



DEPARTMENT OF MATHEMATICS



PREFACE

DR. AJIT KUMAR

Associate Professor
Head of the Department

M.Sc., Ph.D.

The Department of Mathematics, Institute of Chemical Technology, Mumbai, aims to be an internationally leading mathematics department that will offer innovative educational and research programmes in mathematical sciences and their applications in science and technology. In pursuit of its vision, the department wish to (i) offer courses and programs that will ensure that the students get practical knowledge in mathematics which will be relevant to the society (ii) provide a modern educational environment for instruction and research (iii) create an environment for learner to engage in solving real-world problems (iv) contribute to the understanding of complex mathematical structures and their applications.

The Department of Mathematics, ICT Mumbai was established in the year 1944. Since its inception, it caters to all the courses related to mathematics, statistics and computer programming of UG and PG programmes in ICT. The department offers a 2 year M.Sc. programme in "Engineering Mathematics". This programme was started in the academic year 2012-2013 under the UGC INNOVATIVE SCHEMES and is very unique in its nature.

The department also has Ph.D. programme in Mathematics covering diverse area of research. The community of the department consists of six faculty members, with broad areas of expertise related to mathematics and statistics, and two support staffs. The department has modern and high level computational facilities, consisting of 50 All-In-One Computers, Two Servers, one workstation and a High Performance Computing (HPC) cluster. All computers are installed with software such as MATLAB, Mathematica, SPSS, R, Python and Sagemath etc. The department has strong research collaborations with other renowned academic institutions and industries. Students are also provided with industrial internship and placements opportunity. The faculty members of the department are member of Board of Studies of several institutes. The department regularly arranges workshops, conferences and seminars for students and teachers of other colleges. Faculties are also engaged in various training programmes in mathematics and statistics across the country.

RESEARCH AREAS:

The Department of Mathematics has research expertise mainly in the areas of Computational Fluid Dynamics and Mathematical Modeling, Momentum, Heat and Mass Transfer in Newtonian Non-Newtonian Fluids, Singular Perturbation Theory, Optimization Techniques, Statistical Analysis, Data Analysis, Mathematical Biology, Species Distribution Modeling, Applied Functional Analysis, Differential Equations, and Mathematical Pedagogy.

FACULTY



DR. AJIT KUMAR

M. Sc. & Ph. D. (University of Mumbai)
Associate Professor and Head

PROFILE:

I am currently an Associate Professor and Head, Department of Mathematics, Institute of Chemical Technology, Mumbai. I did Masters and Ph.D. from University of Mumbai. My current areas of interest are Optimization Techniques, Data Analysis, and Mathematical Pedagogy. I have published more than ten research papers, four books and six book chapters. Two Ph.D. students are working under my guidance and one of them has submitted her thesis. I have also guided more than 15 masters' students for their home projects.

I have been a prolific user of mathematical software such as Sage, Python, R, Mathematica etc. Due to this expertise, I have been invited to give talks on these topics at several national and international events and conducted numerous training programmes for students and teachers. My mission is to create awareness about innovative use of Mathematical Software among mathematics teachers in India.

I have been associated with one of the most popular and

significant training programmes in Mathematics, "Mathematics Training and Talent Search Programme" for last several years in various capacity. Currently I am the managing trustee of MTTS TRUST which is organizing all the programmes under MTTS umbrella. This programme has made a significant impact on Mathematical scene in India over the years.

PROFESSIONAL ACTIVITIES:

- Life time Member of the Ramanujan Mathematical Society (RMS) India.
- Life time member of the Indian Mathematics Consortium.
- Life member of Mathematics Teachers' Association.
- Managing Trustee of MTTS TRUST
- Member of Board of Studies of several Colleges such as NMIMS Mumbai, SPIT, Mumbai, Jai Hind College, Mumbai, SIES College, Mumbai, KBP College, Vashi, SP College, Pune, Patkar College, Mumbai

SUBJECTS TAUGHT:

M.Sc. in Engineering Mathematics:

- Applied Linear Algebra
- Computer Programming
- Optimization Techniques
- Software Lab

RESEARCH INTERESTS:

- Optimization Techniques
- Statistical Techniques
- Machine Learning
- Data Analytics
- Mathematical Pedagogy

PUBLICATIONS:

(peer reviewed) so far : 06

CONFERENCE PROCEEDINGS/
PAPERS: 04

BOOKS PUBLISHED: 04

- Ajit Kumar, Bhaba kumar sarma, S. Kumaresan, Foundation Course in Mathematics. Narosa Publication. Delhi 2018.

BOOK (CHAPTERS) PUBLISHED: 06

SEMINARS/LECTURES/ORATIONS
DELIVERED: 100

POST GRADUATE PROJECT
SUPERVISION: 05

PHD PROJECT SUPERVISION:
02 (1 thesis submitted, 1 ongoing)

POST GRADUATE STUDENTS' SEMINARS/PROJECTS:

No.	Name of the Student	Topic
1.	Aniket Sandeep Wakankar	Stock Market Prediction Using Machine Learning In Python
2.	Ranjeet Kumar	Image detection and recognition using machine learning algorithm
3.	Ankit Suryamani Sharma	Forex market prediction using genetic algorithm and support vector machine
4.	Darshan Tribhuwan Dathiya	Forex market prediction using genetic algorithm and support vector machine
5.	Pooja Ramsewak Mishra	Forex market prediction using genetic algorithm and support vector machine

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

My current area of interest is in the field of Optimization Techniques, Statistical Techniques, Machine Learning, Data Analytics and Mathematical Pedagogy.

One of the thrust areas of my interest is in area of Machine Learning (ML) and Deep Learning Algorithms and their applications to various forms of real data. One Ph.D. students is working on using ML on stock market data for building clustering and predictive models. Recently, several students have done projects on various aspects of machine learning algorithms under my guidance some of which have resulted in conference proceedings. I would further like to focus on some of the modern data analysis tools such as Deep Learning, TensorFlow and Block Chain etc.

