Curriculum Vitae

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Education

–2013	CISCE 10th Board in Bangalore, Karnataka
2013–2015	Karnataka Pre University Board (11th and 12th) in Bangalore, Katnataka
2015–Current	Integrated BS-MS at Indian Institute of Science Education and Research, Kolkata

Ongoing Work

August 2019 - Present

Masters Thesis
Collective Dynamics : Long range order of SPPs in heterogenous media
Dr. Rumi De — IISER Kolkata

Collective ordered motion (flocking in common terms) is seen in nature frequently. Efforts to explain this through simple rules has been an ongoing endeavour for the past few decades. Simple models with Self Propelled Particles (SPPs) have been found which result in flocking and also show phase transitions like physical systems. Taking these models a step further, we seek to introduce heterogenity in the medium through placement of obstacles. The motivation comes from analogy of a herd of deer encountering a tree or a school of fish encountering a rock. We seek to understand how obstacles affect the dynamics of the system and what specific properties (geometry, area, number etc) of obstacles are more important than others.

Fall 2019

Non-linear Workbook in Python
Dr. Ananda Dasgupta — IISER Kolkata

The book The Nonlinear Workbook by Willi Hans Steeb is a toolbox of various algorithms and methods used in the field of non-linear dynamics. The book contains the tools and brief overview of the math behind the tools, ranging from chaos to genetic algorithms to neural networks. This book is of immense use for anyone foraying into the field of scientific computation.
One of the widely used languages in computation in science is Python. The main reasons behind this are the ease of coding and the availability of numerous packages for specific purposes. The goal of the independent study is to study the algorithms and tools listed in the book and to recreate them in Python (using plain python and at places possible, the available additional packages).

Past Experience

Summer 2019 | **Stochastic Amplification of Ecological Systems**
Dr. Amos Maritan — University of Padua, Italy
Population Level Models often show different behaviour than Individual Level Models because the PLMs are mean field equivalent of the ILMs. In particular, Lotka Volterra equations in finite size systems do not show cyclic populations (unlike infinite population size model). But in observation, we see many predator prey systems having cycles. This can be explained using tools of stochastic processes (like Fokker Planck Equation, van Kampen Expansion, Langevin Dynamics) which manage to include the finite size effects and stochasticity in the population to qualitatively show cycles in population with finite size. The same tools were also extended to MacArthur Consumer Resource model to show non trivial power spectrum of simulated time series population data.

Summer 2018 | **Analysis of Template directed Polymerization**
Dr. Supratim Sengupta — IISER Kolkata
RNA replication should have preluded DNA replication. But there is evidence to suggest that a pre-RNA world existed where replication occurred due to self replicating polymers, that led later to complex structures like RNA. In such a self replicating polymer, the conditions of template directed polymerization were studied.

Summer 2017 | **Extreme Events on Complex Networks**
Dr. MS Santhanam — IISER Pune
Work here primarily consisted of running simulations of random walks on complex graphs to check for a pattern arising in extreme events i.e, paths with low probability and to see if it would help in prediction of probability of occurrence of paths in the graph.

Summer 2016 | **Game Theory and Population Dynamics**
Dr. Sandeep Krishna — NCBS Bangalore
This was mainly a reading project in Game Theory. The basics of Game Theory was studied and some simulations of three player and five player games (equivalent to Rock Paper Scissors and Rock Paper Scissors Lizard Spock) was done. Towards the later part of the summer, population dynamics model of Cuscuta (a plant that is a parasite of plants) was attempted and prelimnary simulations were run.

Conferences and Workshops

July 2019 | **Conference on Complex Systems - 2019 — Trento, Italy**
Organized by Complex Systems Society, Italy

June 2016 | **Physics of Life, Annual Monsoon School — Bangalore, India**
Organized by Simons Centre for the Study of Living Machines, NCBS

[1]Indian Institute of Science Education and Research

Relevant Courses

Fall 2019	**Biophysics** Course on use of physical techniques in biological systems and non equilibrium statistical mechanical tools like Master equation formalism, Fokker-Planck Equation.
Spring 2019	**Evolutionary Dynamics** A course on introduction to evolutionary dynamics ideas like fitness landscape, sequence spaces, evolutionary games, finite population games and evolutionary graph theory.
	Statistics Laboratory Introduction, visualization and computation of various statistical tools using MATLAB.
	Advanced Statistical Mechanics An advanced course on statistical mechanics dealing with topics such as mean field theory and renormalization group theory.
	Soft Matter Physics An introductory course on soft matter systems using tools learnt in statistical mechanics. Topics range from broken symmetry to elasticity.
Fall 2018	**Non-Linear Dynamics** Introduction to the basic ideas of nonlinear dynamics and chaos in classical systems modelled by ordinary differential equations and iterated maps
Fall 2017	**Computational Physics** Course primarily covered introduction to some of the widely used methods of computational physics. Emphasis was on numerical methods of differentiation, integration, solving ODEs and PDEs and Monte Carlo methods. Problems from classical mechanics, quantum mechanics and statistical physics were tackled.

Languages Known

C++	Beginner proficiency
Python	Advanced proficiency (packages used: NumPy, matplotlib, SciPy, NetworkX)
LaTeX	Intermediate proficiency
gnuplot	Intermediate proficiency in graphing software

Extracurricular Activities

Web Development	**Designed websites for the following:** Inquivesta : Annual College Fest of IISER Kolkata Lexis : Literary Festival of IISER Kolkata Campus Radio : College Radio Station IICM : Inter IISER Cultural Meet iGEM IISER Kolkata : International synthetic biology competition started by MIT
Dramatics	**Encounters with theatre include:** Dramatics Club Treasurer in year 2017 Cast member in multiple college plays
Initiatives	**Helped start/lead the following events:** iGEM : Helped start iGEM team at IISER Kolkata which bagged gold at Boston twice Lexis : Started the first literary fest at the college Inquivesta : Lead the fest as events coordinator in 2017