ACADEMIC REVIEW

for the period

April 2006 – March 2011

Department of Mathematics
Indian Institute of Science
Bangalore

May 13, 2011

Prepared by
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Contents

1 About the Department

1.1 Institute and Department background

Indian Institute of Science was set up in 1909 as envisaged by J N Tata as an institute of higher learning, pursuing excellence in research and education in science and engineering. The Institute is probably the oldest and the finest institution of its kind in India. On one hand, IISc is like a national laboratory where research gets a high priority. On the other hand, emphasis is also given to teaching (as in a university) and training younger generation of scientists and engineers, and initiating them in to a career in research.

The Department of Mathematics traces its beginnings to the fledgling Department of Applied Mathematics established in 1956. By the early 1950's, the Indian Institute of Science had begun to keenly feel the need for teaching mathematics to its postgraduate science and engineering students and, in January 1956, invited a young, but already well-known, mathematician as Professor of Applied Mathematics. This mathematician was P. L. Bhatnagar, whose work on the kinetic theory of gases would later come to be widely recognized as the influential BGK Model of gas dynamics. Owing to Bhatnagar's enthusiasm, research students from all across India were drawn to the Institute. This core group, specializing in the Kinetic Theory of Gases and Plasma Physics, soon became the nucleus of one of the most active applied-math departments in India. By the mid-1970's, the Department of Applied Mathematics had research groups working in Fluid Mechanics, Non-linear Waves and Shock Waves, Diffraction Theory, and in the mathematical aspects of General Relativity. In all these years, the department continued to live up to its initial mandate of providing mathematical training to students in the science and engineering programmes at the Institute.

In tune with changing trends, a programme of recruiting active mathematicians across a range of disciplines was begun in the mid-1980's. The late 20th century witnessed, in many of the strongest mathematical developments of that time, a gradual blurring of the boundaries between Pure and Applied Mathematics. In keeping with this trend, and to reflect the range of interests of its faculty, the department was renamed the Department of Mathematics in 1989. The department is today one of the leading centers of research in Mathematics and has the unique feature of having strong research programmes in both Applied and Pure Mathematics in one department. The department today has a widely respected research programme. Since the mid-1990's, the department has built up research groups in Combinatorial Topology; Commutative Algebra and Algebraic Geometry; Complex Analysis in Several Variables, and Complex Geometry; Harmonic Analysis; Low-dimensional Topology; Non-linear Dynamics; Operator Theory; Partial Differential Equations; and Stochastic Systems, Differential Games, and Stochastic Control. It has recently started - in collaboration with interested colleagues across several departments in the Institute - a major new initiative in Mathematical Biology. The department has a postgraduate programme offering the Ph.D. In addition, it runs an Integrated Ph.D. programme designed for students who have completed a Bachelors degree and intend to pursue research leading to a Ph.D

The department has been a pioneer in nurturing mathematics talent at the school level through the Mathematical Olympiad (MO) programmes since 1968. Since 1991, training programmes for the International Mathematical Olympiad (IMO) have been taking place in the Department of Mathematics as the nodal centre.

1.2 Scientific Staff in the Department

1.2.1 Faculty

Name, Designation	Qualification	Fields of Research Interest
Gautam Bharali Assistant Professor	Ph. D (Wisconsin)	Several Complex Variables
Tirthankar Bhattacharyya Associate Professor	Ph. D (ISI)	Functional Analysis
Basudeb Datta Professor	Ph. D. (ISI) FASc	Combinatorial and Piecewise Linear Topology
Siddhartha Gadgil Associate Professor	Ph. D. (Caltech)	Low-dimensional Topology, Mathematical Biology
Mrinal K. Ghosh Chairman, Professor	Ph. D. (TIFR-IISc) FASc, FNASc	Stochastic Processes, Applied Probability, Mathematical Finance
Thirupathi Gudi Assistant Professor	Ph. D. (IIT Mumbai)	Numerical Analysis, PDE
Srikanth K. Iyer Professor	Ph. D. (UC Santa Barbara)	Probability, Stochastic Processes, Statistics, Mathematical Finance
Manjunath Krishnapur Assistant Professor	Ph. D. (UC Berkeley)	Probability Theory
Gadadhar Misra Professor	Ph. D. (Stony Brook) FNA, FASc	Functional Analysis
A. K. Nandakumaran Professor	Ph. D. (TIFR-IISc)	PDE, Homogenization, Controllability, Computations
E. K. Narayanan Associate Professor	Ph. D. (ISI)	Harmonic Analysis
Dilip P. Patil Professor	Ph. D. (TIFR-BU)	Commutative Algebra, Algebraic Geometry
Govindan Rangarajan Professor	Ph. D. (Maryland) FASc, FNASc	Nonlinear Dynamics & Chaos, Time Series Analysis
Harish Seshadri Associate Professor	Ph. D. (Stony Brook)	Differential Geometry
S. Thangavelu Professor	Ph. D. (Princeton) FNA, FASc	Harmonic Analysis
Kaushal Verma Associate Professor	Ph. D. (Indiana)	Several Complex Variables

1.2.2 Honorary Professors

Name	Duration	Qualification	Fields of Research Interest
Phoolan Prasad	02.08.2006 – 31.07.2011	Ph. D. (IISc) FNA, FASc, FNASc	Nonlinear Waves, PDE, Fluid Mechanics

1.2.3 Affiliated Scientists

Name	Designation	Qualification	Fields of Research Interest
Mahesh Kumari	UGC Research Scientist C	Ph. D. (IISc)	Fluid mechanics, Heat & Mass Transfer
Phoolan Prasad	DAE Raja Ramanna Fellow	Ph. D. (IISc), FNA, FASc, FNASc	Nonlinear Waves, PDE, Fluid Mechanics
A. Sitaram	DAE Raja Ramanna Fellow	Ph. D. (Washington), FASc	Harmonic Analysis, Lie Groups
A. Chakrabarti	NASI Platinum Jubilee Fellow	D. Phil. (Calcutta), FNASc, FIMA, C.Math	Integral Equations, Diffraction Theory
R.L. Karandikar	Adjunct Faculty	Ph. D. (ISI), FNA, FASc	Stochastic calculus, Stochastic finance
M.S. Narasimhan	IMI Distinguished Associate	Ph.D. (Bombay), FRS, FNA, FASc, FNASc	Algebraic Geometry, Differential Geometry,
K. B. Sinha	IMI Distinguished Associate	Ph. D. (Rochester), FTWAS, FNA, FASc	Noncommutative Geometry
V. S. Borkar	IMI Distinguished Associate	Ph. D. (Berkeley), FNA, FASc	Stochastic Processes, Applied Probability

1.2.4 Visiting Professors

Name	Affiliation	Duration	Fields of Research Interest
K. B. Athreya	Iowa State University, USA	10.05.07–15.08.07, 15.01.09–15.03.09, 12.11.09–20.01.10	Stochastic Processes, Probability Theory
Marcus Kraft	TU Hamburg, Germany	01.06.07–31.08.07	Numerical analysis, Heat Transfer
Asha Rao	RMIT University, Australia	02.09.07–28.12.07	Combinatorics, Functional analysis
Uwe Storch	Ruhr-Universität Bochum, Germany	10.02.08–07.04.08, 09.11.09–23.12.09	Commutative Algebra, Algebraic Geometry
Rakesh	University of Delaware, USA	06.08.09–20.12.09	PDE, Functional Analysis
R.V. Ramamoorthi	Michigan State University, USA	19.01.10–18.01.11	Statistics

1.2.5 MO Cell Faculty

Name	Designation	Qualification	Fields of Research Interest
C. R. Pranesachar	Associate Professor, HBCSE, TIFR	Ph. D. (IISc)	Combinatorics
B. J. Venkatachala	Associate Professor, HBCSE, TIFR	Ph. D. (IISc)	Differential Equations

1.2.6 Post Doctoral Fellows/Research Associates

Name, Period	Qualification	Scholarship	Fields of Research Interest
D. Narayana 01.09.04 - 31.05.07	Ph. D. (Paris)	NBHM	Functional Analysis
Anuradha Narasimhan 01.7.05 - 31.7.06	Ph. D. (Pune)	IMI	Algebraic Number Theory
Sachi Srivastava 06.12.05 - 5.12.06	D. Phil (Oxford)	IISc	Functional Analysis
A. K. Upadhayay 06.12.05 - 31.12.06	Ph. D. (IISc)	NBHM	Combinatorial Topology
Karabi Sikdar 01.08.05 - 31.07.07	Ph. D. (IIT, KGP)	NBHM	Queueing Theory
Shrihari Sridharan 01.12.06 - 01.06.07	Ph. D (Manchester)	IMI	Complex Dynamics
Tejaswi Navilarekallu 19.01.07 - 18.01.08	Ph. D (Caltech)	IISc (CPDF)	Number Theory
P. Palaniyandi 01.02.07 - 15.08.07	Ph. D. (Bharathidasan)	DRDO	Nonlinear Dynamics
Anita Majumdar 01.09.04 - 31.08.08	Ph. D. (ISI)	NBHM	Algebraic Topology
V.V.K. Srinivas Kumar 01.01.05 - 30.06.08	Ph. D. (IIT, Kanpur)	DST	Scientific Computation
M. Muslim 01.09.06 - 31.08.08	Ph. D. (IIT, Kanpur)	NBHM	Differential Equations
T. Muthukumar 01.01.07 - 30.11.08	Ph. D. (Madras)	NBHM	Partial Differential Equations
Ranja Sarkar 24.02.09 - 30.09.09	Ph. D. (Pune)	DST	Mathematical Finance
C. Sudheesh 05.08.09 - 11.02.10	Ph. D. (IIT, Madras)	IISc	Dynamical System
S. C. Martha 01.07.07 - 31.03.10	Ph. D. (IIT, Guwahati)	NBHM	Fluid Dynamics, Integral Transforms
Aparajita Dasgupta 10.02.09 - 01.07.10	Ph. D. (York, Canada)	DST	Harmonic Analysis
Arijit Chakrabarty 17.02.10 - 31.12.10	Ph. D. (Cornel)	IISc (CPDF)	Applied Probability, Statistics
Prachi Mittal 06.05.10 - 30.09.10	Ph. D. (IISc)	IISc Jr. Res. Asso.	Several Complex Variables
Arun K. R. 25.05.10 - 25.10.10	Ph. D. (IISc)	IISc Jr. Res. Asso.	Nonlinear Waves, PDE
Ashisha Kumar 04.08.10 - 31.01.11	Ph. D. (IIT, Kanpur)	DST (RA)	Harmonic Analysis

Name, Period	Qualification	Scholarship	Fields of Research Interest
Harishankar Gupta 01.08.10 - 31.12.10	Ph. D. (IISc)	DAE (SRF)	Numerical Analysis, PDE
Sanjoy Pusti 01.07.09 -	Ph. D. (ISI)	UGC	Harmonic Analysis
Hemangi Shah 01.10.09 - 30.09.11	Ph. D. (IIT, Mumbai)	IISc (CPDF)	Differential Geometry
Bappaditya Bhowmik 05.01.10 -	Ph. D. (IIT, Chennai)	UGC (Kothari-PDF)	Complex Analysis
Nidhin K. 03.06.10 -	Ph. D. (Calicut)	UGC	Statistics
Manoj K Yadav 02.08.10 -	Ph. D. (IIT, Chennai)	NBHM	Asymptotic & applied Analysis, Nonlinear PDE
Ashisha Kumar 01.02.11 -	Ph. D. (IIT, Kanpur)	UGC (Kothari-PDF)	Harmonic Analysis
Sushil Gorai 27.07.10 -	Ph. D. (IISc)	IISc Jr. Res. Asso.	Several Complex Variables
Diganta Borah 27.07.10 -	Ph. D. (IISc)	IISc Jr. Res. Asso.	Several Complex Variables
Harishankar Gupta 01.01.11 -	Ph. D. (IISc)	NBHM	Numerical Analysis, PDE
Venku Naidu D. 01.01.11 -	Ph. D. (IIT, Chennai)	DST (RA)	Harmonic Analysis

1.2.7 Students

1.2.6.1 Research Scholars

Sl. No.	Name	Year of joining	Guide	Scholarship
1.	Gururaj, H. A.	2006	Harish Seshadri	CSIR (SPM)
2.	Amit Tripathi	2006	M. K. Ghosh	IISc
3.	G. P. Balakumar	2007	Kaushal Verma	CSIR (SPM)
4.	Atreyee Bhattacharya	2007	Harish Seshadri	CSIR
5.	Rahul Garg	2007	S. Thangavelu	CSIR
6.	Tapan Kumar Hota	2007	Gadadhar Misra	IISc
7.	Dinesh Kumar Keshari	2007	Gadadhar Misra	CSIR
8.	Dheeraj Kulkarni	2007	Siddhartha Gadgil	CSIR
9.	Soma Maity	2007	Harish Seshadri	CSIR
10.	Sourav Pal	2007	T. Bhattacharyya	CSIR
11.	Avijit Pal	2008	Gadadhar Misra	IISc

Sl. No.	Name	Year of joining	Guide	Scholarship
12.	Sandeep Mody	2009	G. Rangarajan	IISc
13.	Kamana Porwal	2009	Thirupathi Gudi	IISc
14.	Senthil Raani K. S.	2009	E. K. Narayanan	CSIR
25.	Sayani Bera	2009	K. Verma	CSIR
16.	Pradeep Boggarapu	2009	S. Thangavelu	CSIR
17.	Bidyut Sanki	2009	S. Gadgil	IISc
18.	Biplab Basak	2010	yet to decide	NBHM
19.	Sudipto Chowdhury	2010	yet to decide	NBHM
20.	Rajeev Gupta	2010	yet to decide	NBHM
21.	Pranav Haridas	2010	yet to decide	IISc
22.	Jis Joseph	2010	yet to decide	CSIR
23.	Ratna Pal	2010	yet to decide	IISc
24.	Tulasi Ram Reddy	2010	yet to decide	CSIR

1.2.6.2 Integrated Ph. D. Students

Sl. No.	Name	Year of joining	Guide	Scholarship
25.	Tamal Banerjee	2005	M.K. Ghosh/S.K. Iyer	CSIR
26.	Amit Samanta	2005	E. K. Narayanan	IISc
27.	Jotsaroop Kaur	2005	S. Thangavelu	IISc
28.	Ravi Prakash	2006	A. K. Nandakumaran	IISc
29.	Divakaran, D.	2007	S. Gadgil	IISc
30.	Jaikrishnan, J.	2007	G. Bharali	IISc
31.	T. V. H. Prathamesh	2007	S. Gadgil	IISc
32.	Subhamay Saha	2007	M. K. Ghosh	CSIR (SPM)
33.	Santanu Sarkar	2007	T. Bhattacharyya	IISc
34.	Amita	2008	T. Bhattacharyya	IISc
35.	Sayan Bagchi	2008	S. Thangavelu	IISc
36.	Prahllad Deb	2008	G. Misra	IISc
37.	Jonathan Fernandes	2008	T. Bhattacharyya	IISc
38.	Abhinav Verma	2008	T. Bhattacharyya	IISc