Another area I am focusing on is in the area of vehicle routing problems (VRP). One of the Ph.D. students has worked on applying heuristic methods to solve heterogeneous vehicle routing problem to a real data set. We would like to extend this work to various aspects of vehicle routing problems using Machine Learning algorithms such as reinforced learning and neural networks.

Third area of my interest is in Mathematical Pedagogy. I have been prolific user of several mathematical softwares for teaching and research. I

have been actively involved in training mathematics teachers in use of such tools. I would like to use my rich expertise on mathematical software and programming languages to build innovative teaching modules and Mobile Apps which can bring a lot of pedagogical benefits to teachers and students.

MEMBERSHIP OF IN-HOUSE COMMITTEES

- Head, Department of Mathematics
- Member of TEQUIP-III Core Team
- Unfair Means Committee
- UGPC and PGPC
- Handbook committee

SEMINARS / LECTURES / CONFERENCES / SYMPOSIA / WORKSHOPS / SUMMER OR WINTER TRAINING SCHOOLS ATTENDED/ ORAL OR POSTER PRESENTATIONS:

Conference/Workshop attended

- Participated in a National Workshop on "Strategic Quality Initiatives in Technical Education" during 09-13 May 2019 at Lakshadweep.
- Attended a two days national conference on "Equity: Achievements and Challenges in India" during February 15-16, 2019 at the college of Engineering Pune. The conference was organized by NPIU in collaboration

with DTE.

- Attended a "Professional Development Training Programme" at Indian Institute of Management (IIM) Raipur during February 11-15, 2019.
- Attended a AICTE workshop on "Examination Reforms" on February 01, 2019 at COEP Pune.
- Attended the inaugural conference on "Mathematics Teacher Association" during January 03-05, 2019 at the Homi Bhabha Centre Science and Education, Mumbai.

Lectures Delivered

- Invited to give a series of lectures on "SageMath for teaching and research" in a faculty development programme on "Applications of Mathematical Software in Teaching and Research" at KTMH College, Nashik on June 28, 2019.
- Invited to give a course of lectures on "Foundations" in the Mathematics Training and Talent Search (MTTS) Programme during May 20 to June 01, 2019 at Regional Institute of Education, Ajmer.
- Invited to give a lecture on "Clustering Techniques" in a RUSA Short Term course at HRDC, University of Mumbai on April 10, 2019.
- Invited to conduct a faculty training programme on "Python

Programming Language" at the DBT Star College Scheme at the Ramnarain Ruia College, Mumbai during January 17-19, 2019.

- Invited lectures (Four lectures) on "SVD and PCA with Sage and Hands on" in a STTP programme at K. J. Somaiya College Of Engineering, Mumbai on January 10 and 12, 2019.
- Invited to give lectures on "Introduction to Python" in the per-conference workshop of "55th Annual Conference of Indian Economics Society" on January 07, 2019 at the National Institute of Security Market (NISM), Patalganga, Navi Mumbai.
- Invited to conduct a workshop on "Modeling with Spreadsheet" in the inaugural conference on "Mathematics Teachers Association" during January 03-05, 2019 at the Homi Bhabha Centre Science and Education, Mumbai.
- Invited to give 4 lectures and hands on Introduction to Sage, in a national workshop on "Free and open Source for Teaching and Research" at SRTM, Nanded during December 28-29, 2018.
- Invited to give 5 lectures on "Introduction to Sage" in a two days State Level Workshop on "Mathematical Software" held during on 14 - 15 Dec, 2018 at

MIT, Arts Science and Commerce College, Pune.

- Given a course of lectures in the mini-MTTS programme held at the IIT Mandi Mandi during Dec. 03-08, 2018.
- Given a course of lectures in the mini-MTTS programme held at the NES Ratnam College, Mumbai during Nov. 26- Dec. 01, 2018.
- Invited to give four lectures in a Faculty Development Program in "Analysis, Algebra and Sage software" during 15th - 17th November 2018 at RBVRR Women's College, Hyderabad.
- Invited to give three lectures in a national level Faculty Development Programme (FDP) on Innovative Teaching Skills in Mathematics, held at the Department of Mathematics, University of Pune on November 14-15, 2018.
- Invited to conduct a workshop on LaTeX at the R. Jhunjhunwala College Mumbai on Oct 19, 2018.
- A series of lectures on Applications of Linear Algebra at the Dept. of Mathematics, Devi Ahilya Vishwavidyalaya, Indore in a National Workshop on Algebra and Analysis held during Oct. 12-13, 2018.
- Invited to conduct a workshop on LaTeX at during a state level workshop on LaTeX at the HR

College, Mumbai on Sept. 08, 2018.

- A series of lectures "Introduction to R" at KBN College, Vijaywada during August 27-29, 2018.
- A series of lecture on SageMath and its application to Linear Algebra and Calculus during the UGC Refresher Course at the University of Hyderabad on July 23 and July 24, 2018.

EVENTS ORGANIZED AND RESPONSIBILITY (CONVENER /SECRETARY/ MEMBER):

- Organized a workshop on "3D Simplified Mathematics with Excel" in jointly with NES Ratnam College Mumbai and Dass Scientific Research Labs Pvt Ltd, Ahmedabad during June 24-26, 2019.
- Organized a workshop on "Deep Learning with Python" during December 17-19, 2018 at ICT Mumbai under TEQUIP-III.
- Organized as an academic coordinator, "mini-MTTS Programme" held at the NES Ratnam College Mumbai, during Nov. 26, 2018 to December 01, 2018.
- Organized as an academic coordinator, "mini-MTTS Programme" held at the Bhaskaracharya Pratisthana, Pune during Nov. 23-28, 2018.



DR. A. K. SAHU

M.Sc. (Utkal University), Ph.D. (IIT Bombay)

Professor

PROFILE:

After completing my PhD from IIT Bombay in 1991, I joined in Chemical Engineering department of ICT Mumbai as a PDF with Prof. J. B. Joshi. During my PDF, I was involved in various projects to simulate the one and two phase flow problems numerically using finite control volume method. Specifically, the main object was to obtain numerical solution to find the turbulent flow characteristics in baffle cylindrical vessel with axial flow impellers. In the year 1998, I joined in the Department of Mathematics, ICT Mumbai as an Associate Professor on temporary basis and got the permanent position in June 2004. From the first day of my joining, I was heading the Department of Mathematics till November 2018. During this time I was member of various in-house committees. I had got a project from IGCAR in 2007 and it was completed successfully in 2012. Further, through CAS I become professor in 2016.

