How to apply?

- Mandatory one time registration at GIAN portal (`http://www.gian.iitkgp.ac.in`).
- Registration form, along with the latest CV, to be emailed to `gian@physics.bdu.ac.in`
- Faculty/students from academic institutions are also required to send a copy of their current valid Identity card or a bonafide certificate from their institution.

The workshop is aimed for a maximum of **50** participants.

Important Dates

☆ Last date for Registration: **20 November 2017**
☆ Intimation of Selection: **23 November 2017**

Guest Faculty: Dr. Fernando Fagundes Ferreira has a long-standing experience in research and teaching. He is an Assistant Professor at the University of São Paulo, Brazil. His Ph.D. thesis was about computational complexity and optimization using Statistical Mechanics tools. After that, his research moved to Complex Systems modeling to study collective behavior in dynamical systems. He has published several original papers in peer-reviewed journals addressing many themes as synchronization in chaotic systems, data analysis and modeling of asset prices in financial markets, the emergence of the social dilemma in social and ecological systems. Those research has allowed him to address several tools and concepts from Statistics, Game Theory, Optimization, Ecology and Nonlinear Dynamical Systems. Now his is training researchers with interdisciplinary skills and interest in complex systems modeling.

Host Faculty: Dr. Paulsamy Muruganandam is presently working as Assistant Professor, Department of Physics, Bharathidasan University, Tiruchirappalli. He has published more than 60 research articles in reputed International Journals. His research interests include Nonlinear Dynamics and Complex Systems, Computational Physics, and Quantum Gases. His current focus is on the study of matter-wave solitons in spin-orbit coupled Bose-Einstein condensates from the numerical solutions of mean field Gross-Pitaevskii equation and Bogoliubov de Gennes equation and complex networks.

About the Department

The Department of Physics, Bharathidasan University came into existence in 1982 The Department has emerged as the center of research excellence and the researchers currently engaged in the thrust area of physics such as Nonlinear Dynamics, Theoretical, Computational, and Experimental Physics. The department has been recognized for special funding by DST-FIST, UGC-SAP, and MHRD-RUSA (R&I). The Department is equipped with sophisticated instruments including XRD, AFM, FESEM, PPMS, PL, Sputtering Unit, Micro-Raman Spectrometer, and good computational facilities of international standard. The researchers of the department have won many National/International awards/honours and received sponsored research projects from various National/International bodies.

GLOBAL INITIATIVE OF ACADEMIC NETWORKS

Ministry of Human Resource Development
Government of India

Complex Systems: Modeling and Analysis (CSMA)

Bharathidasan University

December 11 – 15, 2017

Call for Registration and Participation

Guest Faculty
Dr. Fernando Fagundes Ferreira
Universidade de São Paulo (USP)
Brazil

Course Coordinator & Host Faculty
Dr. Paulsamy Muruganandam

Department of Physics
Bharathidasan Univeristy
Tiruchirappalli – 620024
Tamilnadu
India

Overview

Complexity science is a modern way of thinking and approaching large systems, i.e., systems formed by many interacting elements. Traditionally, science was developed based on the reductionist approach by focusing on the parts of a system. This strategy has led to a striking development. However, the reductionism has revealed to be limited to solve many interesting problems due to many limitations imposed by computational or mathematical capabilities known.

Increased computational processing and data storage capacity have brought new scientific challenges. Among the novelties are the great amount of data collected in numerous experiments in high energy physics, gene regulation networks, social networks, technological networks, patient data in health systems, financial transactions or neural activities. All of these examples share several properties in common and can be better understood from the study of complex systems.

Complex systems are characterized by some properties such as emergence, self-organization, nonlinearity, and feedbacks which make them so special. Part of the lecture will be devoted to discussing some mechanisms responsible for generating the above properties, as well as the role played by each one of them.

Besides lectures, workshops will be offered to whom want to learn and use programming language Python. The main motivation is that Complex systems modeling demand an expertise in programming language and as well as mathematical skills. Typically computational analysis and simulations are tools indispensable to deal with problems hard to solve. Python is a scientific programming language, which offers several packages to help programmers develop sophisticated codes easily and efficiently. There are others tools such as R-package and C language, which can be used to increase the performance. Python is integrated with such tools.

The participants will learn concepts, mathematical and computational tools commonly used in complexity science. This knowledge opens a way to a broad range of application in physics, biology, and society and fosters the interdisciplinary scientific collaboration.

Objectives

The primary objectives of the course are:

- To introduce the foundations of complex systems
- To present computational tools for simulations
- Prepare the audience to design models inspired by classical examples
- Discuss the importance of complex systems modeling

Course details

The following topics will be covered

- Nonlinear dynamics and chaos: Introduction and preliminaries.
- Chaotic systems: Identification and characterizations.
- Discrete dynamics and cellular automata.
- Introduction to complex systems and complexity.
- Properties: self-organization, emergence, nonlinearity, feedback, numerosity, universality, learning and adaptation, unpredictability.
- Introduction to Python programming
- Data analysis tools: Detrended Fluctuation analysis (DFA), power law, fractals, statistics and machine learning.
- Critical phenomena: bifurcation and phase transition.
- Scaling and multifractality: calculation the DFA and power Law exponents.
- Self-organized criticality.
- Paradigmatic models: Kuramoto model, Schelling model, Sugarscape, and Minority Game.
- Implementation of Kuramoto and Minority Game models using Python.
- Applications in Physics, Biology and Society.
- Problem solving section with examples: complex network and game theory to build models.

Who can attend

Students (PG and M.Phil), Research Scholars, Post-Doctoral Fellows, Faculty Members, and Members from Industry.

Registration Fee

A course fee of IN ₹ 2,000/- can be paid either in the form of demand draft (DD) or through bank transfer. DD should be in favour of ***Course Coordinator, CSMA***, payable at Tiruchirappalli and send to ***Dr. P. Muruganandam, Course Coordinator, CSMA, Department of Physics, Bharathidasan University Tiruchirappalli – 620024, Tamil Nadu, India***.

Or the following **State Bank of India** Account may be used for depositing the fee.

- A/c No. **37285793839**.
- Name: **Course Coordinator, CSMA**
- IFSC Code: **SBIN0007014**

Global Initiative of Academic Networks (GIAN)
176008M04 - Complex Systems: Modeling and Analysis
December 11 – 15, 2017

REGISTRATION FORM

Name (in block letters) : _____

Age and date of birth : _____

Gender : Male □ Female □ Transgender □

Educational qualification : _____

Designation : _____

Experience : _____

Institution : _____

Address : _____

_____

_____

_____

Mobile : _____

E-mail : _____

GIAN Application ID[†] : _____

Research Interests : _____

Course fee details[‡] : DD/UTR No. _____ Amount ₹ _____

Bank _____ Date _____

Place :

Date : Signature

APPROVAL FROM INSTITUTION

Place :

Date : Signature of the Principal/Head with seal

[†] Application ID generated during one time registration at GIAN portal of IIT Kharagpur (http://www.gian.iitkgp.ac.in). [‡] A course fee of ₹ 2,000/- can be either paid in the form of demand draft (DD) drawn in favour of Course Coordinator, CSMA, payable at Tiruchirappalli or deposited in the State Bank of India account (A/c No. 37285793839, Name: Course Coordinator, CSMA, IFSC Code: SBIN0007014)