Sl. No.	Name	Year of Joining	Guide	Scholarship
39.	Kartick Adhikari	2009	M. Krishnapur	IISc
40.	Choiti Bandyopadhyay	2009	K. Verma	IISc
41.	Chandan Biswas	2009	G. Bharali	IISc
42.	Vikramjeet Singh Chandel	2009	G. Bharali	IISc
43.	Indrajit Jana	2009	M. Krishnapur	IISc
44.	Arpan Kabiraj	2009	S. Gadgil	IISc
45.	Eliza Philip	2009	K. Verma	IISc
46.	Samya Kumar Ray	2009	G. Misra	IISc
47.	Md. Ramiz Reza	2009	G. Misra	IISc
48.	Himadri Karmakar	2010	yet to decide	IISc
49.	Sumit Kumar	2010	yet to decide	IISc
50.	Bidhan Chandra Sardar	2010	yet to decide	IISc
51.	Haripada Sau	2010	yet to decide	IISc

1.2.6.3 Research Scholars under QIP programme

Sl. No.	Name	Year of joining	Guide	Affiliation
52.	P. K. Sanjay	2009	S. Thangavelu	NIT, Calicut

1.2.6.4 IMI Interdisciplinary Ph. D. Students
(with one guide from the department)

Sl. No.	Name	Year of joining	Guides	Under the Department
53.	Srishti Shukla	2008	B. Sundar Rajan & G. Rangarajan	ECE
54.	Saptak Banerjee	2008	Rajesh Sundaresan & S. K. Iyer	ECE
55.	Samar S. Bahadur	2008	S. Raha & A. K. Nandakumaran	SERC
56.	Nitin Singh	2009	Basudeb Datta & Vijay Natarajan	Mathematics
57.	Satya Prakash Rangta	2010	Aditya Murthy & G. Rangarajan	CNS
58.	Anju Menon	2010	Arun Sripati & G. Rangarajan	CNS

1.2.6.5 Research scholars of other departments working under joint guides

Sl. No.	Name	Year of joining	Guide	Under the Department
59.	K. P. Mohanan	2009	R. M. Vasu & A. K. Nandakumaran	Instrumentation

1.2.6.6 Students awarded Ph. D. degree during the period under review

Sl. No.	Name	Title of the thesis
1.	Jaydeb Sarkar (Sept., 2006)	Characteristic functions for tuples of commuting operators
2.	Sanjiban Santra (Sept., 2006)	On a class of superlinear elliptic problems in symmetric domains and a fourth order singular eigen value problem
3.	S. Akila (June, 2007)	Orbit model analysis and dynamic filter compensation for onboard autonomy
4.	Prabal Paul (June, 2007)	On the PAPR of affine linear codes
5.	J. P. Mohan Das (Dec., 2007)	Spectral theory and root bases associated with multiparameter eigenvalue problems
6.	Anindya Goswami (June, 2008)	Semi-Markov Processes in Dynamic Games and Quantitative Finance
7.	Nedungadi Aatira (January, 2010)	Granger causality for point processes and block coherence
8.	Prachi Mittal (Sept. 2010)	Some aspects of the Kobayashi and Caratheodory metrics on pseudoconvex domains
9.	Arun K. R. (Dec., 2010)	Kinematical conservation laws and propogation of nonlinear waves in three dimensions
10.	Sushil Gorai (Dec., 2010)	Exploring polynomial convexity of certain classes of sets
11.	Diganta Borah (Dec., 2010)	Study of the metric induced by the Robin function
12.	Hari Shankar Gupta (Dec., 2010)	Numerical Study of Ragularization Method for Elliptic Cauchy Problems
13.	Suparna Bhattacharya (March, 2011)	Segal-Bargmann transform and Paley Wiener theorems on motion groups

1.2.6.7 Awarded M. S. degrees during the period under review

Sl. No.	Name	Title of MS thesis
1.	Dhrubajit Choudhury (2006)	Polyhedral and Combinatorial Maps
2.	D. Yogeshwaran (2006)	Connectivity and Tracking Problems in Wireless Sensor Networks
3.	Suparna Bhattacharya (2007)	The Segal - Bargmann transform on compact lie groups
4.	Prachi (2007)	A study of the Caratheodory and the Kobayashi metric
5.	Souvik Goswami (2008)	Projective modules and a theorem of Quillan and Suslin
6.	Debleena Thacker (2008)	Connectivity in Random Geometric Graphs
7.	Tamal Banerjee (2008)	Coverage Processes
8.	Amit Samanta (2008)	A spectral Paley-Wiener theorem for Euclidean spaces and applications
9.	Geetanjali Kachari (2008)	Commutators and Group homology
10.	Shubhra Ray Chaudhury (2008)	Curves on Surfaces
11.	Jotsaroop Kaur (2008)	Segal-Bargmann transform through Gutzmer's formula
12.	Angshuman Bhattacharya (2009)	Multivariable Dilation Theory: A Short Survey
13.	Subhajyoti Pal (2009)	The Schwarz Lemma
14.	Sandeep Bhupatiraju (2010)	Some Aspects of the First Passage Time Problem in Neuroscience
15.	Purvi Gupta (2010)	Some descriptions of the envelopes of holomorphy of domains in $\mathbb{C}^n$
16.	Prasanna Muralidharan (2010)	Hand-movement prediction using LFP data
17.	Rishika Rupam (2010)	Bounded analytic functions

1.2.8 Visiting Students

1. Dr. Bhupender Gupta (Research Scholar, IIT, Kanpur), visited the department for several months during the period 2005 - 2007. During the visits, he worked for his Ph. D. thesis under the supervision of Prof. S. K. Iyer. He has obtained the Ph. D. degree from IIT, Kanpur in 2007. The title of his thesis is "*Random Geometric Graphs on a Class of Densities with Unbounded Support*".

2. Dr. Tejas Kalelkar (Research Scholar, ISI, Bangalore) visited the department from April 2006 to August 2008. During the visits, he worked for his Ph. D. thesis under the supervision of Prof. S. Gadgil. He has successfully defended his Ph. D. degree from ISI in February, 2010. The title of his thesis is "*Normal surfaces and Heegaard splittings of 3-manifolds*".

3. Dr. Suhas Pandit (Research Scholar, ISI, Bangalore) visited the department from April 2006 to October 2008. During the visits, he worked for his Ph. D. thesis under the supervision of Prof. S. Gadgil. He has successfully defended his Ph. D. degree from ISI in April, 2010. The title of his thesis is "*Intersection numbers, Embedded spheres and Geosphere laminations for free groups*".

4. Mr. Shibananda Biswas (Research Scholar, ISI, Bangalore) visiting the department from July 31, 2007. He is working for his Ph. D. thesis under the supervision of Prof. G. Misra.

5. Ms. Soumya, S. H. (Department of Mathematics & Computer Science, Kuvempu University, Shimoga), worked (during February to May, 2006) for her final M. Tech. project under the guidance of Prof. B. Datta in the department. She obtained the M. Tech. degree from Kuvempu University in July, 2006. Title of her thesis was "*Construction of combinatorial objects using GAP* ".

6. Ms. Madhulika Prasad (Department of Computer Science, Mangalore University, Mangalore), worked (during December 2006 to May 2007) for her final M. Sc. project under the guidance of Prof. B. Datta in the department. She obtained the M. Sc. degree from Mangalore University in August, 2007. Title of her thesis was "*Lexicographic Enumeration of Triangulated Surfaces*".

7. Mr. Hoel Queffelec, M. Sc. second year student, École Normale Supérieure de Cachan and Université Paris VI Jussieu, France, visited (during his scientific training period at the department of Mathematics under the Research Training Agreement between École Normale Supérieure and IISc) from May 16 – July 17, 2009. During his visit, he has prepared his M. Sc. Internship Thesis on "*A modern view of Voronoï's work on polytopes and quadratic forms*" under the guidance of Prof. B. Datta.

8. Mr. M. Gustavo Gianotti, Cordoba University, Argentina, spent a semester (August - December, 2010) in the department. He worked with Prof. S. Thangavelu on some problems in Harmonic Analusis.

9. Ms. R. Lakshmi Lavanya, Ramanujan Institute, Chennai, visited the department during March - June, 2010. She worked with Prof. S. Thangavelu on her Ph. D. thesis.

2 Thrust area during DSA-IV under SAP

Non-Linear Systems, Analysis and Applications

2.1 Faculty involved (in the identified thrust area)

- Dr. Gautam Bharali
- Prof. Tirthankar Bhattacharyya
- Prof. Mrinal K. Ghosh
- Prof. Srikanth K. Iyer
- Dr. Manjunath Krishnapur
- Dr. Mahesh Kumari
- Prof. Gadadhar Misra
- Prof. A. K. Nandakumaran
- Prof. E. K. Narayanan
- Prof. Phoolan Prasad
- Prof. Govindan Rangarajan
- Prof. Harish Seshadri
- Prof. S. Thangavelu
- Prof. Kaushal Verma

3 Major achievements

3.1 New Ph.D. Programme

A new interdisciplinary Ph.D. Programme in Mathematical Sciences was started. Each student works in an interdisciplinary area under two research guides selected from two different programmes. Seven students are currently working towards their Ph.D. under this programme.

3.2 Teaching

The courses taught during the period Jan-Apr 2006 were:

1. MA 213: Algebra-II by B. Datta
2. MA 222: Analysis-II by S. M. Jalnapurkar
3. MA 223: Functional Analysis by T. Bhattacharyya
4. MA 224: Complex Analysis by B. J. Venkatachala
5. MA 233: Differential Geometry by A. K. Nandakumaran

6. MA 327: Complex Harmonic Analysis by S. Thangavelu
7. MA 328: Introduction to Several Complex Variables by G. Bharali
8. MA 332: Algebraic Topology by A. K. Upadhyay
9. MA 347: Advanced PDE and Finite Element Method by A. K. Nandakumaran
10. MA 364: Linear and Nonlinear Time Series Analysis by G. Rangarajan

The courses taught during the academic year 2006-2007 were:

1. MA 212: Algebra-I by Harish Seshadri
2. MA 217: Discrete Mathematics by D. P. Patil
3. MA 219: Linear Algebra by C. R. Pranesachar and B. J. Venkatachala
4. MA 221: Analysis-I by S. Thangavelu
5. MA 222: Analysis-II by E. K. Narayanan
6. MA 224: Complex Analysis by G. Bharali
7. MA 229: Calculus on Manifolds (in Aug-Dec) by A. K. Upadhyay
8. MA 229: Calculus on Manifolds (in Jan-Apr) by K. Verma
9. MA 231: Topology-I by C. R. Pradeep
10. MA 241: Ordinary Differential Equations by M. K. Ghosh
11. MA 242: Partial Differential Equations by A. K. Nandakumaran
12. MA 251: Numerical Methods by Mahesh Kumari
13. MA 261: Probability Models by Srikanth K. Iyer
14. MA 314: Computational Number Theory by V. Patankar
15. MA 323: Operator Theory by T. Bhattacharyya
16. MA 326: Fourier Analysis by S. Thangavelu
17. MA 327: Harmonic Analysis on $\mathrm{SL}(2,\mathbb{R})$ by A. Sitaram
18. MA 329: Topics in Several Complex Variables by G. Bharali
19. MA 331: Topology-II by B. Datta and S. Gadgil.
20. MA 332: Algebraic Topology by S. Gadgil
21. MA 333: Riemannian Geometry by Harish Seshadri
22. MA 361: Probability Theory by Srikanth K. Iyer
23. MA 362: Stochastic Processes by Srikanth K. Iyer
24. MA 364: Linear and Nonlinear Time Series Analysis by G. Rangarajan

25. MA 365: Stochastic Dynamic Optimization I by M. K. Ghosh

The courses taught during the academic year 2007-2008 were:

1. MA 212: Algebra-I by G. V. Ravindra
2. MA 217: Discrete Mathematics by C. R. Pranesachar and B. J. Venkatachala
3. MA 219: Linear Algebra by Harish Seshadri
4. MA 221: Analysis-I by G. Bharali
5. MA 222: Analysis-II by S. Thangavelu
6. MA 223: Functional Analysis by K. Verma
7. MA 224: Complex Analysis by G. Misra
8. MA 229: Calculus on Manifolds by T. Bhattacharyya
9. MA 231: Topology-I by B. Datta
10. MA 241: Ordinary Differential Equations by A. K. Nandakumaran
11. MA 242: Partial Differential Equations by E. K. Narayanan
12. MA 251: Numerical Methods by Mahesh Kumari
13. MA 261: Probability Models by M. K. Ghosh
14. MA 312: Commutative Algebra by D. P. Patil
15. MA 313: Algebraic Geometry by J. Biswas and G. V. Ravindra
16. MA 326: Fourier Analysis by S. Thangavelu
17. MA 327: Topics in Banach space theory by T. Bhattacharyya
18. MA 328: Theory of Semigroup and Applications by K. B. Sinha
19. MA 329: Topics in Several Complex Variables by K. Verma
20. MA 331: Topology-II by S. Gadgil.
21. MA 332: Algebraic Topology by B. Datta
22. MA 333: Riemannian Geometry by Harish Seshadri
23. MA 361: Probability Theory by Srikanth K. Iyer

The courses taught during the academic year 2008-2009 were:

1. MA 212: Algebra I by G. V. Ravindra
2. MA 213: Algebra II by S. Viswanath
3. MA 219: Linear Algebra by S. Viswanath

4. MA 221: Analysis I by K. Verma
5. MA 222: Analysis II by T. Bhattacharyya
6. MA 223: Functional Analysis by E. K. Narayanan
7. MA 224: Complex Analysis by S. Thangavelu
8. MA 226: Complex Analysis-II by G. Bharali
9. MA 229: Calculus on manifolds by G. Misra
10. MA 231: Topology I by B. Datta
11. MA 241: Ordinary Differential Equations by Harish Seshadri
12. MA 242: Partial Differential Equations by A. K. Nandakumaran
13. MA 251: Numerical Methods by G. Rangarajan
14. MA 261: Probability Models by M. K.Ghosh and S. K. Iyer
15. MA 263: Stochastic Finance I by M. K.Ghosh
16. MA 264: Introduction to Stochastic Processes by K. B. Athreya and M. K. Ghosh
17. MA 312: Commutative Algebra by G. V. Ravindra and S. Viswanath
18. MA 314: Topics in Commutative algebra by S. Viswanath and D. Ambedkar
19. MA 321: Analysis III by A. K. Nandakumaran
20. MA 326: Fourier Analysis by E. K. Narayanan
21. MA 328: Introduction to Several Complex Variables by G. Bharali
22. MA 331: Topology II by S. Gadgil
23. MA 332: Algebraic Topology by B. Datta and A. Naolekar
24. MA 334: Curvature and Topology by Harish Seshadri
25. MA 335: Symplectic Topology by S. Gadgil
26. MA 361: Probability Theory by S. K. Iyer
27. MA 366: Stochastic Finance II by M. K. Ghosh and S. K. Iyer
28. MA 382: Special Topics in Operator Theory by T. Bhattacharyya and K. B. Sinha