SUBJECTS TAUGHT:

M.Sc. in Engineering Mathematics:

- Software Lab-II
- Numerical method-I
- Numerical method – II
- Finite element method.

RESEARCH INTERESTS:

- CFD, Mathematical modeling
- Momentum and heat transfer in Non-Newtonian fluids and Nanofluids

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

- My basic research interest is in the field of Computational fluid dynamics (CFD), numerical methods and mathematical modeling. In case of CFD, the thrust is giving to simulate turbulent flows for some realistic problems using latest turbulent models and numerical techniques. As it is known that for turbulent flows, the governing equations for a given problem are highly nonlinear and it is impossible to obtain an analytical solution. Therefore, the emphasis is given to use efficient numerical techniques such as: finite volume, initial value and finite difference methods to obtain the numerical solutions. Grid generation is also an important aspect of the numerical techniques and emphasis is also given for this. Mostly for turbulent flows, the problems are chosen related to axial flow impeller, thermal stratification in molten sodium

pool, flow inside a cavity etc.

- At present, it is observed that nanofluids are gaining importance in thermal engineering due to its improving thermo-physical properties such as thermal conductivity, thermal diffusivity, viscosity and convective heat transfer. Hence, its importance in forced, mixed and natural convection is being studied. It has also been observed that nanofluids have very good heat transfer enhancement properties.

PUBLICATIONS:

(peer reviewed) so far : 09

- Effect of viscous dissipation on finding dual solutions for mixed convection boundary layer flow for nanofluid- S. Maji and A.K.Sahu. Heat Transfer—Asian Research, Wiley. Accepted. (DOI: 10.1002/htj.21512), 2019.

CONFERENCE PROCEEDINGS/PAPERS: 10

SEMINARS/LECTURES/ORATIONS DELIVERED: 11

Ph.D.S AWARDED AS SINGLE/CO-GUIDE: 01

MASTERS AWARDED AS SINGLE/CO-GUIDE: 1

POST GRADUATE THESIS SUPERVISION: 05

No.	Name of the Student	Topic
1.	Khan M. M. Zeenat	Numerical Solution of Heat and momentum transfer problems
2.	Khan Anjum	Numerical Solution of steady state Heat Diffusion Problem
3.	Bhattacharya Ishika	Numerical Solution of steady state Heat Diffusion Problem
4.	Talkar A. Akshata	Numerical Solution of Heat and momentum transfer problems

MEMBERSHIP OF IN-HOUSE COMMITTEES

- UGPC and PGPC
- Academic Council
- MIS Committee (TEQIP-II)
- Steering committee of COE (TEQIP-II)
- Examination Committee



DR. AKSHAY S. RANE

M.Sc. (Mumbai University), Ph.D. (IIT Bombay)

UGC Assistant Professor

Ex Assistant Professor, Department of Mathematics, BITS Pilani, KK Birla Goa Campus.

PROFILE:

Dr. Akshay Sakharam Rane had his schooling and education from Mumbai. He obtained B.Sc. from D. G. Ruparel College from the University of Mumbai. He did M.Sc. from the Department of Mathematics of the University of Mumbai. He has secured first rank and gold medal at both the B.Sc. and M.Sc. degree examinations. He received the NBHM fellowship during his M.Sc. He did his Ph.D. from the Department of Mathematics, Indian Institute of Technology, Bombay. He received the Charpak fellowship to do a part of his research in France and was also awarded the Best student amongst the Ph.D. students at IIT Bombay in the annual convocation. He has been a research associate at the Center

for Excellence in Basic Sciences in Mumbai for about 9 months. He has been a post doctoral student at Jean Monnet University of Saint Etienne, France under an Indo-French project. He has been an assistant professor at Institute of Chemical Technology Mumbai for a couple of years. Then he joined the Department of Mathematics, BITS Pilani, Goa as an assistant Professor. He rejoined ICT as UGC-assistant professor. His research area is Numerical Functional Analysis, Spectral Approximation and Operator theory. He has 7 publications in international journals.

SUBJECTS TAUGHT:

M.Sc. in Engineering Mathematics:

- Advanced Calculus

- Advanced Analysis
- Applied Functional Analysis
- Complex Analysis

RESEARCH INTERESTS:

- Numerical Functional Analysis
- Spectral Approximation
- Operator theory

PUBLICATIONS:

International (peer reviewed) so far: 7

CONFERENCE PROCEEDINGS/PAPERS: 03

SEMINARS/LECTURES/ORATIONS DELIVERED: 03

POST GRADUATE THESIS SUPERVISION: 06

H-INDEX: 2

CITATIONS: 11

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

Operator equations and eigenvalue problems occur in many physical and engineering applications and quite often are not exactly solvable. Hence approximate solutions are required. Once asymptotic series expansions of approximate solutions are established extrapolation can be used to increase the orders of convergence of the approximate solutions. We have obtained asymptotic expansions of approximate solutions of operator equations and eigen elements associated with integral operators with non-smooth or Green's kernel. The operator approximations considered are the classical Nystrom operator, collocation operator and iterated Galerkin operator. These results are extended to nonlinear Hammerstein equations. We have also studied a modified projection method which has proved to be better than the classical Nystrom and projection methods. Asymptotic series were also obtained for integral

operators with weakly singular periodic kernel. Asymptotic series for simple eigenvalues of integral operator associated with Galerkin projections were considered. Proving the existence of asymptotic series expansion was challenging as the earlier tools failed. Eigenvalues with multiplicity 1 required different treatment with product and adjoint spaces setting. Numerical results confirmed the theoretical predictions.

