Sharathi Dutta
Department of Mathematics
IIT Roper

Dr. Debopriya Mukherjee
Department of Mathematics
IIT Indore

Dr. Bapan Ghosh
Department of Mathematics
IIT Indore

Registration Guidelines

- The maximum number of participants is limited to **25**.
- Students selected for this workshop are eligible for travel allowance (**TA**) reimbursement (**3rd AC**) for their journey to and from IIT Indore, as per SERB and GoI norms.
- Accommodation for the participants will be provided at the IITI hostel with catering facilities.
- During registration, the candidate must upload a **NOC** letter duly signed by the competent authority.
- Who can apply: Preferably second-year PG students and first and second-year PhD scholars. Women candidates are highly encouraged to apply.

Registration Information and Process: link

Application Deadline: 7th June, 2023

Registration Fee: **NIL.** However, the selected candidate has to deposit Rs 3000/-which will be **refundable** after the completion of the course.

Format for NOC

To, Date _____
Dr. Bapan Ghosh
Workshop Coordinator

This letter is to certify that [Student's Full Name], a student/PhD scholar of [School/Institution Name], has sought permission to attend the High-End workshop titled **Bifurcations and Chaos: Computations and Applications**, which is scheduled to take place on *3rd-9th, July 2023* at IIT Indore.

We hereby confirm that we have no objection to the applicant in attending the workshop and encourage his/her participation in such educational events that can further enhance knowledge and skills.

Signature of the applicant
Date and place:
Recommended and forwarded by

Signature of the Head of the Department / Head of the Institution with seal

Coordinator: Dr. Bapan Ghosh

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website link

Tutors

Dr. Mo Faheem
Aman
Debdeep Roy
Rahul Som
Rajni