The courses taught during the academic year 2009-2010 were:

1. MA 212: Algebra I by S. Gadgil
2. MA 213: Algebra II by S. Viswanath
3. MA 219: Linear Algebra by C. R. Pranesachar and B. J. Venkatachala
4. MA 221: Analysis I by K. Verma

5. MA 222: Analysis II by T. Bhattacharyya
6. MA 223: Functional Analysis by S. Thangavelu
7. MA 224: Complex Analysis by G. Bharali
8. MA 229: Calculus on manifolds by K. Verma
9. MA 231: Topology I by B. Datta
10. MA 241: Ordinary Differential Equations by M. K. Ghosh
11. MA 242: Partial Differential Equations by A. K. Nandakumaran and Phoolan Prasad
12. MA 251: Numerical Methods by Mahesh Kumari
13. MA 261: Probability Models by S. K. Iyer
14. MA 312: Lie Algebras and their representations by S. Viswanath.
15. MA 323: Operator Theory by E. K. Narayanan
16. MA 325: Operator Theory II by T. Bhattacharyya
17. MA 329: Topics in Several Complex Variables by G. Bharali
18. MA 330: Topology II by B. Datta
19. MA 331: Topology and Geometry by B. Datta and Harish Seshadri
20. MA 332: Algebraic Topology by S. Gadgil
21. MA 333: Riemannian Geometry by Hemangi Shah
22. MA 336: Topics in Riemannian Geometry by Harish Seshadri
23. MA 337: Computer Assisted Topology and Geometry by S. Gadgil
24. MA 347: Advanced PDE and FEM by A. K. Nandakumaran
25. MA 361: Probability Theory by Manjunath Krishnapur
26. MA 364: Linear and Nonlinear Time Series Analysis by G. Rangarajan
27. MA 391: Spectral Algorithms by Ravi Kannan
28. MA 367: Brownian motion by Manjunath Krishnapur

The courses being taught during the academic year 2010-2011 are:

1. MA 212: Algebra I by C. R. Pranesachar and B. J. Venkatachala
2. MA 213: Algebra II by T. Bhattacharyya
3. MA 219: Linear Algebra by B. Datta
4. MA 221: Analysis I by G. Bharali
5. MA 222: Analysis II by A. K. Nandakumaran

6. MA 223: Functional Analysis by Manjunath Krishnapur
7. MA 224: Complex Analysis by S. Thangavelu
8. MA 229: Calculus on manifolds by G. Misra
9. MA 231: Topology I by E. K. Narayanan
10. MA 241: Ordinary Differential Equations by G. Rangarajan
11. MA 242: Partial Differential Equations by K. Verma
12. MA 251: Numerical Methods by Mahesh Kumari
13. MA 261: Probability Models by M. K. Ghosh
14. MA 312: Commutative Algebra by D. P. Patil
15. MA 320: Representation Theory of Compact Lie Groups by E. K. Narayanan
16. MA 322: Fourier/Harmonic Analysis by S. Thangavelu
17. MA 324: Topics in Complex Analysis by G. Misra
18. MA 326: Fourier Analysis by S. Thangavelu
19. MA 329: Topics in Several Complex Variables by K. Verma
20. MA 330: Topology II by E. K. Narayanan and Harish Seshadri
21. MA 331: Topology and Geometry by Harish Seshadri
22. MA 332: Algebraic Topology by S. Gadgil
23. MA 333: Riemannian Geometry by Harish Seshadri and Hemangi Shah
24. MA 336: Topics in Riemannian Geometry by Harish Seshadri
25. MA 348: Mathematica Theory of Finite Element Methods by T. Gudi
26. MA 361: Probability Theory by M. K. Ghosh
27. MA 368: Topics in Probability and Stochastic Processes by S. K. Iyer
28. MA 369: Random Matrix Theory by Manjunath Krishnapur
29. MA 392: Probabilistic Graphical Models by R. V. Ramamoorthi

3.3 Research

3.3.1 Research Highlights in Thrust area

Fluid Mechanics : • The mixed convection (combined forced and free convection) flow occurs in many technological and industrial applications such as solar central receivers exposed to wind currents, nuclear reactors cooled during emergency shut down, heat exchangers placed in low-velocity environments, boundary-layer control on aerofoil.

• The non-Newtonian fluids with or without magnetic field find an increasing applications in industry and technology. A few examples are the flow of nuclear fuel slurries, coating of paper an lubrication with heavy oils and greases.

• The natural convention flow over a surface embedded in saturated porous media is encountered in many engineering problems such as the design of pebble-bed nuclear reactors, catalytic reactors and compact heat exchangers, geothermal energy conversion, use of fibrous material in the thermal insulation of buildings, heat transfer from storage of agricultural products which generate heat as a result of metabolism, petroleum reservoirs, storage of nuclear wastes etc.

• The study of unsteady boundary layers is important in several physical problems in aeronautics, missile dynamics, acoustics etc.

• The flow and heat transfer problem in the boundary layer induced by a continuous moving surface in an ambient fluid is important in many industrial processes such as the cooling of a hot metallic plate in a cooling bath, the extrusion of a plastic sheet, glass blowing, continuous casting, spinning of fibers etc. ([67, 68, 69, 127, 175][1].)

• Flow and heat transfer through fluid - saturated porous media has been studied quite extensively during the last few decades. This has been motivated by its importance in many natural and industrial problems. Prominent among these are the utilization of geothermal energy, chemical engineering, thermal insulation systems, nuclear waste management, grain storage, migration of moisture through air contained in fibrous insulation, heating of rooms, combustion, fires, and many others ([174, 175, 179]).

• Buoyancy induced flow within fluid - saturated porous media has also attracted considerable attention. The interest for such studies is motivated by a wide range of thermal engineering applications which include geothermal systems, oil extraction, ground water pollution, thermal insulation, solid matrix heat exchangers, storage of nuclear waste, packed - bed catalytic

• Fluids with or without magnetic field find an increasing applications in industry and technology. A few examples are the flow of nuclear fuel slurries,liquid metal and alloys plasma and mercury, coating of paper and lubrication with heavy oils and greases ([176, 177]).

Functional Analysis : • A complete classification of $\widetilde{SL(2,\mathbb{R})}$-homogeneous vector bundles were obtained. A set of invariants for these bundles was constructed [107].

• A complete set of unitary invariants for the quotient Hilbert module over a function algebra were found [116].

• A characterization of homogeneous operators in the Cowen-Douglas class with multiplicity-free representation was obtained. An explicit realization was also given [122].

[1]The numbers in [ ]'s refer to those in the **List of Publications** given in Subsection 3.3.3.

• A possible generalization of the notion Wallach set which plays a significant role in the representation theory of semi-simple groups was given. The generalized Wallach set itself was explicitly described in the case of the unit disc [231].

• The classification of homogeenous operators in the Cowen-Douglas class of the unit disc with respect to the equivalence induced by conjugation under unitary and invertible operators has been completed [255].

• For an analytic Hilbert module $\mathcal{M}$ over a function algebra $\mathcal{A}(\Omega)$, motivated by the correspondence of vector bundles with locally free sheaf, a sheaf of modules $\mathcal{S}(\mathcal{M})$ over $\mathcal{O}(\Omega)$ is constructed. This sheaf is shown to be a coherent analytic subsheaf of $\mathcal{O}(\Omega)$. Thus the stalk $\mathcal{S}(\mathcal{M})_w$ at $w \in \Omega$ is generated by a finite number of elements $g_1, g_2, \ldots, g_n$ from $\mathcal{O}(\Omega)$. If K is the reproducing kernel for $\mathcal{M}$, and $w_0 \in \Omega$ is a fixed but arbitrary point, then for w in a small neighborhood Ω_0 of w_0,

$$K_w = g_1^0(w)K_w^{(1)} + \cdots + g_n^0(w)K_w^{(n)},$$

where g_i^0, $1 \leq i \leq n$, are the generators for the stalk $\mathcal{S}(\mathcal{M})_0 := \mathcal{S}(\mathcal{M})_{w_0}$ and $K^{(p)} : \Omega_0 \to \mathcal{M}$, $1 \leq k \leq n$, is anti-holomorphic. If $g_1, \ldots, g_n$ is a minimal set of generators then we show that the elements $K_{w_0}^{(p)}$, $1 \leq p \leq n$, are linearly independent in $\mathcal{M}$ and are uniquely determined by the generators. In this case, the vectors $K_{w_0}^{(p)}$ are eigenvectors for the adjoint of the action of $\mathcal{A}(\Omega)$ on the Hilbert module $\mathcal{M}$ at w_0 [272].

• Let $\mathcal{M}$ be the completion of the polynmial ring $\mathbb{C}[\underline{z}]$ with respect to some inner product and for any ideal $\mathcal{I} \subseteq \mathbb{C}[\underline{z}]$, let $[\mathcal{I}]$ be the closure of $\mathcal{I}$ in $\mathcal{M}$. For a homogeneous ideal $\mathcal{I}$, the joint kernel of the submodule $[\mathcal{I}] \subseteq \mathcal{M}$ is shown, after imposing some mild conditions on $\mathcal{M}$, to be the linear span of the set of vectors

$$\{p_i(\tfrac{\partial}{\partial \bar{w}_1}, \ldots, \tfrac{\partial}{\partial \bar{w}_m})K_{[\mathcal{I}]}(\cdot, w)|_{w=0}, 1 \leq i \leq t\},$$

where $K_{[\mathcal{I}]}$ is the reproducing kernel for the submodule $[\mathcal{I}]$ and $p_1, \ldots, p_t$ is some minimal "canonical set of generators" for the ideal $\mathcal{I}$. The proof includes an algorithm for constructing this canonical set of generators, which is determined uniquely modulo linear relations, for homogeneous ideals. A short proof of the "Rigidity theorem" using the sheaf model for Hilbert modules over polynomial rings has been obtained. Tractable invariants for Hilbert modules of the form $[\mathcal{I}]$, via the monoidal transformation, have been constructed. Several examples are given to illustrate the explicit computation of these invariants [320].

• It is shown that a quasi-free Hilbert module $\mathcal{R}$ defined over the polydisc algebra with kernel function $k(\boldsymbol{z}; \boldsymbol{w})$ admits a unique minimal dilation (actually an isometric coextension) to the Hardy module over the polydisk if and only if $S^{-1}(\boldsymbol{z}; \boldsymbol{w})k(\boldsymbol{z}; \boldsymbol{w})$ is a positive kernel function, where S is the Szego kernel for the polydisk. Moreover, the equivalence of such a factorization of the kernel function and a positivity condition, defined using the hereditary functional calculus is established. An explicit realization of the dilation space is given along with the isometric embedding of the module $\mathcal{R}$ in it [283].

• A natural class of weighted Bergman spaces on the symmetrized polydisc is isometrically embedded as a subspace in the corresponding weighted Bergman space on the polydisc. We find an orthonormal basis for this subspace. It enables us to compute the kernel function for the weighted Bergman spaces on the symmetrized polydisc using the explicit nature of our embedding. This family of kernel functions include the Szego and the Bergman kernel on the symmetrized polydisc [321].

• Characteristic function: The characteristic function has been an important tool for studying completely non unitary contractions on Hilbert spaces. In the several variables context, completely non-coisometric contractive tuples of commuting operators on a Hilbert space $\mathcal{H}$ were considered. The theory of characteristic function as an invariant for n-tuples of operators was developed from scratch. It was shown that the characteristic function, which is an operator valued analytic function on the open Euclidean unit ball in $\mathbb{C}^n$, is a complete unitary invariant for such a tuple. The characteristic function was shown to satisfy a natural transformation law under biholomorphic mappings of the unit ball. All operator-valued analytic functions which arise as characteristic functions of pure commuting contractive tuples were characterized ([7, 8]).

Just as a contraction is related to the Szego kernel $k_S(z,w) = (1-z\overline{w})^{-1}$ for $|z|,\ |w| < 1$, by means of $(1/k_S)(T,T^*) \geq 0$, an arbitrary open connected domain Ω in $\mathbb{C}^n$ and a kernel k on Ω so that $1/k$ is a polynomial, was considered. A tuple $T = (T_1, T_2, \ldots, T_n)$ of commuting bounded operators on a complex separable Hilbert space H which satisfies $(1/k)(T,T^*) \geq 0$ then may or may not have a characteristic function. Under some standard assumptions on k, it turns out that whether a characteristic function can be associated with T or not depends not only on T, but also on the kernel k. A necessary and sufficient condition is given. When this condition is satisfied, a functional model can be constructed. Moreover, the characteristic function then is a complete unitary invariant for a suitable class of tuples T ([270]).

Consider an arbitrary open connected domain Ω in $\mathbb{C}^n$, a complete Nevanilinna-Pick kernel k on Ω and a tuple $T = (T_1, \ldots, T_n)$ of commuting bounded operators on a complex separable Hilbert space H such that $(1/k)(T,T^*) \geq 0$. For a complete Pick kernel the $1/k$ functional calculus makes sense in a beautiful way. It turns out that the model theory works very well and a characteristic function can be associated with T. In this case also, the characteristic function is a complete unitary invariant for a suitable class of tuples T ([216]).

• Schur-Agler class: The characteristic function is one among a large class of functions now known as the Schur - Agler class. The novelty about this class is in the representation that the functions of this class have. Schur showed that holomorphic functions from the disc into the disc have a certain form. This theorem has been generalized in mainly two directions - to domains in $\mathbb{C}^n$ and to non-commutative domains such as the unit ball of the dual of a C^*-algebra. In a recent work, it has been shown that, in the language of Hilbert modules, the various realization theorems can be brought under one umbrella, thus obtaining a very general result ([313]).

In a purely multi-variable setting (i.e., the issues discussed are not interesting in the single variable operator theory setting), it has been shown that the coincidence of two operator valued Schur class multipliers of a certain kind on the Drury-Arveson space is characterized by the fact that the associated colligations (or a variant, obtained canonically) are 'unitarily coincident' ([269]).

• Holomorphic control theory: Holomorphic function algebras have always been intimately connected with control theory. Motivated by a control theoretic problem, it has been shown that given a domain Ω in $\mathbb{C}^n$ and a sufficiently nice Hilbert space of holomorphic functions on Ω, the multiplier algebra is a Hermite ring. This, in informal terms, means that if a tall matrix with entries from this algebra has a left inverse then it can be grown to an invertible matrix. This result was proved in more generality than this, from which the Hermite property follows. The general theorem was then applied to the multiplier algebra if the Arveson space and a certain Hilbert space of holomorphic functions in the right half plane ([270]).

• Completely bounded kernels: It is a classical result that scalar valued positive kernels have Kolmogorov decompositions. This has been extended in various ways, culminating in a version of the Kolmogorov decomposition for completely positive $\mathcal{L}(\mathcal{A},\mathcal{B})$ valued kernels, $\mathcal{A}$ and $\mathcal{B}$ C^*-algebras. The notion of a Kolmogorov decomposition has also been extended to operator valued hermitian, though not necessarily positive, where a condition for decomposability is shown to be that the kernel can be written as a difference of positive kernels. For $\mathcal{L}(\mathcal{A},\mathcal{B})$ valued kernels, the appropriate analogue is that of a completely bounded kernel, which has now been defined in both the hermitian and non-hermitian case. It has been shown that the Schwartz boundedness condition implies the existence of a Kolmogorov decomposition for Hermitian kernels, and that when $\mathcal{A}$ is unital and $\mathcal{B}$ is injective (much as in the Wittstock decomposition theorem), completely bounded kernels have Kolmogorov decompositions ([318]).