SPECIAL AWARDS/ HONOURS:

- Received DST Travel grant to present paper at University of Brighton, U.K in 2018
- Gave an invited lecture at St. Xavier's college, Mumbai.
- Gave a series of lectures in "Analysis" for M.Sc. and M.Phil/ Ph.D. lectures in the university of Mumbai

SEMINARS / LECTURES / CONFERENCES / SYMPOSIA / WORKSHOPS / SUMMER OR WINTER TRAINING SCHOOLS ATTENDED/ ORAL OR

POSTER PRESENTATIONS:

- Resource person at a DST Pursue Funded workshop "A glimpse into Higher Mathematics" conducted in the Department of Mathematics at University of Mumbai from 11th February 2019 to 16th February 2019.
- Undertook research visit to NITTTTR Bhopal during 5th February to 8th February 2019 and also gave an invited talk.
- Gave a contributed talk at the 15th International Conference on Integral Methods in Science and Engineering, held at University of Brighton, in July 2018.
- Undertook research visit to BITS Pilani, KK Birla Goa campus during November 2018.
- Presented a paper at the Symposium held at IIT Bombay during 4th January 2018 -6th January 2018.

which motivated me into shifting my focus from pure mathematics to applied mathematics problems. After completion of my Ph.D. in early 2013, I worked in prestigious positions such as the Institute Post-doctoral fellow at the Department of Mathematics, Indian Institute of Technology – Bombay on Inverse Problems' theory, and as a Airbus Prize post-doctoral fellow at TIFR's International Centre for Theoretical Sciences, Bangalore on Turbulence and Statistical Physics. From my research experience during my doctoral and post-doctoral stints, I have published extensively in leading international journals such as Physics of Fluids, Journal of Fluids & Structures, and Proceedings of the Royal Society; and presented my group's research work in several national international conferences conducted by societies such as

Euromech, IUTAM, ERCOFTAC, NBHM. Subsequently I secured a faculty position at the Institute of Chemical Technology, Mumbai under the UGC Faculty Recharge Programme in end 2016 along with a start-up research grant – being one among almost 100 candidates from all over India.

SUBJECTS TAUGHT:

B. Chem. Engg.

- Applied Mathematics I
- Applied Mathematics II

M.Sc. in Engineering Mathematics:

- Momentum, Heat & Mass transfer
- Computational Fluid Dynamics
- Number Theory

RESEARCH INTERESTS:

- Fluid mechanics (theoretical and computational) and applications to flight optimization through

fluid-structure interaction and collective aerodynamics;

- Non-linear dynamics and reduced-order modelling of expensive computational fluid-dynamical models;
- Statistical analysis of turbulence and applications to hydromechanics equations;
- Regularization of ill-posed problems with applications to Inverse problems and parameter identification.

PUBLICATIONS:

International (peer reviewed) so far: 06

CONFERENCE PROCEEDINGS/ PAPERS: 05 (1 Book Chapter)

SEMINARS/LECTURES/ORATIONS DELIVERED: 04

POST GRADUATE THESIS SUPERVISION: 04

POST GRADUATE STUDENTS' SEMINARS/PROJECTS:

No.	Name of the Student	Topics
1.	Iffat Fatima Razi Ahmed	Nonlinear dynamics for the development of reduced-order models for aerodynamic applications.
2.	Rasika Vijay Mhatre	Reduced-order models for the nonlinear aerodynamic forces on an aerofoil.
3.	Shreya Anil Kelkar	Development of nonlinear reduced-order models for aerodynamics problems.
4.	Vrushali Sitaram Satpute	Nonlinear dynamics: Applications for development of reduced-order models for aerospace applications.

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

My major research interests lie in the area of fluid mechanics, non-linear dynamics and inverse problem theory applied to parameter identification. During my Ph.D., I worked on the computational as well as theoretical modelling of flows around moving immersed boundaries, and how this knowledge can be useful in solving engineering problems in fluid-structure

interaction. Specifically, applications of this research include the flow around a bluff body that is coated with a layer of poro-elastic feathers which has interesting implications for efficient aerodynamics. Among many salient features, such aerodynamic efficiency leads to lift-vs-drag ratio optimization as well as noise reduction, all of which have applications in the design of small and silent Unmanned Aerial Vehicles (UAVs) which are very useful in

military reconnaissance operations. Some of these problems, that involve very expensive computational resources, can also be effectively investigated using methods of reduced-order modelling, wherein some key features of the ambient flows are captured using inexpensive and highly efficient low-order non-linear dynamical models. This whole work was very well received and was published, at various stages, in prestigious journals such



DR. V. DIVYA

M. Math. (ISI Bangalore), Ph. D. (University of Genoa, Italy)

UGC Assistant Professor

PROFILE:

I am currently working as a UGC Assistant Professor in the Department of Mathematics, ICT Mumbai. I did my B. Sc. (Honours) in Mathematics from St. Stephen's college (University of Delhi) in 2005

followed by M. Mathematics from the Indian Statistical Institute (ISI) – Bangalore in the year 2007. Prior to joining for my doctoral work in Fluid Dynamics at the University of Genoa – Italy (which was fully funded and with full tuition-fee

waiver), I briefly worked as a research assistant at the Bangalore Centre for Applicable mathematics of Tata Institute of Fundamental Research (TIFR) on Adjoint Problem formulation of Differential equations and their Computational modelling,

as Physics of Fluids (published by the American Institute of Physics) and Journal of Fluids & Structures (Elsevier) as well as a popular Italian science magazine. This work was also presented on many international platforms such as the World Congress on Biomechanics (in Singapore), European Mechanics Society Fluid Mechanics Conference (in Germany), International Union of Theoretical and Applied Mechanics (IUTAM) Symposium (in India), European Research Community on Flow, Turbulence and Combustion (ERCOFTAC) Symposium (in Greece) and American Physical Society (APS) annual meeting (in the US) – with a dedicated book chapter in Proceedings of the ERCOFTAC symposium held at Greece.