Harmonic Analysis on Lie Groups : • The problem of characterising the image of L^2 spaces and Sobolev spaces under the heat kernel transform was studied on nilmanifolds and Riemannian symmetric spaces of compact type. When M is a nilmanifold of the Heisenberg group it was shown that the image of $L^2(M)$ under the heat kernel transform is a direct sum of weighted Bergman spaces which are related to twisted Bergman and Hermite-Bergman spaces ([123]). In the case of compact symmetric spaces the images of Sobolev spaces under the heat kernel transform were shown to be certain holomorphic Sobolev spaces ([86]). These spaces were characterised in terms of pointwise estimates. The images of the spaces of smooth functions and distributions were also characterised settling a conjecture of Hall and Lewkeeratiyutkul. The main ingredients used were Gutzmer's formula, due to Lassalle, for compact symmetric spaces and heat kernel estimates, due to Anker and Ostellari, for noncompact symmetric spaces. Holomorphic Sobolev spaces associated to Hermite and special Hermite semigroups have also been studied using analogues of Gutzmer's formula. As a consequence, a Paley-Wiener theorem for the windowed Fourier transform has been proved ([191]).

• Analogues of Miyachi's theorem for connected simply connected nilpotent Lie groups are formulated and proved. This leads to a proof of the sharpness of the constant 1/4 in the Hardy and Cowling-Price uncertainty principle ([214]).

• Analyticity of solutions of the Schrödinger equation associated to sublaplacian and related operators has been studied. It is proved that the solutions are entire provided the initial conditions have enough Gaussian decay ([347]).

• Boundedness of Toeplitz operators on Segal-Bergmann spaces associated to Lie groups K has been studied in several contexts. The idea is to use the heat kernel transform to transfer the Toeplitz operator into an operator acting on $L^2(K)$. In the classical case of $K = \mathbb{R}^n$ the transferred operator is a pseudodifferential operator. Using Gutzmer's formula we study this problem for compact Lie groups, compact symmetric spaces and Heisenberg groups. Found conditions on the symbol of the Toeplitz operator so that the transferred operator is a multiplier transform on K ([140]).

• Certain uniqueness for solutions of the Schrödinger equation for the sublaplacians on H-type groups has been proved ([338]).

• Dimension free estimates for certains higher Riesz transforms on Hisenberg groups have been studied. A characterisation of such Riesz transforms have been proved ([290]).

• The structure of analytic and entire vectors for the Schrödinger representations has been studied. Using refined version of Hardy's theorem and their connection with Hermite expansions, very precise representation theorems for such vectors have been obtained ([284]).

• The problem of estimating the optimal decay of the Hermite coefficients of functions which together with their Fourier transforms are bounded by a constant multiple of $e^{-1/2\tanh(2t)|x|^2}$ has been addressed. The best possible estimates has obtained under an additional hypothesis on the function, viz. the $SO(n)$-finiteness. This extends to higher dimensions a result of Vemuri. In a similar vein, the connection between holomorphic extendability of a function and the decay of their generalised Fourier coefficients has investigated.

• The L^p improving properties of certain convolution operators defined by singular measures on the motion group has also studied. The measures are assumed to be supported on certain hypersurfaces satisfying mild geometric conditions. The optimal results which are extensions of earlier results on Radon type transforms on $\mathbb{R}^n$ has obtained.

• Twisted spherical means on $\mathbb{C}^n$ were studied in detail. A support theorem for functions with exponential decay at infinity was proved. With additional but natural assumptions, a support theorem for functions with exponential growth was also proved when dimension equals one. Surprisingly, this latter result does not generalize to higher dimensions. These results were used to prove sharp spectral Paley-Wiener theorem for the Heisenberg group ([31]).

• Translates (by elements from thin sets) of functions which transform according to a fixed irreducible representation of the rotation group on $\mathbb{R}^n$ was considered. It was proved that this class of functions is dense in certain L^p spaces. This question is related to injectivity sets for some weighted spherical means and generalizes earlier results for radial functions on $\mathbb{R}^n$ ([78]).

• Analogues of the Wiener-Tauberian theorems for the non-abelian Lie group $M(2)$ was also studied. Necessary and sufficient conditions for one sided Wiener-Tauberian theorems to be true for $L^p(M(2))$ were found ([236]).

• Some problems of Harmonic Analysis on the locally symmetric space $SL(2,\mathbb{Z})\backslash SL(2,\mathbb{R})/SO(2)$ were investigated. The eigenspace decomposition of the Laplacian on this space has both continuous and discrete spectrum. Hence, some of the results are similar to that of a compact space, while other display the non compact behavior. Versions of Wiener-Tauberian theorem and Paley-Wiener theorem have been proved. Similar results are expected to hold for $SL(2,\mathbb{Z})\backslash SL(2,\mathbb{R})$.

• A Wiener-Tauberian theorem for K-biinvariant functions on a semisimple Lie group of arbitrary real rank was proved using results from several complex variables theory along with properties of a complex analytic set ([188]).

• Segal-Bargmann transform on the group $M(2)$ was studied. The image of $L^2(M(2))$ under this transform turns out to be a class of entire vectors for the regular representation. Hence the result may be viewed as a Paley-Wiener type theorem. Similar results were proved for the Poisson integrals on $M(2)$ too. A Paley-Wiener theorem for the inverse Fourier transform was also established ([238]).

• Schwartz theorem and Wiener-Tauberian theorem were established for radial functions on a symmetric space of non compact type and of higher rank. This greatly improved the earlier results in this direction ([256]).

• A new type uncertainty principle was proved on the Heisenberg group. It was proved that if f is a compactly supported function on the Heisenberg group and the group Fourier transform $\hat{f}(\lambda)$ is a finite rank operator for all λ, then f is the zero function ([235]).

• An explicit inversion formula for spherical means centered at a hyperplane was established with the help of techniques from wave equation ([234]).

• Support theorems on $\mathbb{R}^n$ and noncompact symmetric spaces were proved. Under natural assumptions on the zero set of the Fourier transform of T (a compactly supported distribution) it was proved that $f * T = g$ with $f \in L^p, 1 \leq p \leq 2n/(n-1)$ and g compactly supported would imply that f too is compactly supported. Similar results were proved for noncompact symmetric spaces of arbitrary rank.([237]).

• Lacunary Fourier series on compact Lie groups were introduced. It should be emphasized that this definition was different from the ones existed in the literature. It was proved that if $f \in L^1$ has lacunary Fourier series and vanishes in an open set then f vanishes identically. This may be viewed as a qualitative uncertainty principle.([257]).

• By decomposing the Laplacian on the Heisenberg group into a family of parametrized partial differential operators $\tilde{L_\tau}$, $\tau \in \mathbb{R} \setminus 0$ and using parametrized Fourier-Wigner transforms, obtained formulas and estimates for the strongly continuous one-parameter semigroup generated by $\tilde{L_\tau}$, and the inverse of $\tilde{L_\tau}$. Using these formulas and estimates, Sobolev estimates for the one parameter semigroup and the inverse of the Laplacian were obtained ([282]).

Hyperbolic Equations and Nonlinear Waves : • General formulation of ray theory : A general form of ray equations has been described and a proof has been given for the extended lemma on bicharacteristics. Equivalence of the ray equations to the differential form of the kinematical conservation laws in two and three space dimensions, has also been proved ([81]).

• 3-D Kinematical Conservation Laws (KCL) : Various properties of the KCL of Giles, Prasad and Ravindran (1995) in 3-space dimensions have been investigated. These equations of evolution of a *propagating* surface Ω_t, are derived assuming the motion of the surface to be isotropic. These are the most general equations in conservation form, governing the evolution of Ω_t with singularities which we call *kinks* and which are curves across which the normal $\mathbf{n}$ to Ω_t and amplitude w on Ω_t are discontinuous. A simpler system of six differential equations from KCL have been derived and it has been shown that the KCL system is equivalent to the ray equations for Ω_t. The six independent equations and an energy transport equation involving w (which is related to the normal velocity m of Ω_t) form a completely determined system of seven equations. The eigenvalues of the system have been obtained by a very novel method and it is found that the system has two distinct nonzero eigenvalues and five zero eigenvalues and the dimension of the eigenspace associated with the multiple eigenvalue 0 is only 4. For an appropriately defined m, the two nonzero eigenvalues are real when $m > 1$ and pure imaginary when $m < 1$ ([160, 212]).

• In [159, 383], a generalization of the finite volume evolution Galerkin scheme for hyperbolic systems with spatially varying Jacobians has been considered. The goal is to model wave propagation in heterogeneous media. The theory has been developed for acoustic waves in heterogeneous medium but the results can be generalized to more complex systems. The finite volume evolution Galerkin (FVEG) method is a predictor-corrector method combining the finite volume corrector step with the evolutionary predictor step. In order to evolve fluxes along the cell interfaces, a multi-dimensional approximate evolution operator has been used. The latter is constructed using the compatibility condition (of Prasad) along bicharacteristics under the assumption of spatially dependent wave speeds. In order to approximate heterogeneous medium a staggered grid approach is used. Several numerical experiments for wave propagation with continuous as well as discontinuous wave speeds confirm the robustness and reliability of the new FVEG scheme.

• A novel genuinely multi-dimensional relaxation scheme is proposed. Based on a new discrete velocity Boltzmann equation, which is an improvement over previously introduced relaxation systems in terms of isotropic coverage of the multi-dimensional domain by the foot of the bicharacteristic, a finite volume method is developed in which the fluxes at the cell interfaces are evaluated in a genuinely multi-dimensional way, in contrast to the traditional dimension-by-dimension treatment. This algorithm is tested on some bench-mark test problems for hyperbolic conservation laws.

• The 3-D KCL based weakly nonlinear ray theory (WNLRT) is a weakly hyperbolic system with incomplete eigenspace. In addition there is a system of 3 constrains, termed as geometric solenoidal constraint, which must be satisfied initially in an initial value problem. The non-degeneracy (i.e., the loss of hyperbolicity) is intriguing and presents a real challenge for mathematical analysis and for computation of solution. However, a numerical scheme to solve this large system has been successfully developed ([211]). Further an analysis of a Cauchy problem for the linearised system shows that when this constraint is satisfied initially, the solution does not exhibit any Jordan mode. For the numerical simulation of the conservation laws we employ a high resolution central scheme. The second order accuracy of the scheme is achieved by using MUSCL type reconstructions and Runge-Kutta time discretisations. A constrained transport type technique is used to enforce the geometric solenoidal constraint. The results of several numerical experiments are presented, which confirm the efficiency and robustness of the proposed numerical method and the control of Jordan mode. The constrains are satisfied up to machine accuracy - a good achievement ([306]).

• In [327], an ill-posed Cauchy problem is considered, which appears in a sonic boom produced by a maneuvering aerofoil. This Cauchy problem is for a nonlinear second order elliptic equation. The optimal control technique is used to deal with this ill-posed Cauchy problem and suggest conjugate gradient method to solve it. As a first step to examine the feasibility of this approach, a linear model problem is considered. Finally some numerical results is presented.

• A kinetic relaxation scheme for the Euler equations of gas dynamics in one space dimension have been developed but the method is applicable to solve any complex system of conservation laws. The numerical scheme is based on a relaxation approximation for conservation laws viewed as a discrete velocity model of the Boltzmann equation of kinetic theory. The discrete kinetic equation is solved by a splitting method consisting of a convection phase and a collision phase. The convection phase involves only the solution of linear transport equations and the collision phase instantaneously relaxes the distribution function to an equilibrium distribution. It is proved that the first order accurate method is conservative, preserves the positivity of mass density and pressure and entropy stable. An anti-diffusive Chapman-Enskog distribution is used to derive a second order accurate method. The results of numerical experiments on some benchmark problems confirm the efficiency and robustness of the proposed scheme ([307]).

Integral Equations : • A class of weakly singular as well as Hypersingular integral equations has been analyzed in the light of new sets of Plemelj-Sokhotski type of formulae connecting the limiting values of appropriately selected sectionally analytic functions involving weakly singular and hypersingular integrals, depending on the types of integral equations to be solved and complete solutions of such equations have been determined by using direct function theoretic methods ([53, 277, 278]).

• New methods involving singular integral equations with Cauchy-type singularities have been developed and utilized in problems of scattering of surface water waves by discontinuities on the surface boundary conditions ([54, 109]).

• Several problems involving very large floating structures (VLFS) have been analyzed for their approximate solution by using the theory of eigenfunction expansion involving the self-adjoint elliptic type operators occurring in such boundary value problems ([280]).

• A class of scattering problems involving floating elastic plates on the surface of water of finite depth has been examined for their complete solution by employing the Wiener-Hopf Technique along with its recent developments. Computable and exact analytic expressions have been derived for the associated reflection and transmission coefficients satisfying the energy balance relations ([55, 56, 370, 166, 110]).

• Scattering problems arising in the theory of surface water waves involving finite depth fluid and deformed bottom topography as well as bottom porosity have been solved approximately by employing the Fourier analysis in conjunction with the theory of regular perturbation ([180]).

• Integral Equations involving unknown ranges of integration with Application to Boundary Value Problems of Mathematical Physics are being analyzed for obtaining useful solutions to problems of application, with special emphasis to problems of Fluid Mechanics ([265, 279]).

Mathematical Finance : • Option pricing in a regime switching market where the risk free interest rate, growth rate and the volatility of a stock depends on a finite state Markov chain was studied. Using a minimal martingale measure explicit expressions for the risk minimizing option price and the corresponding hedging strategy were obtained ([113, 248]).

• The problem of estimation of the parameters of a Markov switched geometric Brownian motion for modelling stock prices is considered. The drift and volatility parameters are functions of a continuous time Markov chain, which is not observed. Bayesian estimation technique is used with the prior being a Dirichlet process on the path space of the Markov chain. Posterior distribution is computed using the Gibbs sampling procedure. The algorithm is applied to the Indian Stock Market Index, the Nifty. Six regimes are identified in which the index operates. A significant outcome is the demonstration and quantification of the fact that in high volatility regimes, the asset prices tend to decrease, as is empirically observed. Another important outcome of this estimation procedure is the distribution of the current state of the underlying chain, which is required to estimate the option price.

• A zero-sum stochastic differential game with multiple modes arising in portfolio optimization problem was studied. The state of the system is governed by "controlled switching" diffusion processes. Under certain conditions, it was shown that the value functions of this game were unique viscosity solutions of the appropriate Hamilton-Jacobi-Isaacs' system of equations. These results were then applied to the analysis of a portfolio optimization problem where the investor is playing against the market and wishes to maximize his terminal utility. It was shown that the maximum terminal utility functions were unique viscosity solutions of the corresponding Hamilton-Jacobi-Isaacs'system of equations ([51]).

• Risk minimizing option pricing in a semi-Markov modulated market where the floating interest rate depends on a finite state semi-Markov process is studied. The growth rate and the volatility of the stock also depend on the semi-Markov process. Using Follmer-Schweizer decomposition the locally risk minimizing price for European options and the corresponding hedging strategies are obtained. Suitable numerical methods for computing option prices are developed ([169]).

• A portfolio optimization problem in a semi-Markov modulated market is studied. The terminal expected utility optimization on finite time horizon and risk-sensitive portfolio optimization on finite and infinite time horizon are considered. A numerical procedure is also developed to compute the optimal expected terminal utility for finite horizon problem ([170]).

• A stochastic differential game arising in a stock market largely controlled by big traders is studied. The stock price behaviour is modelled as a standard geometric Brownian motion and the stock market as characterized by the presence of a few large traders and a fringe of marginal "noise traders". Using the concept of Nash equilibrium, the equilibrium strategies and optimal value functions for the large traders are computed. The stability of the state process under equilibrium strategies of the large traders is also established ([161]).

• Asymptotic analysis of option pricing in a Markov modulated market is studied. Both fast moving and slow moving chains are considered. In each case asymptotic results are derived ([162]).

• A portfolio optimization in a semi-Markov modulated is studied on both finite and infinite planning horizon with standard utility functions. Optimal portfolios are obtained via appropriate HJB equations ([170]).

• An enhancement of the Credit Risk$^+$ model to incorporate correlations between sectors is proposed and analyzed. The sectoral default rates are modelled as linear combinations of a common set of independent variables that represent macro-economic variables or risk factors. A formula for exact computation of *VaR* contributions at the obligor level is also derived [121].

• An empirical comparison of hedging strategies for two different stochastic volatility models proposed in the literature have been carried out. One is an asymptotic expansion approach and the other is the risk-minimizing approach applied to a Markov-switched geometric Brownian motion. We also compare these with the Black-Scholes delta hedging strategies using historical and implied volatilities. The derivatives we consider are European call options on the NIFTY index of the Indian National Stock Exchange (NSE). We find that for the cases that we analyzed, by far the best results are obtained for the Markov-switched geometric Brownian motion [341].

Nonlinear Systems : • More than 99% of the species that ever existed on the surface of the earth are now extinct and their extinction on a global scale has been a puzzle. A significant advance was made in resolving this puzzle by showing that, for a general model under a common external forcing, the species first undergoes spatial synchronization and then extinction. Thus, the populations cannot survive in isolated locations and become extinct globally. This effect was seen even when the external forcing acts only on some locations provided the dynamics contains a synchronizing term [3].

• Stress relaxation measurements on wormlike micelles using a Rheo-SALS (rheology + small angle light scattering) apparatus allow simultaneous measurements of the stress and the scattered depolarised intensity. The latter is sensitive to orientational ordering of the micelles. To determine the presence of causal influences between the stress and the depolarised intensity time series, the technique of linear and nonlinear Granger causality was used. It was found that there exists a feedback mechanism between the two time series and that the orientational order has a stronger causal effect on the stress than vice versa. The phase space dynamics of the stress and the depolarised intensity time series was also studied using the recently developed technique of cross recurrence plots (CRPs). The presence of diagonal line structures in the CRPs unambiguously was used to demonstrate that the two time series share similar phase space dynamics [58].

• Diffusively coupled map lattices with P neighbors where P is arbitrary were considered and the stability of the synchronized state was studied. It was shown that there exists a critical lattice size beyond which the synchronized state is unstable. This generalizes earlier results for nearest neighbor coupling. The analytical results were confirmed by performing numerical simulations on coupled map lattices with logistic map at each node. The above analysis was also extended to two-dimensional P-neighbor diffusively coupled map lattices [79].

• A system of many coupled oscillators on a network can show multi-cluster synchronization. Existence conditions and stability bounds for such a multi-cluster synchronization were obtained. When the oscillators are identical, the interesting result that network structure alone can cause multi-cluster synchronization to emerge even when all the other parameters are the same was shown. Occurrence of multi-cluster synchronization when two different types of oscillators are coupled was demonstrated [158].

• Networks of biochemical reactions regulated by positive- and negative-feedback processes underlie functional dynamics in single cells. Synchronization of dynamics in the constituent cells is a hallmark of collective behavior in multi-cellular biological systems. Stability of the synchronized state is required for robust functioning of the multi-cell system in the face of noise and perturbation. Yet, the ability to respond to signals and change functional dynamics are also important features during development, disease, and evolution in living systems. Using a coupled multi-cell system model, we investigated [224] the role of system size, coupling strength and its topology on the synchronization of the collective dynamics and its stability. Even though different coupling topologies lead to synchronization of collective dynamics, diffusive coupling through the end product of the pathway does not confer stability to the synchronized state. The results were discussed with a view to their prevalence in biological systems.

• Given a Hamiltonian system, one can represent it using a symplectic map. This symplectic map is specified by a set of homogeneous polynomials which are uniquely determined by the Hamiltonian. An invariant norm was constructed [239] in the space of homogeneous polynomials of a given degree. This norm is a function of parameters characterizing the original Hamiltonian system. Such a norm has several potential applications.

Numerical Analysis and Computation : • The Cahn-Hilliard equation plays an important role in the phase separation in a binary mixture. This is a fourth order nonlinear partial differential equation. In [12], it was shown that the behaviour of the solution by using orthogonal cubic spline collocation method and derive optimal order error estimates. It is also discussed some computational experiments by using monomial basis functions in the spatial direction and RADAU 5 time integrator. The method presented here is better in terms of stability, efficiency and conditioning of the resulting matrix. Since no integrals to be evaluated or approximated, it behaves better than finite element method.

• Diffraction tomographic reconstruction of refractive index distribution requires complete knowledge of the transmitted complex field at the boundary. A method [77] was presented which can reconstruct the complex refractive index distributions from intensity-based measurements which are logarithm of intensity and the normal derivative of intensity. An iterative algorithm was presented which requires efficient implementation of a forward wave propagation equation and sensitivity matrices for the above two type of measurements. An efficient method for estimation of the sensitivity matrices was given and also the forward operator. The results of numerical experiments show that the two data types, namely $log(I)$ and $\frac{\partial I}{\partial n}$ reconstruct respectively the imaginary and real part of the refractive index distribution. The forward operator, a Helmholtz equation, was implemented for small k(k=50 in our example). As a consequence, the reconstructed inhomogeneities are spread and smoothened. Implementation of the Helmholtz equation for large k requires very fine meshing which pushes up computation and numerical instability. For the present method to be applicable in optical refractive index reconstruction an accurate and efficient forward solver for large k is required. This is currently being attempted using a wavelet-based, multiscale procedure. We have also results on diffuse optical correlation tomography. We have also studied the inverse problem associated with the propagation of field autocorrelation of light through a highly scattering object like tissue [335]. The measurements are integrals of the intensity auto-correlation $g_2(\tau)$ at the boundary, with the intervals of integration chosen appropriately to recover the optical absorption coefficient μ_a and particle diffusion coefficient D_B. The reconstruction results for $\mu - a$ and D_B which show forth reasonably good position and quantitative accuracy are presented. More results related to tomography are available in [196], [197].

• Discontinuous Galerkin methods have been attractive over the past fifteen years. But their error analysis assumes additional regularity when a standard approach is followed. This limits the application of the methods to interface problems since their solutions are usually not regular enough to follow this line. In [225], it is shown using a new (nonstandard) analysis using the techniques from both the *a priori* and *a posteriori* analysis that the discontinuous Galerkin methods converge under the minimal regularity.

• The numerical solutions of fully nonlinear Monge-Ampere equation are quite useful in optimal transport problems. But the nature of the Monge-Ampere equation naturally guides a practitioner to use C^1 finite element methods which are practically very copmlicated and expensive. In [275], a C^0 penalty method is formulated and shown to be convergent with rigorous error analysis. It is the first numerical method in the literature that is simple to use and can be implemented on many commercial packages.

• While the use of discontinuous Galerkin methods has been much popular, there are a very handful results dealing with the fast solution techniques for them. When the solutions exhibit singularities (for example on general domain with corners), the standard fast solvers suffer from the suboptimal convergence rate which cause the computations expensive. In this case, graded mesh refinement is a remedy. In [276], a class of symmetric and stable discontinuous Galerkin methods are considered on graded meshes and multilevel fast solvers are designed and shown to exhibit optimal convergence rates.

• C^0 interior penalty methods for higher order equations have become attractive due to their less computation cost and simplicity. The standard interior penalty formulations based on Nitsche's techniques need tuning of stabilizing parameters. In [329], an unconditional stable formulation is derived and applied to a general plate bending equation. Error analysis is also carried out for the weak solution in contrast to the standard approach which considers the strong solution with additional regularity. Estimates in lower order norms including maximum norm are also derived. Conforming finite element method for a sixth order equation requires C^2 finite elements which are very complicated to construct in 2 dimensions and almost out of the scope in 3 dimensions. In [286], we have addressed this issue by constructing C^0 interior penalty method. This numerical method provides a easy way for computations in oxidation in superconductor devises and phase field crystals. Another interesting application of C^0 interior penalty methods is for the singularly perturbed Extended Fisher-Kolmogorov equation. In [330], robust error bounds are derived.

• Kirchhoff type nonlocal nonlinear problems generally can not be treated as equations since they involve a global integral as a coefficient. This stimulates a major difficulty in solving them numerically since the Jacobian for Newton-Raphson method is a full matrix. Storing this matrix needs a very big memory and involves huge floating point operations. In [331], a constrained formulations is introduced to remedy this difficulty and moreover its solution process is treated as in the case of point-wise equations.

Partial Differential Equations : • A non-linear third order dispersion system has been considered. Exact controllability of the system has obtained under two types of nonlinearities, namely, Lipschitzian and monotone are obtained [61]. Further, exact controllability of the same system through the approach of Integral Contractors has also investigated, which is a weaker notion than Lipschitz.

• An abstract model described by the controlled generalized Hammerstein type integral equation

$$x(t) = \int_0^t h(t,s)u(s)ds \; + \int_0^t k(t,s,x)\; f(s,x(s))ds; \;\; 0 \leq t \leq T < \infty,$$

where, the state $x(t)$ lies in a Hilbert space H and control $u(t)$ lies another Hilbert space V for each time $t \in I = [0,T]$, $T > 0$ has considered. The exact controllability of the above system under suitable assumptions on h, k and f has obtained using the monotone operator theory.

• For $1 < p < \infty$, the spectral invariance of SG pseudo-differential operators on $L^p(\mathbb{R}^n)$ was proved by using the equivalence of ellipticity and Fredholmness of SG pseudo-differential operators on $L^p(\mathbb{R}^n)$. A key ingredient in the proof is the spectral invariance of SG pseudo-differential operators on $L^2(\mathbb{R}^n)$ ([372]).

• By decomposing the Grushin operator on $\mathbb{R}^2$ into a family of parameterized Hermite operators, estimates for the inverses and the heat semigroups of these Hermite operators are given which are then used to obtain Sobolev estimates for the inverse and the heat semigroup of the Grushin operator. Using the global hypoellipticity of the parametrized Hermite operators, Liouville's theorems for harmonic functions of the Grushin operator on $\mathbb{R}^2$ are obtained. The spectrum of the Grushin operator is computed ([326]).

• Schrodinger Equation : Strichartz estimates for a generalized Hermite–Schrödinger equation associated to a family of differential-difference operators involving the Dunkl Laplacian and unbounded potentials has established [337]. This family includes the Hermite and Laguerre differential operators in particular. The study relies on the analysis of the so-called (k, a)-generalized semigroup. Moreover, homogeneous Strichartz estimates for the Schrödinger equation associated to the Dunkl Laplacian can be obtained from those for the generalized Hermite–Schrödinger equation.

• Homogenization : The homogenization of an optimal control problem governed by the Stokes system has been studied [130]. The homogenized limit of the Stokes system as well as its adjoint system arising from the optimal control problem is obtained. The convergence of the optimal control and cost functional is obtained on some specific control sets.

• The asymptotic behaviour of some low-cost control problems in periodically perforated domains with Neumann condition on the boundary of the holes has been obtained. It is assumed that the cost of the control is of the same order as that describing the oscillations of the coefficients. The asymptotic analysis of small cost problem is more delicate and need the H-convergence result for weak data. In this connection, a H-convergence result for weak data under some hypotheses is also proved in [184].

• Fractional order Functional Differential Equations : The existence of local and global solutions of the fractional order integral equations in an arbitrary Banach space by using the semigroup theory of linear operators and Schauder's fixed point theorem has been established. Some examples to illustrate the applications of the abstract results are also presented in [128]. Further another fractional order functional integral equation has been considered. In [232], the existence and uniqueness of mild and global solution in a Banach space was established. It is also established the existence, uniqueness and convergence of approximate solutions of the given problem in a separable Hilbert space. Further results in this area are presented in [233, 183].

Random matrices and random analytic functions : • Random matrix-valued analytic functions: In [173], a new family of random matrix-valued analytic functions were introduced, and the distributions of their zero sets were explicitly computed. These turned out to be one-component plasma on the sphere and in the hyperbolic plane.

• Explicit computation of eigenvalue distribution of truncated unitary matrices: In [168], a simple derivation of the explicit distribution of eigenvalues of truncated random unitary matrices was given. This result has important applications to random analytic functions, as in the paper [173] cited above, and was originally proved by Zyczkowsky and Sommers in a more complicated and non-rigorous manner.

• Hermitian to non-hermitian invariance principles: In the paper [242], the authors Terence Tao and Van Vu settle the long standing "circular law conjecture" for eigenvalue distribution of matrices with independent and identically distributed entries. This landmark paper uses invariance principles to prove the circular law. In an appendix, the non-hermitian invariance principle was extended and it was shown to arise from an earlier hermitian invariance principle of Sourav Chatterjee.

• Random analytic functions and determinantal processes: The book [1], jointly authored by Hough, Krishnapur, Peres and Virág, titled *Zeros of Gaussian analytic functions and Determinantal point processes*, was published by the American Mathematical Society, as volume 51 of its *Uniersity lectures series*, in the year 2009. This book is expected to be of use to graduate students as well as researchers who wish to learn about this still growing field.

• Single ring theorem: An intriguing question in non-hermitian random matrices was the limiting eigenvalue distribution of a random matrix whose singular value distribution has a certain limit. What answers to expect was known earlier, but a rigorous derivation is first given in the paper [287] for a wide class of such matrices. In particular, the celebrated *single ring* phenomenon, whereby, the support of the limiting eigenvalue distribution turns out to be a single connected annulus, is also shown for these class of random matrices.

• A determinantal and Gaussian analytic functions: The infinite Ginibre ensemble is a translation invariant determinantal point process in the plane which exhibits "repulsion betweeen points". Zeros of random analytic functions also typically show the same behaviour at short distances but widely different behaviour at long distances. In preprint [343], this difference is explained by showing that the Ginibre ensemble is a mixture of zeros of Gaussian analytic functions.