During my post-doctoral work, I was also involved with statistical analysis of turbulence and its applications to hydromechanics, along with an indirect extension of my Ph.D work to the phenomenon of flocking in bird flight which has positive implications in group aerodynamics optimization. A thorough understanding of the mathematical and physical nature of the equations of hydromechanics and turbulence yields deep insights into the million-dollar problem of the solvability of the Navier-Stokes equations for modeling fluid flow. An overview of this work was presented at the Indian Women in Mathematics (IWM) conference in Delhi. I have peer-reviewed publications in these two areas also, in Europhysics letters and Proceedings of the Royal Society. I have also briefly worked

in some mathematical aspects of projection regularization theory and its applications to inverse problems and parameter identification.

DETAILS OF SPONSORED PROJECTS

UGC-FRP Start-up research grant, University Grants Commission, Delhi, 2 years, Rs. 6,00,000/-

DETAILS OF NATIONAL AND INTERNATIONAL COLLABORATIONS:

National Collaboration:

- Prof. Neela Nataraj, Department of Mathematics, Indian Institute of Technology – Bombay;
- Prof. Samridhi Sankar Ray, International Centre for Theoretical Sciences, Tata Institute of Fundamental Research, Bangalore.

International Collaboration:

- Prof. Alessandro Bottaro, Department of Civil, Chemical & Environmental engineering, University of Genoa, Italy.

MEMBERSHIP OF IN-HOUSE COMMITTEES

- Department Course Co-coordinator, Department of Mathematics, ICT – Mumbai: UG & PG programmes offered by the department (July 2018 – till date).
- In-charge of Co-curricular & Extra-curricular activities for students of Mathematics department.
- Member, Department Safety committee.

SEMINARS / LECTURES / CONFERENCES / SYMPOSIA /WORKSHOPS / SUMMER OR WINTER TRAINING SCHOOLS ATTENDED/ ORAL OR POSTER PRESENTATIONS:

- Participated in Workshop on “Outcome based Education Training” under the TEQIP-III twinning program – 1st October 2018, Institute of Chemical Technology – Mumbai.
- Participated in Continuing Education Programme (CEP) course on “Big Data, Bioinformatics & Proteomics” – 5th to 8th March 2019, Indian Institute of Technology – Bombay.
- Attended Indian Women and Mathematics Annual Conference 2019 organized by DAE’s National Board for Higher Mathematics and the International Mathematical Union’s (IMU) Committee for Women in Mathematics – 10th to 12th June 2019, Department of Mathematics, Indian Institute of Technology – Bombay.
- Participated in Workshop on “3D Simplified Mathematics with Excel” organized by the Department of Mathematics & Statistics, NES Ratnam College of Arts, Science & Commerce; Department of Mathematics, Institute of Chemical Technology – Mumbai; and Dass Scientific Research Labs Pvt. Ltd, Ahmedabad – 24th to 26th June 2019, Institute of Chemical Technology – Mumbai.



DR. STUTI BORGOHAIN

M.Sc. (Tezpur Central University, Assam)

Ph. D. (Institute of Advanced Study in Science and Technology (IASST), Guwahati, Assam)

Assistant Professor

PROFILE:

I am currently working as an Assistant Professor in the Department of Mathematics, ICT Mumbai. I did my MSc from Tezpur Central University, Assam in the year 2004. I completed my PhD under a UGC sponsored project in 2012 under the supervision of Prof. Binod Chandra Tripathy from Institute of Advanced Study in Science and Technology, an autonomous DST funded multi-disciplinary research institute in North East (located in Guwahati). I received DST Women Scientists-A fellowship in 2009 for three years to continue my research works which I successfully completed at the Department of Mathematics, IIT Bombay under the supervision of Prof. Inder Kumar Rana. After that I got the NBHM Post Doctoral Fellowship which I again completed in the Department of Mathematics, IIT Bombay.

Meanwhile I got the chance to work with Prof. Ekrem Savas (Turkey) and Prof. Adem Kilicmen (Malaysia) and visited their Universities several times. I received the prestigious Tubitak Fellowship (Short term) also to work in Turkey.

My main research interest is Sequence Spaces and Summability Theory and Fuzzy Mathematics. After

joining in ICT, I grew up an inclination towards the subject Artificial Intelligence and Machine Learning too. I have started working on these subjects using the concept of fuzzy mathematics and python language. One undergraduate Summer Intern (DST Inspire Fellow, IISER Tirupati) has worked with me with these problems and we are planning to work further on some specific Artificial Intelligence Problems using the concept of Fuzzy Mathematics and developed them in Python language.

PROFESSIONAL ACTIVITIES (MEMBERSHIP OF IMPORTANT COMMITTEES):

- Life Member of the Art Society of India

JOURNAL REVIEWER:

- Mathematical Reviews USA (Reviewer Number: 104677)
- Annals of Fuzzy Mathematics and Informatics (AFMI)
- Brazilian Journal of Science and Technology
- Mathematical & Computational Applications
- Calcutta Mathematical Society
- Proyecciones Journal of Mathematics
- American Mathematical Monthly

SUBJECTS TAUGHT:

B. Tech. and B. Chem. Engg.

- Applied Mathematics – I
- Applied Mathematics-II
- Computer Applications Lab

M.Sc. in Engineering Mathematics:

- Differential Equation - I
- Differential Equation - II

RESEARCH INTERESTS:

- Sequence Spaces and Summability Theory
- Fuzzy Mathematics
- Measures of Non-compactness

PUBLICATIONS:

International (Peer reviewed) so far: 18

- Stuti Borgohain, On new f-statistical convergence in probabilistic normed spaces. New Trends in Mathematical Sciences, 6(3), 181-188, 2018

CONFERENCE PROCEEDINGS/ PAPERS: 2

SEMINARS/LECTURES/ORATIONS DELIVERED: 20

H-INDEX: 5

CITATIONS: 135

JOURNAL REVIEWER : 7

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

My Research area is Sequence Spaces and Summability Theory, Fuzzy mathematics, Measures on Non-compactness etc. We worked on different sequence spaces of fuzzy real numbers defined by Orlicz functions and studied some of their topological properties as well. We introduced some new difference sequence spaces related to I_p space and examined some of their topological properties like solidness, symmetricity, convergence-free etc.