Several Complex Variables : • Local polynomial convexity and degenerate CR singularities: A compact subset $K \subset \mathbb{C}^n$ is said to be *polynomially convex* if, for every point $\zeta \notin K$, there exists a complex polynomial P such that $P(\zeta) = 1$ and $\sup_K |P| < 1$. A real surface $\mathcal{S} \subset \mathbb{C}^2$ is known to be locally polynomially convex at each point $p \in \mathcal{S}$ at which the tangent space $T_p(\mathcal{S})$ is *not* a complex subspace of the ambient $\mathbb{C}^2$. Additionally, one now has — owing to the works of Bishop, Forstnerič-Stout, and Jöricke — a full understanding of the local polynomial convexity (or the lack thereof) of $\mathcal{S}$ at each isolated $p \in \mathcal{S}$ with the property that the tangent space $T_p(\mathcal{S})$ is a complex subspace of the ambient $\mathbb{C}^2$, and the order of contact of $T_p(\mathcal{S})$ with $\mathcal{S}$ at p *precisely equals* 2. Such a point p is called a non-degenerate CR singularity. In contrast to the above situation, very little was known about whether $\mathcal{S}$ is locally polynomially convex at p if p is a *degenerate CR singularity*. However, progress was made towards a fuller understanding of this setting through the results in [6]. Since then, these results have been further refined in [267] to address a conjecture that extends the Bishop/Forstnerič-Stout/Jöricke scheme for local polynomial convexity to degenerate CR singularities.

• Polynomial convexity and approximation: Given a $\mathbb{C}$-valued function f on a compact planar set, the polynomial convexity of its graph Gr_f converys a lot of information on whether continuous functions defined on Gr_f can be unformly approximated on this set by holomorphic polynomials on $\mathbb{C}^2$. Using this viewpoint, and working with suitably chosen plurisubharmonic functions, a new and more transparent proof was given for the Axler–Shields theorem. This was obtained as a special case of a theorem [249] that shows that the uniform algebra on the closed unit disc generated by the identity function and a close-to-harmonic function equals the algebra of $\mathbb{C}$-valued continuous function on the unit disc.

• Characterising domains that have a non-compact automorphism group is of interest in complex analysis. A complete characterisation of those bounded domains in $\mathbb{C}^2$ that admit an orbit that accumulates at a smooth real analytic and finite type boundary point was obtained in [198].

• Theorems on the boundary behaviour of holomorphic correspondences and analytic continuation of germs of holomorphic mappings along real hypersurfaces were obtained in [34] and [101] respectively.

• Stability properties of the integrated Carathéodory and Kobayashi distance on strongly pseudoconvex domains, weakly pseudoconvex finite type domains in $\mathbf{C}^2$ and convex finite type domains were studied in [289] and these led to an understanding of Fridman's invariant associated to these metrics. Applications include several theorems on the biholomorphic inequivalence of a given pair of domains with different Levi geometry, a theorem on the characterisation of the polydisk in terms of its automorphism group and estimates on the integrated distance on the aforementioned domains.

• Several properties of the metric induced by the Robin function were obtained in [273]; these include the boundary behaviour of the global potential function, estimates on the holomorphic sectional curvature along normal directions and a comparison with the Kobayashi metric on strongly pseudoconvex domains.

• A general extension theorem for holomorphic mappings between domains in $\mathbb{C}^2$, both of which may possibly be unbounded, was obtained in [292]. The mappings considered here are not necessarily proper.

• Regularity theorems for Lipschitz CR mappings from h-extendible hypersurfaces were obtained in [310].

• The spectral Pick-interpolation problem: The spectral Pick-interpolation problem (SPIP) has a statement similar to the classical Pick-interpolation problem except that the target space — rather than being the operator-norm unit-ball of $n \times n$ matrices — is the class of $n \times n$ complex matrices having spectral radii less than 1 (which we denote by Ω_n). The spectral Pick-interpolation problem (SPIP) is much subtler than the classical problem because the spectral radius is not a norm. This unbounded-in-norm interpolation problem has its origins in Control Theory. The pioneering contribution to solving the SPIP is a famous paper by Bercovici, Foias & Tannenbaum, but implementing their solution involves a non-trivial, non-convex gradient search. Thus, a lot of interest is focused on finding more tractable approaches to the SPIP. A promising new approach was suggested by Agler and Young in 1999. The Agler-Young approach has, due to Agler-Young and several collaborators, led to a necessary condition on the given data for the SPIP to be solvable. This was conjectured to also be a sufficient condition. However, using techniques in several complex variables, it was shown in [52] that the Agler-Young-type condition is *not a sufficient condition.* In the positive direction, a technique on how to incorporate information about the minimal polynomials of the matricial data involved (which has long been suggested by Bercovici, Foias & Tannenbaum), when studying the SPIP, was demonstrated.

• Explicit and optimal constructions of outward bumpings of smoothly bounded pseudoconvex domains in $\mathbb{C}^3$ were studied. The term "outward bumping" of a smoothly bounded pseudoconvex domain in $\Omega \subset \mathbb{C}^n,\ n \geq 2$, refers to the following construction (here p is a point in $\partial\Omega$):

(*) To construct a smoothly bounded pseudoconvex domain $\widetilde{\Omega}$ with $\partial\widetilde{\Omega} \ni p$ such that there is a ball B centered at p and such that $(B \cap \overline{\Omega}) \setminus \{p\} \subset_{proper} \widetilde{\Omega} \cap B$.

If $\widetilde{\Omega}$ can be so constructed that the orders of contact of $\partial\widetilde{\Omega}$ with the various complex-tangential directions in $T_p(\partial\widetilde{\Omega}) = T_p(\partial\Omega)$ are exactly equal to the corresponding orders of contact of $\partial\Omega$, then $\widetilde{\Omega}$ is called an *optimal outward bumping* of Ω at p. This rather technical-sounding problem has several important consequences in the function theory on weakly pseudoconvex domains in $\mathbb{C}^n$, $n \geq 2$. In joint work with B. Stensønes, the key function-theoretic step towards the explicit construction of optimal outward bumpings was accomplished [163]. The central result of [163] was used in recent work [311] to construct bumpings for several large classes of weakly pseudoconvex domains in $\mathbb{C}^3$ (all of which include the so-called h–extendible domains, for which this construction has been known).

• A novel approach using Weinstock's normal form for a pair of transverse, maximally totally-real subspaces in $\mathbb{C}^n$, $n \geq 2$, was used to address a variety of questions on determining the local polynomial convexity at the origin in $\mathbb{C}^2$ of various unions of smooth, totally-real objects intersecting at $0 \in \mathbb{C}^2$. These include unions of pairs of $\mathcal{C}^2$-smooth totally real 2-surfaces, and unions of two or more totally-real planes. Necessary conditions and sufficient conditions for local polynomial convexity at $0 \in \mathbb{C}^2$ for pairs of 2-surfaces were obtained in [251].

Stochastic Processes and Probability Models : • The long time behaviour of the empirical distribution of age and normalised position of an age dependent super critical branching Markov process is studied [213].

• The long time behaviour of the empirical distribution of age and normalised position of an age dependent critical branching Markov process conditioned on non-extinction; and the super-process limit of a sequence of age dependent critical branching Brownian motions are studied [247].

• The problem of coverage of a target in a field of unreliable sensor field is studied. The underlying coverage process is modelled as a *Markov-Poisson-Boolean model*. Limit laws for k-coverage of an area at an arbitrary instant are first obtained. Then the limit laws for the k-coverage seen by a particle as it moves along a one-dimensional path are derived [119].

• Let n points be placed independently in $d-$dimensional space according to the density $f(x) = A_d e^{-\lambda\|x\|^\alpha}$, $\lambda > 0$, $x \in R^d$, $d \geq 2$. Let d_n be the longest edge length of the nearest neighbor graph on these points. A fluctuation limit and an almost sure convergence result are established for d_n. It is shown that the exponential rate of decay $\alpha = 1$ is critical, in the sense that for $\alpha > 1$, $d_n \to 0$, whereas for $\alpha \leq 1$, $d_n \to \infty$ $a.s.$ as $n \to \infty$ [226].

• The asymptotic properties of a random geometric graph on uniform points in which a directed link exists between two nodes if the *signal to interference-noise ratio* is above a certain threshold is studied. An almost sure upper bound on the maximum *received interfence* is first proved. This allows a choice of an asymptotic *spread* parameter so as to bound the maximum received interference. Subsequently, under the assumption that the interference effects are uniformly bounded, the critical power required to ensure that the graph does not possess isolated nodes with high probability in the presence of fading effects alone is studied. Next an almost sure limit for the critical power is shown. A key tool in proving this and a few other results in the paper is an upper bound on the length of the longest edge in the graph [322].

• A generalization to the continuum of the discrete AB percolation model on discrete lattices is studied. Let P_λ, P_μ be independent Poisson point processes in $\Re^d$, $d \geq 2$, of intensities λ, μ respectively. The AB random geometric graph $G(\lambda, \mu, r)$ is a graph whose vertex set is P_λ with edges between any two points $X_i, X_j \in P_\lambda$ provided there exists a $Y \in P_\mu$ such that $|X_k - Y| \leq r$, $k = i, j$. Percolation and connectivity in AB random geometric graphs are investigated [340].

• A unified approach to the study of connectivity in non-uniform RGGs is proposed. In the case of uniform distribution of nodes it is known that the critical radius would be $O((\log\ n/n)^{1/d})$. For non-uniform distributions, the critical radius is determined by the value of the underlying density at its minimum, which is where the node distribution will be sparse and hence inter-point distances will be large. The critical radius for connectivity is important in wireless communication in ad-hoc networks, since it allows for spatial reuse. By choosing uniform radius in case of non-uniform distribution, spatial reuse is reduced. Another aspect is that existing results are not valid if the density vanishes on a set of positive measure. Consider a RGG where apart from the underlying density and the number of nodes in the network, each node also knows its location. The problem is to arrive at a location dependent formula so that if each node chooses its transmission radius according to this formula then the graph is connected with high probability. A formula that will give a Poisson limit for the number of isolated nodes has been derived. This method has been demonstrated to work for densities that have compact support and are either non-vanishing or having polynomial decay to zero. A criterion to ensure connectivity in this framework is also given [339].

• The problem of coverage in sensor networks having two types of nodes, sensors and backbone nodes is studied. Each sensor is capable of transmitting information over relatively small distances. The backbone nodes collect information from the sensors. This information is processed and communicated over an ad-hoc network formed by the backbone nodes, which are capable of transmitting over much larger distances. Two modes of deployment of sensors are considered, one a Poisson-Poisson cluster model and the other a dependently-thinned Poisson point process. We deduce limit laws for functionals of vacancy in both models using properties of association for random measures. [315].

• A method to compute a probably approximately correct (PAC) normalized histogram of observations with a refresh rate of $\Theta(1)$ time units per histogram sample on a random geometric graph with noise-free links is proposed. The delay in computation is $\Theta(\sqrt{n})$ time units. We further extend our approach to a network with noisy links. While the refresh rate remains $\Theta(1)$ time units per sample, the delay increases to $\Theta(\sqrt{n}\log n)$. The number of transmissions in both cases is $B(n)$ per histogram sample.

The achieved $\Theta(1)$ refresh rate for PAC histogram computation is a significant improvement over the refresh rate of $\Theta(1/\log n)$ for histogram computation in noiseless networks. This is achieved by operating in the super-critical thermodynamic regime where large pathways for communication build up, but the network may have more than one component. The largest component however will have an arbitrarily large fraction of nodes in order to enable approximate computation of the histogram to the desired level of accuracy. Operation in the super-critical thermodynamic regime also reduces energy consumption. A key step in the proof of our achievability result is the construction of a connected component having bounded degree and any desired fraction of nodes. This construction may also prove useful in other communication settings on the random geometric graph [253].

• A Stochastic Differential Equation (SDE) appearing in the statistical theory of turbulence is extended in random environment by assuming that its two parameters are switched by an unobserved continuous-time Markov chain whose states represent the states of the environment. A Dirichlet process is placed as a prior on the space of the sample paths of this chain, leading to a hierarchical Dirichlet model whose estimation is done both on simulated data and on real data of wind speed measured at the entrance of a mangrove ecosystem [317].

• Vacation queueing models have wide range of application in several areas including computer-communication, and manufacturing systems. A finite-buffer single-server queue with renewal input and multiple exponential vacations had been analyzed by Karaesmen and Gupta (1996). The analysis to cover the batch arrivals has been extended in this paper i.e a batch arrival single-server queue with renewal input and multiple exponential vacations have been considered. The imbedded Markov chain and supplementary variable techniques has been used to obtain steady-state distribution of number of customers in the system at pre-arrival and arbitrary epochs. The Laplace-Stieltjes transforms of the actual waiting-time distribution of the first-, arbitrary- and last-customer of a batch under FCFS discipline have been derived. Finally, useful performance measures of interest such as probability of blocking, average queue (system) length have been presented. Some tables and graphs showing the effect of model parameters on key performance measures have been presented [121].

• A linear function approximation based reinforcement learning algorithm was proposed for Markov decision processes with infinite horizon risk-sensitive cost. Its convergence was proved using the 'o.d.e. method' for stochastic approximation. The scheme was also extended to continuous state space processes ([104]).

• Consider a finite buffer single server batch service queue where server takes multiple vacations. Arrival of customers follows a Markovian arrival process (MAP). The server is unavailable for occasional intervals of time called vacations, and when it is available, customers are served in batches of maximum size b with a minimum threshold value a. The queue length distributions at various epochs has been obtained with some key performance measures and finally presented with numerical results ([135]).

• A finite-buffer variable batch arrival and variable batch service queue with single and multiple vacations has been studied, which has a wide range of applications in several areas including manufacturing, internet web-server and telecommunication systems. The steady-state distributions of the number of customers in the queue at service completion, vacation termination, departure, arbitrary and pre-arrival epochs have been obtained. Finally, various performance measures such as average queue length, average waiting time, probability that the server is busy, blocking probabilities, etc. are discussed ([136]).

• Consider a finite buffer batch service GI/M/1 queue with multiple vacations and exhaustive service such that the server works with different service rates rather than completely stopping service during a vacation period. Such a vacation is called a working vacation. The analysis of the actual waiting time in the system under the FCFS discipline is carried out. It is hoped that the results obtained in this work may provide useful information to designers of telecommunication systems, practitioners, and others ([350]).

• Consider a MAP/G/1/N queue under a modified vacation policy, in which server takes a finite number (say J & # 8805; 0) of vacations whenever the system becomes empty at service completion epoch until at least one customer is found waiting in the queue when the server returns from vacation. If no customers are found by the end of the Jth vacation, the server stays in the system (called dormant period) until one customer arrives. The distributions of number of customers in the queue at various epochs have been obtained along with the L.S.T. of the actual waiting-time distribution in the queue of a customer under FCFS discipline ([351]).

• Stochastic processes with age dependent transition rates are studied. A typical example of such a process is a semi-Markov process which is completely determined by the holding time distributions in each state and the transition probabilities of the embedded Markov chain. The process that has been constructed generalizes semi-Markov processes. One important feature of this process is that unlike semi-Markov processes the transition probabilities of this process are age dependent. Under certain condition the Feller property of the process is established. Finally the limiting distribution of the process are computed explicitly.

Stochastic Dynamic Games : • Partially observable semi-Markov games with discounted payoff on a Borel state space were studied. Both zero sum and nonzero sum cases were considered. Saddle point equilibrium and Nash equilibrium for relevant cases were established ([15]).

• A zero-sum partially observable semi-Markov game with average payoff on a countable state space was studied. Under certain conditions the existence of a saddle point equilibrium was established ([117]).

• A zero-sum stochastic game where each player uses both control and stopping times was studied. Under certain conditions the existence of a saddle point equilibrium was established. It was further shown that the value function of the game was the unique solution of certain dynamic programming inequalities with bilateral constraints ([62]).

Time Series Analysis : • Computing Granger causal relations among bivariate experimentally observed time series has received increasing attention over the past few years. Such causal relations, if correctly estimated, can yield significant insights into the dynamical organization of the system being investigated. Since experimental measurements are inevitably contaminated by noise, it is thus important to understand the effects of such noise on Granger causality estimation. An analytical and numerical analysis of the above problem was provided. Specifically, it was shown that, due to noise contamination, (1) spurious causality between two measured variables can arise and (2) true causality can be suppressed. A denoising strategy to mitigate this problem was provided. Specifically, a denoising algorithm based on the combined use of the Kalman filter theory and the Expectation-Maximization algorithm was proposed. Numerical examples were used to demonstrate the effectiveness of the denoising approach [74].

• The above method was applied to denoise two datasets of local field potentials recorded from monkeys performing a visuomotor task. For the first dataset, it was found that the analysis of the high gamma band (60-90 Hz) neural activity in the prefrontal cortex is highly susceptible to the effect of noise, and denoising leads to markedly improved results that were physiologically interpretable. For the second dataset, Granger causality between primary motor and primary somatosensory cortices was not consistent across two monkeys and the effect of noise was suspected. After denoising, the discrepancy between the two subjects was significantly reduced [185].

• Experiments in many fields of science and engineering yield data in the form of time series. The Fourier and wavelet transform-based nonparametric methods are used widely to study the spectral characteristics of these time series data. The framework of nonparametric spectral methods was extended to include the estimation of Granger causality spectra for assessing directional influences. The utility of the proposed methods was illustrated using synthetic data from network models consisting of interacting dynamical systems [114]. This method was successfully applied to data from a neuroscience experiment [115].

• Simultaneous recordings of spike trains from multiple single neurons are becoming commonplace. Mathematically, spike trains can be modelled as point processes. Understanding the interaction patterns among these spike trains (point processes) remains a key research area. A question of interest is the evaluation of information flow between neurons through the analysis of whether one spike train exerts causal influence on another. For continuous-valued time series data, Granger causality has proven an effective method for this purpose. However, the basis for Granger causality estimation is autoregressive data modelling, which is not directly applicable to spike trains. Various filtering options distort the properties of spike trains as point processes. A new nonparametric approach to estimate Granger causality directly from the Fourier transforms of spike train data was proposed. The method was validated on synthetic spike trains generated by model networks of neurons with known connectivity patterns and then applied it to neurons simultaneously recorded from the thalamus and the primary somatosensory cortex of a squirrel monkey undergoing tactile stimulation [189].

• Rapid oscillations in the intensity of the Southwest monsoon during the last glacial phase was inferred for the first time using newly generated continental records from the site of Bhimpura. Performing time series analysis on several climate sensitive proxy variables, seven flood periods and non-flood periods were identified. These episodes were found to reflect strong and weak monsoonal phases with a time scale of a few thousand years.

• Two popular methods for estimating the power spectrum for short time series, namely adaptive multivariate autoregressive (AMVAR) method and the multitaper method were compared. By analyzing a simulated signal (embedded in a background Ornstein-Uhlenbeck noise process) it was demonstrated that the AMVAR method peforms better at detecting short bursts of oscillations when compared to the multitaper method. However, both methods were immune to jitter in the temporal location of the signal. It was shown that coherence can still be detected in noisy bivariate time series data even if the individual power spectra fail to show any peaks. Finally, AMVAR method was applied to data from a neuroscience experiment. By performing short window spectral analysis on local field potential (LFP) data from the motor cortex of macaque monkeys performing a visual discrimination task, it was found that the AMVAR method is able to reliably detect the duration of beta oscillations [186].

• A method to use the variance to estimate the fraction of patients on whom a drug has an effect was developed. This was based on the principle that a drug that acts on only some patients tends to increase the variance. In the case of a multiplicative model for the effect of the drug, the fraction of patients on whom the drug has an effect can be estimated in terms of the variances of the logarithm of survival times in the treated and control populations. When applied to breast cancer treatment by Tamoxifen, now known to act only on patients with Oestrogen receptors, our estimate agreed with experimental data.

3.3.2 Research Highlights in other areas

Algebraic Topology : • The deformation cohomology of a finite dimensional coalgebra over a finitely generated quadratic operad is defined and is shown to have the structure of a graded Lie algebra. It has been also proved that the cohomology of such a coalgebra is isomorphic to the cohomology of its linear dual as graded Lie algebras ([204]).

• A theory of versal deformations has been developed for dialgebras, and a method has been described to construct a miniversal deformation of a dialgebra ([200]).

Algebraic Geometry : • The Lefschetz theorems state that under certain conditions, the Picard groups of a pair $Y \subset X$ of smooth projective varieties are isomorphic under certain conditions. Generalisations of these theorems to pairs of normal projective varieties were obtained. A new proof of a Noether-Lefschetz theorem using coherent cohomology was also obtained ([152]).

• Splitting criteria for vector bundles on smooth projective hypersurfaces were studied. Generalisations of some of the existing criteria for vector bundles on projective spaces were obtained. In particular, it was shown that rank 2 vector bundles on hypersurfaces of degree at least 6 on $\mathbb{P}^4$ and of degree at least 3 on $\mathbb{P}^n$ for $n \geq 5$ with vanishing intermediate cohomology are sums of line bundles. It was also shown that on a generic hypersurface in $\mathbb{P}^{m+1}$ of dimension at least 3, a vector bundle with $r \leq m$ generators must be split if m is odd. If m is even, then the same was shown to be true if the degree of X is at least 3 ([145]).

Let X be a compact connected Riemann surface of genus $g \geq 2$, r an integer, $r \geq 2$, and ξ a line bundle on X with $\deg \xi > r(2g-1)$. Denote by $J(X)$ the Jacobian of X and by $\mathcal{M}_\xi(r)$ the moduli space of stable bundles of rank r and determinant ξ on X. Let $\mathcal{L}$ be a Poincaré line bundle on $X \times J(X)$ and denote by p_X, p_J the projections of $X \times J(X)$ on the two factors. For any $F \in \mathcal{M}_\xi(r)$, the sheaf $p_{J*}(\mathcal{L} \otimes p_X^* F)$ is locally free, defining a vector bundle $\mathcal{V}_F$ The rank δ and Chern classes of $\mathcal{V}_F$ are independent of F and so is the determinant line bundle $\bigwedge^\delta \mathcal{V}_F$. Let $\mathcal{M}(J(X))$ denote the corresponding moduli space of stable bundles on $J(X)$, so that the correspondence $F \mapsto \mathcal{V}_F$ defines a morphism $\beta\colon \mathcal{M}_\xi(r) \to \mathcal{M}(J(X))$. It was shown that β is injective. Now suppose $g = 2$ and, if $\deg \xi$ is even, $r \geq 3$. Let C_i denote Chern classes in the Chow groups and let $\mathcal{M}^0(J(X))$ be the subvariety of $\mathcal{M}(J(X))$ defined by the condition that the image of $C_1^2 - 2C_2$ in Deligne-Beilinson cohomology is zero. It was shown that the image of β is a Lagrangian subscheme of the symplectic variety $\mathcal{M}^0(J(X))$ ([199]).

• It was shown that generalised quadrics are reduced. These quadrics arise in a natural way in the context of vector bundles with vanishing intermediate cohomology.

• It was shown that an automorphism of Riemann surfaces acting trivially on theta divisors is a hyperelliptic involution ([88]).

• For X, a geometrically irreducible smooth projective curve, defined over $\mathbb{R}$, of genus at least two and σ a non-trivial automorphism of X satisfying a mild technical condition, it was shown that σ acts trivially on the set of all real theta characteristics of X if and only if X is hyperelliptic with σ being the unique hyperelliptic involution of X, provided that X does not have any real points. Examples are given showing that the condition that X does not have any real points is necessary ([296]).

Coding Theory : • For practical reasons one would like to design codes with 'Peak-to-Mean-Envelope-Power-Ratio' (PMEPR) as low as possible. For decoding purpose, linear codes are efficient. In [151], it was shown that any linear (over $\mathbb{Z}_m$ or $\mathbb{F}_q$) code having a coset with low PMEPR can be obtained using the Coset-Combining method iteratively starting from the trivial subspace. As a consequence, it was shown (among others) the following: Fixed $s \in \mathbb{Z}^+$. Let $\varepsilon \in \mathbb{R}^+$ and $r \in \mathbb{Z}^+$. Then there exists $N = N(\varepsilon, r) \in \mathbb{Z}^+$ such that (i) for every $n \geq N$ there exists an affine linear code over $\mathbb{Z}_{2^s}$ of length $2^n + r$ with PMEPR at most $2 + \varepsilon$, (ii) for every $n \geq N$ there exists a $[2^n + r, 1 + \binom{m}{1} + r]$ linear code over $\mathbb{Z}_{2^s}$ which has a coset with PMEPR at most $2 + \varepsilon$ and (iii) for every $n \geq N$ and $0 < d \leq r$, there exists a $[2^n + r, 1 + \binom{m}{1} + h(d), d]$ linear code over $\mathbb{Z}_{2^s}$ which has a coset with PMEPR at most $2 + \varepsilon$, where $h(d)$ is the maximum of the dimensions of all the subspaces of $\mathbb{Z}_{2^s}^r$ whose minimum Hamming distance is at least d. All these works have applications in Electrical and Communication Engineering.

Combinatorial Topology : • In 1986, Kühnel constructed a $(2d+3)$-vertex d-dimensional simplicial complex K^d_{2d+3} which triangulates a sphere bundle over the circle for each $d \geq 2$. In 1987, Brehm and Kühnel showed that any triangulation of a non-simply connected closed pl manifold of dimension $d \geq 3$ requires at least $2d + 3$ vertices. In [143], it was shown that K^d_{2d+3} is the unique $(2d + 3)$-vertex triangulation of a non-simply connected closed d-manifold for all $d \geq 3$. The uniqueness of K^d_{2d+3} in the broader class of homology manifolds under the same hypothesis is also shown recently in [358].

• By constructing examples, it was shown that there are both orientable and non-orientable S^{d-1}-bundle over S^1 with $2d + 4$ vertices and the number of non-isomorphic $(2d + 4)$-vertex triangulations of these d-manifolds grow exponentially with d ([143]).

• In [144], a self-contained combinatorial proof of the lower bound theorem for normal pseudomanifolds, including a treatment of the cases of equality in this theorem was presented. A new lower bound conjecture for non-simply connected triangulated manifolds is posed.

• A new self-complete proof was obtained for the following result: 'For $d \geq 4$, the vertex-links of a triangulated d-manifold X are stacked $(d-1)$-spheres if and only if X is obtained from a stacked d-sphere by elementary handle additions' ([144]).

• In [146], all the 3-dimensional normal pseudomanifolds with eight vertices were classified. It was shown that there are exactly 74 such pseudomanifolds, 39 of which triangulate the 3-sphere and 28 (among the remaining 35) are branched quotients of some 14-vertex regular pseudotriangulations of the 3-sphere. It was also shown that any 8-vertex 3-dimensional pseudomanifold is equivalent by proper bistellar moves to an 8-vertex 3-dimensional neighborly pseudomanifold. This result is best possible since there exists a 9-vertex non-neighborly 3-dimensional pseudomanifold which does not allow any proper bistellar move.

• From some results of Walkup and Kühnel, it follows that for an n-vertex triangulated 4-manifold with Euler characteristic χ, $n(n - 11) \geq -15\chi$, with equality only for 2-neighborly manifolds whose vertex-links are stacked 3-spheres. There is a unique 11-vertex triangulated 4-manifold with Euler characteristic 0. In [260], it was shown that there is a 15-vertex triangulated 4-manifold with Euler characteristic -4. It triangulates a non-orientable closed 4-manifold with first Betti number $\beta_1 = 3$.

• Let S^2_4 and S^2_{12} denote the boundary of the tetrahedron and the icosahedron respectively. The group $\mathbb{Z}_2$ acts on S^2_{12} by antipodal action and the quotient $\mathbb{R}P^2_6 := \mathcal{I}/\mathbb{Z}_2$ triangulates the real projective plane.

In [295], it was shown that there exists (unique up to isomorphism) a simplicial subdivision X of the cell complex $S^2_4 \times S^2_4$ inside $S^2_4 * S^2_{12}$ such that $\mathbb{C}P^2_{10} := X/\mathbb{Z}_2$ is a 10-vertex triangulation of the complex projective plane. (Action of $\mathbb{Z}_2$ on S^2_4 is trivial.) Thus $\mathbb{C}P^2_{10}$ is a subcomplex of $S^2_4 * \mathbb{R}P^2_6$.

• The permutation group S_n acts on the product $S^2 \times \cdots \times S^2$ of n copies of the 2-sphere by co-ordinates permutation and the quotient space $(S^2 \times \cdots \times S^2)/S_n$ is the n-dimensional complex projective space $\mathbb{C}P^n$.

In [357], a 124-vertex simplicial subdivision K of the cell complex $S^2_4 \times S^2_4 \times S^2_4$ was found and shown that the quotient complex K/S_3 is a 30-vertex triangulation of $\mathbb{C}P^3$. This is the first explicit triangulation of $\mathbb{C}P^3$.

• In [358], the class $\Sigma_k(d)$ of k-stellated triangulated spheres of dimension d, so that $\Sigma_0(d) \subseteq \Sigma_1(d) \subseteq \cdots \subseteq \Sigma_d(d) \subseteq \Sigma_{d+1}(d)$ is a filtration of the class of combinatorial d-spheres is introduced. Studied the comparison of these classes with the classes $\mathcal{S}_k(d)$ of k-stacked d-spheres. Again, there is a filtration $\mathcal{S}_0(d) \subseteq \mathcal{S}_1(d) \subseteq \cdots \subseteq \mathcal{S}_d(d)$ of the class of all triangulated d-spheres, and the easy inclusion $\Sigma_k(d) \subseteq \mathcal{S}_k(d)$ with equality for $k \leq 1$. But, for each $k \geq 2$, there are k-stacked spheres which are not k-stellated.