Later on, some statistically convergent difference sequence spaces were also introduced and examined as well. Also some inclusion results of these spaces were established during our PhD work. Moreover, we have worked out on some new sequence spaces of fuzzy real numbers defined by Orlicz functions which are examined with respect to the fuzzy metric. Besides, some new generalized difference Cesaro sequence spaces of fuzzy real numbers defined by Orlicz functions are also studied in various aspects.

After that we worked on n -normed sequence spaces in various aspects and found new results in terms of fuzzy real numbers with respect to Orlicz functions and statistical convergence as well.

Currently we are working on f -statistical convergence on probabilistic normed linear space. We find some results in probabilistic normed linear space and applied the Tauberian conditions on these sequence spaces. We also study on μ -statistical convergence in fuzzy real numbers. Moreover at present our works on sliding window convergence, measurable functions

and on its different applications are going on.

SPONSORED PROJECTS:

- DST, Govt of India (SR/WOS-A/MS-07/2008). Studies on the Class of n -normed Sequence Spaces Related to I_p Space. Rs. 810,000/- . Three Years. Acted as Principal Investigator.
- NBHM (DAE, Govt of India) (NBHM/PDF.50/2011/64). Convergent and Statistically Convergent Sequence spaces of Fuzzy Real Numbers defined by Orlicz Functions. Three Years. Rs. 1,042,800 /-. Acted as Principal Investigator.

DETAILS OF NATIONAL AND INTERNATIONAL COLLABORATIONS:

National Collaboration:

- Prof. Binod Chandra Tripathy, Tripura University, Tripura, India
- Prof. Inder Kumar Rana, Indian Institute of Technology, Bombay, India

International Collaborations:

- Prof. Ekrem Savas, Istanbul Ticaret University, Istanbul, Turkey
- Prof. Adem Kilicmen, University Putra Malaysia, Malaysia.
- Dr Mehmet Kucukaslan, Mersin University, Turkey

SEMINARS / LECTURES / CONFERENCES / SYMPOSIA / WORKSHOPS / SUMMER OR WINTER TRAINING SCHOOLS ATTENDED/ ORAL OR POSTER PRESENTATIONS:

Conference/Workshop Attended

- National Symposium on Applications of Mathematics in Science and Engineering, 2019

(March 29-March 30), Veermata Jijabai Technological Institute (VJTI), Matunga, Mumbai : 400019, Maharashtra, India

- Short Term Training Program on Fuzzy Sets and Applications, 2018 (November 9-10), SRM University, Chennai, India.
- Attended Indian woman and mathematics annual conference during June 10-12, 2019 at IIT Bombay

EVENTS ORGANIZED AND RESPONSIBILITY (CONVENER /SECRETARY/ MEMBER):

- Organized a workshop on "3D Simplified Mathematics with Excel" jointly with NES Ratnam College Mumbai and Dass Scientific Research Labs Pvt Ltd, Ahmedabad during June 24-26, 2019.
- Organized one Art and Craft Exhibition entitled as "Mathematics Used in Nature" at the Department of Mathematics, Institute of Chemical Technology, Mumbai at the First Alumni Meet of Mathematics Department, on 9th February 2019 at ICT itself.
- Organized the Art ICT'2019, an Art festival organized by ICT Art Club under Technological Association. This time the event was in collaboration with Department of Mathematics from 4th April 2019 to 5th April 2019 where Mr. Vikrant Shitole, Hon. Secretary of The Art Society of India and Miraculous Speed Painter Rabin Bar were the Chief Guests.



PROFILE:

I am currently Assistant Professor in the Department of Mathematics in Institute of Chemical Technology, Mumbai, India. I received my Bachelor's Degree from Presidency College, Kolkata with Honours in Mathematics (Physics and Chemistry minor) in 2006. I completed Master's in Applied Statistics and Informatics from Indian Institute of Technology, Mumbai (IIT Bombay) in 2008. Prior to joining the Ph.D. program, I had worked as a Statistician in the Cytel Statistical Software Services Pvt. Ltd. Then I joined the Ph.D. program in 2010 in the Agricultural and Ecological Research Unit, Indian Statistical Institute, Kolkata CSIR JRF. I received the Ph.D. degree from the University of Calcutta, Kolkata in Applied Mathematics in 2016.

Soon after submitting my thesis, I joined as an assistant professor in the Department of Mathematics, Institute of Chemical Technology, Mumbai. I have been actively carrying out research in the field of Mathematical Biology and Applied Statistics. My primary research interest includes the application of growth models in biological research, empirical assessment of population dynamics with potential application in ecology and conservation biology. I have several publications in leading international journals in the broad area of

DR. AMIYA RANJAN BHOWMICK

M.Sc. (IIT Bombay), Ph. D. (Calcutta University)

Assistant Professor

Mathematical Biology and Statistics. I am also a regular reviewer of some leading international journals. Apart from the research work I am actively involved in teaching Mathematics at undergraduate level and Statistics and Machine Learning courses at post-graduate level.

PROFESSIONAL ACTIVITIES:

- Life time Member of the Biomathematical Society of India

SUBJECTS TAUGHT:

B. Tech.

- Applied Mathematics – I
- Applied Mathematics-II

M.Sc. in Engineering Mathematics:

- Applied Statistics-I
- Applied Statistics-II
- Advanced Real Analysis
- Machine Learning

RESEARCH INTERESTS:

- Bayesian Statistics with Application in Ecology
- Species Distribution Modelling
- Statistical Inference on Biological Growth Models
- Stochastic Population Dynamics

PUBLICATIONS:

International (peer reviewed) so far: 21

National (peer reviewed): 1

- Bhowmick, A. R., Sardar, T. and Bhattacharya, S. Estimation of growth regulation in natural populations by extended family of growth curve models with

fractional order derivative: Case studies from the global population dynamics database. 2019 (In Press, Ecological Informatics, Elsevier)

- Mukherjee, A., Bhowmick, A. R., Mukherjee, J. and Moniruzzaman, M. Physiological response of fish under variable acidic conditions: A molecular approach through the assessment eco-physiological marker in the brain. 2019 (Accepted in Environmental Science and Pollution Research) (Springer, I. F. 2.8)
- Chakraborty, B., Bhowmick, A. R., Chattopadhyay, J. and Bhattacharya, S. A Novel Unification Method to Characterize a Broad Class of Growth Curve Models using Relative Growth Rate. 2019 (Accepted in Bulletin of Mathematical Biology, Springer, I.F. 1.85)
- Mukherjee, S., Bhowmick, A. R., Ghosh, P. B. and Ray, S. Impact of Environmental Factors on the Dependency of Litter Biomass in Carbon Cycling of Hoogly Estuary, India. Ecological Informatics, Vol 51, pp 193-200, May, 2019 (Elsevier, I.F. 2.12).
- Iyer, S. Banerjee, A. K. and Bhowmick, A. R.* Making Choices that Matter - Use of Statistical Regularization in Species Distribution Modelling for Identification of Climatic

Indicators - A Case Study with Mikania Micrantha Kunth in India. Ecological Indicators, Vol 98, pp 92-103, March 2019 (Elsevier, I.F. – 4.039).

- Banerjee, A., Chakrabarty, M., Rakshit, N., Bhowmick, A. R. and Ray, S. Environmental factors as indicators of dissolved oxygen concentration and zooplankton abundance: Deep learning versus traditional regression approach, Ecological Indicators, Vol 100, pp

99-117, May 2019 (Elsevier, I.F. –4.39).

- Pal, A., Bhowmick, A. R., Yeasmin, F, and Bhattacharya, S. Evolution of Model Specific Relative Growth Rate: Its Genesis and Performance Over Fisher's Growth Rates. Journal of Theoretical Biology (2018) (doi: 10.1016/j.jtbi.2018.02.012) Vol-444, pp 11-27 (I.F. – 2.260)

CONFERENCE PROCEEDINGS/

PAPERS: 1

SEMINARS/LECTURES/ORATIONS DELIVERED: 28

POST GRADUATE THESIS SUPERVISION: 03

H-INDEX: 8

CITATIONS: 161

POST GRADUATE PROJECT SUPERVISION: 06

Ph.D. PROJECT SUPERVISION: 01 (ongoing)

POST GRADUATE STUDENTS' SEMINARS/PROJECTS:

No.	Name of the Student	Topics
1.	Dipali Vasudev Mestry	Estimation of Parameters in Population Dynamics Models using Grid Approximation: A Bayesian Approach
2.	Rahul Chandraprakash Pal	Natural Language Processing Using Python
3.	Keshavarao Boosayya Entenika	Natural Language Processing Using Python
4.	Khsitij Anand Patil	Uncertainty Modelling Using Polynomial Chaos in Spatial Population Dynamical System
5.	Jyoti Jagdish Prajapati	Modeling Species Distribution Using Python
6.	Nilesh Naganath Kokate	Data Analysis using Principal Component Regression and Factor Regression using Python

HIGHLIGHTS OF RESEARCH WORK DONE AND ITS IMPACT:

- Research on Species Distribution Modelling and Identification of Climatic Indicators for Rapid invasion of the Invasive Plant: Mikania micrantha

Biological invasions by alien non-indigenous species are one of the major problems of the present era which impose massive environmental and socio-economic costs. In India about 40% of the floral species have long been recognized to be aliens, but the need for priority conservation efforts has only been felt since the turn of the century. Thus, it is now of utmost importance to predict

the potential distribution of invasive alien species and identify suitable environmental conditions that allow the species to spread rapidly.

The perennial vine *M. micrantha* has been reported to be a serious pest in plantation crops (e.g. tea, teak, rubber, oil palm, and banana) and commercial forests in its invaded range. Huge economic losses have been incurred in the countries where it invades such as China, India, Malaysia, Nepal and Papua New Guinea. In this context, mapping the potential distribution of this species may provide important insights about its invasive potential. Species Distribution models (SDMs) have been utilized to integrate the

environmental information with the evidence of occurrence or abundance data of the species.

To predict the potential distribution, species distribution models (SDMs) were built by using logistic regression and the climatic variables were chosen by using two cross-validated regularization methods induced by least absolute shrinkage and selection operator (lasso) and the ridge penalty function. This approach has twofold benefits; it deals with the multicollinearity problem efficiently and selects the raw environmental covariates. F-score was utilized to measure the models' performance. Combining the data from both native and

alien ranges, seven environmental predictors were selected using four different background choices. Using lasso penalty, mean diurnal range (mean of monthly (max temp – min temp)) (BIO2), Isothermality (BIO2/BIO7) ($\times 100$) (BIO3), Temperature Annual Range (BIO5-BIO6) (BIO7), Precipitation of Wettest Month (BIO13), Precipitation Seasonality (Coefficient of Variation) (BIO15) and Precipitation of Warmest Quarter (BIO18) were found to be strong correlates for all four backgrounds. The predicted probabilities from the model containing these seven selected variables, demonstrated higher invasion risk in the central part of India than the model containing all the predictors.

- A Novel Unification of Growth Curve Models Using Relative Growth Rate

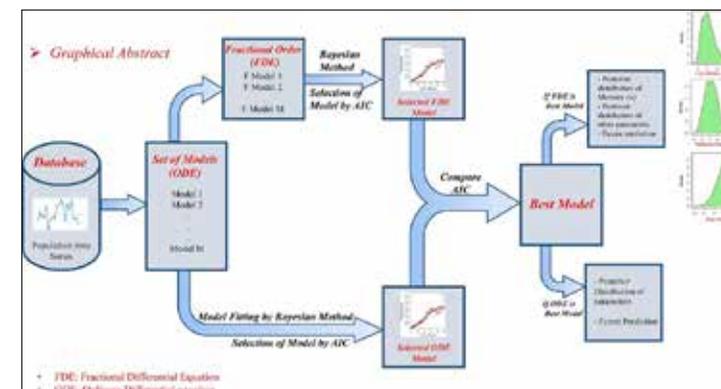
Growth curve models serve as the mathematical framework for the quantitative studies of growth in many areas of applied science. The evolution of novel growth curves can be categorized in two notable directions, namely generalization and unification. In case of generalization, a modeler starts with a simple mathematical form to describe the behavior of the data and increases the complexity of the equation by incorporating more parameters to obtain a more flexible shape. The unification refers to the process of obtaining a compact representation of a large number of growth equations. An enormous number of growth equations are made available in the literature by means of the generalization of existing growth laws. However, the unification of growth equations has received relatively less attention from the researchers.

Existing unification approaches are found to have limited applications if the growth equation is characterized by the relative growth rate (RGR). RGR has immense practical value in biological growth curve analysis, which has been amplified by the construction of size and time covariate models, in which; RGR is represented either as a function of size or time or both. We have proposed a novel unification function for the RGR growth curves. The proposed function combines a broad class of the growth curves and possesses a greater generality than the existing unification functions. We also proposed the notion of generalized RGR, which is capable of making interrelations among the unifying functions. Our proposed method is expected to enhance the generality of software and may aid in choosing an optimal model from a set of competitor growth equations.

- Use of Fractional Differential Equations in Population Dynamical Systems

Estimating the trend in population time series data using growth curve models is a central idea in population ecology. Several models, mainly governed by differential or difference equations, have been applied to real data sets to identify general growth pattern and make predictions. In this article,

we analyze ecological time series data by fitting mathematical models governed by fractional differential equations (FDE). The order of the FDE (α) is used to quantify the evidence of memory in the population processes. The application of FDE is exemplified by analyzing time series data on two bird species *Phalacrocorax carbo* (Great cormorant) and *Parus bicolor* (Tufted titmouse) and two mammal species *Castor canadensis* (Beaver) and *Ursus americanus* (American black bear) extracted from the global population dynamics database. Five different population growth models were fitted to these data; density-independent exponential, negative density-dependent logistic and θ -logistic model, positive density-dependent exponential Allee and strong Allee model. Both ordinary and fractional derivative representations of these models were fitted to the time series data. Markov chain Monte Carlo (MCMC) method was used to estimate the model parameters and Akaike information criterion was used to select the best model. By estimating the return rate for each of the time series, we have shown that populations governed by FDE with a small value of α (high level of memory) return to the stable equilibrium faster. This demonstrates a synergistic interplay between memory and stability in natural populations.



MEMBERSHIP OF IN-HOUSE COMMITTEES

- Department TEQIP Coordinator, Department of Mathematics, ICT Mumbai (March, 2019 – Till Date)
- In-charge of Students Training, Placement and Alumni Affairs, Department of Mathematics, ICT Mumbai

SEMINARS / LECTURES / CONFERENCES / SYMPOSIA /WORKSHOPS / SUMMER OR WINTER TRAINING SCHOOLS ATTENDED/ ORAL OR POSTER PRESENTATIONS:

Conference/Workshop Attended

- International Conference on Applied and Computational Mathematics (ICACM – 18) (Nov 23-25, 2018) organized by the Department of Mathematics, IIT Kharagpur. Delivered talk in contributory session entitled "Estimation of Parameters in Population Dynamic Models Using Gibbs Sampling Approach: An application to theta-logistic model".

Invited Lectures delivered

- Resource Person in the "Workshop on Statistical Methods in Biological Data Analysis Using R Programming" organized by the Department of BioEngineering, BIT Mesra on 15th April 2019. This workshop was organized under the Twinning Activities under TEQIP-III.

- Resource Person in the "Data Analysis and Statistical Techniques using R" for College teachers in Goa, a state level workshop organized by the Department of Mathematics, Dhemp College, Goa during 15th - 16th March 2019. The workshop was sponsored by the Department of Science and Technology, Govt. of Goa
- Invited Speaker in the International Conference, 6th India Biodiversity Meet-2019 organized by the Agricultural and Ecological Research Unit, Indian Statistical Institute, Kolkata during 14-16th February, 2019. Title of the Talk: Estimation of Parameters in Population Dynamic Models Using Grid Approximation: A Bayesian Approach.
- Resource Person in the "Workshop on Biological Growth Curve Models in Population Dynamics Using R for Biologists" organized by the Agricultural and Ecological Research Unit, Indian Statistical Institute, Kolkata, India during 12-13th February, 2019. (Pre-conference workshop of IBM 2019, ISI Kolkata)
- Resource person to deliver an introductory lecture on "Probability Distribution and Engineering Applications" for the students of Instrumentation Engineering at RAIT - Ramrao Adik Institute of Technology, Navi Mumbai on 8th February 2019.
- Resource person for STTP on Linear Algebra, Statistics and Mathematical Modeling: Hands on organized by the K. J. Somaiya College of Engineering, Vidyavihar during 8th – 12th Jan 2019. (Delivered three sessions on Multiple Linear Regression and ANOVA on 8th and 9th Jan 2019)
- Resource person in the Workshop on Species Distribution Modelling using MaxEnt and R (Chapter -II) during December 3-9, 2018 organized by the Agricultural and Ecological Research Unit, Indian Statistical Institute, Kolkata. (Contents uploaded: <https://sites.google.com/site/amiyaiitb/research/ecological-niche-modelling>)
- Resource person in the Workshop on "MATLAB and R Training" during 10th-11th July 2018 organized by CPEPA, University of Calcutta.

EVENTS ORGANIZED AND RESPONSIBILITY (CONVENER /SECRETARY/ MEMBER):

- Coordinator of the Workshop of Deep Learning Using Python organized by the Department of Mathematics, Institute of Chemical Technology, Mumbai during 17th -19th December, 2018. This program was supported by TEQIP-III.
- Coordinator of the Friday Talk Series organized by the Department of Mathematics under TEQIP-III.

SUPPORT STAFF



C. R. BORADE
Lab attendant
(Received Gunavant Karmachari Puraskar, 2019)



GOVIND JOGALE
Lab attendant