In analogy with the (generalized) Walkup classes $\mathcal{K}_k(d)$ of triangulated d-manifolds all whose vertex-links are k-stacked spheres, the class $\mathcal{W}_k(d)$ of combinatorial d-manifolds whose vertex-links are k-stellated spheres, so that $\mathcal{W}_k(d) \subseteq \mathcal{K}_k(d)$. For $d \geq 2k+2$ (respectively $d \geq 2k$), every member of $\mathcal{W}_k(d)$ (respectively, of $\Sigma_k(d)$) is the boundary of a canonically defined $(d+1)$-manifold (respectively $(d+1)$-ball) is considered.

Finally, the subclass $\mathcal{W}^*_k(d)$ of $\mathcal{W}_k(d)$ (respectively $\mathcal{K}^*_k(d)$ of $\mathcal{K}_k(d)$) consisting of all $(k+1)$-neighbourly members of the latter class is introduced. It is shown that, for $d \neq 2k+1$, all members of $\mathcal{W}^*_k(d)$ are tight (with respect to any field if $k \geq 2$). Also, the case $d = 2k+1$ is a genuine exception to this result since it is shown that all the cyclic spheres of dimension $2k+1$ are in the class $\mathcal{W}^*_k(2k+1)$. These results partially answer a recent question of Effenberger. It is shown that when $d \geq 2k+2$, any member of $\mathcal{W}^*_k(d)$ has the same homology with $\mathbb{Z}$-coefficients as the connected sum of finitely many copies of $S^k \times S^{d-k}$. A new lower bound on the number of vertices of an even dimensional triangulated manifold in terms of its dimension, connectivity and Euler characteristic is conjectured. This is a common generalisation of the Brehm-Kühnel lower bound on triangulated manifolds which are not k-connected, and Kühnel's lower bound conjecture (now a theorem of Novik and Swartz). Conjecturally, the members of $\mathcal{W}^*_k(d)$, d even, provide the only cases of equality in the new conjecture.

Commutative Algebra: • A criterion that can be used to prove that a given affine domain of dimension one over a field is not an Euclidean domain. This criterion is used to construct examples of PIDs which are not Euclidean domains ([97]).

• The holes and their positions of a numerical semigroup and use this description to compute the type sequence of the semigroup generated by an arithmetic sequence $m_0, m_1, \ldots, m_{p+1}$ explicitly described. As an application, they are able to characterize almost Gorenstein semigroup rings $R = K[[\Gamma]]$ ([98]).

If R is analytically irreducible, then characterization of the Arf property of R using several type sequences is given. As an application, a new characterization of semigroup rings of minimal multiplicity with $\ell^* \leq \tau(R)$ using the Arf property and some type sequences is obtained. Lots of examples of Arf rings and non-Arf rings are provided ([99]).

• The research work on Hilbert functions, their computation with the help of blowing-ups and the Cohen-Macaulaynees of the tangent cone is carried. More precisely: Let $(R, \mathbf{m})$ be a 1-dimensional Cohen-Macaulay local ring of multiplicity e and embedding dimension $\nu \geq 2$. Let B denote the blowing-up of R along $\mathbf{m}$ and let I be the conductor of R in B. Let $x \in \mathbf{m}$ be a superficial element in $\mathbf{m}$ of degree 1 and $\overline{R} = R/xR$, $\overline{I} = (I+xR)/xR$. We assume that the length $\ell(\overline{I}) = 1$. This class of local rings contains the class of 1-dimensional Gorenstein local rings. We prove that if the associated graded ring $\mathrm{G} = \mathrm{gr}_{\mathbf{m}}(R)$ is Cohen-Macaulay, then $I \subseteq \mathbf{m}^s + xR$, where s is the degree of the h-polynomial h_R of R. Further, necessary and sufficient conditions for the Cohen-Macaulayness of G were given. These conditions are numerical conditions on the h-polynomial h_R, particularly on its coefficients and the degree in comparison with the difference $e - \nu$. Conditions for the Gorensteinness of G was given. Lastly, a characterisation of numerical semigroup rings which satisfy the condition $\ell(\overline{I}) = 1$ was obtained ([150]).

• Bases for projective monomial curves and the relationship between the basis and the set of generators for the defining ideal of the curve were studied. We understand this relationship best for curves in $\mathbb{P}^3$ and for curves defined by an arithmetic progression. As an applications of these results a affirmative answer to a special case of the long-standing question on the set-theoretic complete intersections was given. More precisely, it was shown that: *Projective monomial curves defined by arithmetic progression are set-theoretic complete intersections* ([302]).

• For a semigroup ring $R = K[[\Gamma]]$ of a numerical semigroup Γ the study of the Cohen-Macaulayness of the associated graded ring $\mathrm{G}(\Gamma) := \mathrm{gr}_{\mathbf{m}}(R)$ and the behaviour of the Hilbert function H_R of R is stadied. A certain subset $\mathrm{B}(\Gamma) \subseteq \Gamma$ is defined and it is proved that $\mathrm{G}(\Gamma)$ is Cohen-Macaulay if and only if $\mathrm{B}(\Gamma) = \emptyset$. Finally, for the class of balanced unitary numerical semigroups Γ, it is proved that $\mathrm{G}(\Gamma)$ is not Cohen-Macaulay and the Hilbert function h_R is non-decreasing ([263]).

• A characterization of almost-Gorensteinness of the algebroid semigroup ring $R = K[[\Gamma]]$ of the numerical semigroup generated by an arithmetic sequence Γ over a field K is given. A formula for the degree of singularity of R as the sum of the lengths of quotients of the successive terms of its branch sequence as well as the sum of the first coefficients of the Hilbert-Samuel polynomials of the terms of its branch sequence is given. Further, a characterization of complete local Arf domains with algebraically residue field using the type sequence of R and type sequences of the rings in the branch sequence of R is given. Finally, it is proved that the type sequence of the blowing-up ring of a complete local Arf domain with algebraically residue field is the sequence obtained from the type sequence of R obtained by removing its first term. Some examples of Arf rings and some of not Arf rings are given. Necessary and sufficient conditions for the algebroid semigroup ring $R = K[[\Gamma]]$ of the numerical semigroup generated by an arithmetic sequence Γ over a field K to be an Arf ring are given ([388]).

• In the (expository) article [262], the shuffling of cards is used as a motivation for introducing the concept of a group action. It combines the concept of an abstract group with the original idea of a group as a transformation group and is fundamental in almost all parts of mathematics and its applications in physical sciences.

• Obtained a new proof of the classical theorem of Burnside which asserts that the canonical Burnside mark homomorphism of the Burnside algebra $B(G)$ of a finite group G into the product $\mathbb{Z}$-algebra of rank $\# C_G$ is injective, where C_G denote the set of conjugacy classes of the subgroups of G. Further, it is shown that for any finite group G the canonical $\mathbb{Z}$-algebra homomorphism $\mathbb{Z}^{C_{\mathbb{Z}_G}} \to \mathbb{Z}^{C_G}$ maps the Burnside algebra $B(\mathbb{Z}_G)$ of a finite cyclic group $\mathbb{Z}_G$ of order $\# G$ into the Burnside algebra $B(G)$ ([264]).

Differential Geometry : • As a preliminary step to proving a uniformization theorem for simply-connected nonpositively curved Kähler manifolds it was shown that such a manifold is biholomorphic to the ball in $\mathbb{C}^n$ if it has constant negative holomorphic sectional curvature outside a compact set ([49]).

• In trying to understand how the curvature of a Kähler manifold restricts the underlying complex structure, it was shown that a complex product manifold cannot admit a Kähler metric with negative bisectional curvature ([48, 134]).

• Using some elementary techniques in comparison geometry it was proved that hyperbolic space can be characterized as a negatively curved space with certain asymptotic curvature properties. Also, a local rigidity under bounds only on the curvature was proved ([208]).

• A compactness theorem for families of surfaces of bounded mean curvature in a Riemannian n-manifold was proved. Namely, it was shown that given a sequence of closed, orientable surfaces of fixed genus g in a Riemannian manifold M so that there are uniform upper bounds on the mean curvature and the area of the surfaces, on passing to a subsequence and choosing appropriate parametrisations, the inclusion maps converge to a map from a surface of genus g to M. The proof was modelled on Gromov's compactness theorem for J-holomorphic curves. It was also shown that the limit has fractal dimension 2. As a consequence, a purely Riemannian geometry result, namely a uniform upper bound on the diameter in our setting, was obtained ([301]).

• A classification theorem for manifolds with nonnegative isotropic curvature was proved, using Ricci flow. The theorem asserts that such a manifold either admits a positive isotropic curvature, or is locally symmetric or is Kahler and biholomorphic to projective space ([303]).

• It was shown that a closed, orientable Riemannian manifold with positive isotropic curvature and free fundamental group is homeomorphic to a connected sum of copies of $S^{n-1} \times S^1$ ([203]).

• It was proved that "almost" Einstein manifolds with nonnegative isotropic curvature are diffeomorphic to locally symmetric spaces. This is a smooth version of Brendle's metric rigidity theorem about Einstein manifolds with nonnegative isotropic curvature. ([304])

• It was proved that if a compact complex manifold admits Kähler metrics whose sectional curvatures are negative and "almost" quarter-pinched then the ratios of its Chern numbers are close to that of a ball-quotient. This implies that the Mostow-Siu surfaces do not admit "almost" quarter-pinched Kähler metrics. ([360])

• It was proved that there are strong restrictions on a compact Kähler manifold whose fundamental group surjects to a fundamental group of a compact 3-manifold. ([368])

• It was proved that any Ricci flow invariant positivity condition arising from Wilking's criterion implies the nonnegativity of isotropic curvatures. Moroever one has a precise understanding of those curvature cones for which Ricci flow convergence is guaranteed. ([369])

Lie Algebras : • The infinite dimensional Lie algebra E_{10} has been well studied by physicists since it plays a special role in string theory. E_{10} is the Lie algebra of largest rank in the class of hyperbolic Kac-Moody algebras. It was shown that E_{10} has rich internal structure, specifically that it contains "root subalgebras" isomorphic to every possible simply laced hyperbolic Kac-Moody algebra. This result could potentially allow E_{10} representations to be better understood by restriction to the action of these smaller subalgebras ([154]).

• Coxeter groups associated to affine and general type Kac-Moody algebras were studied. It was shown in the affine case that a certain natural class of subsets of such groups had rational Poincaré series, while in the general case, the growth type of such subsets was exponential ([155]).

• The celebrated Hall-Littlewood and Kostka-Foulkes polynomials were generalized from the classical setting to that of arbitrary symmetrizable Kac-Moody algebras. These Kostka-Foulkes polynomials were shown to coincide with the natural generalization of Lusztig's t-analog of weight multiplicities, thereby extending the classical theorem of Kato. For affine Kac-Moody algebras, t-analogs of string functions were introduced and Cherednik's constant term identities were used to derive explicit product expressions for them ([157]).

• Some new constant term identities for the rank 1 affine Lie algebra $\widehat{sl_2}$ were derived using the theory of Hall-Littlewood polynomials. These generalize the well known Macdonald and Macdonald-Mehta identities proved by Cherednik ([305]).

Low Dimensional Topology : • There is an important partial ordering, called *dominance*, among manifolds of a fixed dimension, which is given by the existence of degree-one maps. In the case of orientable surfaces this is simply the ordering by genus, while it is not a linear ordering in higher dimensions, reflecting the greater complexity. This ordering is especially important in dimension three due to the Thurston-Perelman geometrisation. This ordering was characterised in terms of surgery, showing that a manifold dominates another if and only if it can be obtained from the latter by surgery about a link all of whose components are unknots. This was then related to topological field theories ([246]).

• A basic technique in high-dimensional topology, leading to the Poincaré conjecture for dimensions above four, is Smale's handle cancellation. In particular this says that smooth, simply-connected manifolds have Morse functions without critical points of index one. It was shown that this is false in dimension four for compact manifolds with boundary in a strong sense that is sensitive to exotic structures. The main tool, which was introduced in the course of this work, is the *Knot Concordance Kernel*. Other applications of this to exotic structures were given ([361]).

• A non-orientable version of the Thom-Pontrjagin construction was developed and was used to show uniqueness up to stabilization of non-orientable Seifert surfaces ([148]).

• It was shown that the algebraic intersection number of Scott and Swarup for splittings of free groups coincides with the geometric intersection number for the sphere complex of the connected sum of copies of $S^2 \times S^1$ ([202]).

• A description, modulo torsion, of the cup product on the first group cohomology was given in terms of the descriptions of the second homology group due to Hopf and Miller ([299]).

• The analogue of geodesic laminations, which we called geosphere laminations, for free groups were introduced and studied. The main result was a compactness theorem for geosphere laminations, which is analogous to a central result in the study of surfaces([365]).

• The concept of graphs of trees for spheres in the model space $M = \#S^2 \times S^1$ for free groups was introduced. This was used to give a constructive proof of a criterion for homotopy classes in M being represented by embedded spheres([261]).

• A chain complex was associated to a triangulation of a 3-manifold, so that normal surfaces correspond to homology classes. This was used to study the relation between quadrilateral coordinates and normal surfaces ([300]).

• By a theorem of Gromov, for an almost complex structure J on CP^2 tamed by the standard symplectic structure, the holomorphic curves rep- resenting the positive generator of homology form a projective plane. It was shown that this satisfies the Theorem of Desargues if and only if J is the standard complex structure. This answered a question of Ghys ([366]).

• It was shown that the Goldman bracket together with the power operation determines the geometric intersection number of curves on surfaces. The Goldman bracket was generalised to orbifolds and the result was shown in this case too ([359]).

Mathematical Biology : • New methods were introduced to study the secondary structure of RNA determined by Watson-Crick pairing without pseudo-knots using Milnor invariants of links. The study focused on the first non-trivial invariant, which can be interpreted in terms of the Heisenberg group as well as lattice paths, which was termed the Heisenberg invariant.

It was shown that the Heisenberg invariant is related to a dynamically, hence biologically, important property of RNA folding. Namely, if the Heisenberg invariant in large, then there are widely separated local maxima for the number of Watson-Crick pairs found ([201]).

The problem of optimal RNA secondary structures was formulated in terms of maximal conjugacy invariant norms. It was shown that such a norm is *metrically representable* in an appropriate sense ([362]).

Secondary structures without pseudo-knotting were studied for random RNA. It was shown that an asymptotically positive proportion of bases are unpaired for such structures.

Number Theory : • The study of L-functions attached to the objects in number theory and arithmetic geometry are known (or expected) to carry a rich source of information. The equivariant Tamagawa number conjecture predicts special values of these L-functions in terms of algebraic elements attached to the corresponding object. The verification of the conjecture would answer many of the longstanding questions in number theory and arithmetic geometry. In [364], the conjecture was established in two important cases, one concerning noncommutative Galois extensions of the field of rationals and the other related to the base change of elliptic curves.

• For $d \geq 1$, it was shown (in 297) that a large class of Cantor-like sets C of $\mathbb{R}^d$ contain uncountably many badly approximable numbers if $d = 1$ and badly approximable vectors if $d \geq 2$. An analogous is also proved for subsets of $\mathbb{R}^d$ arising in the study of geodesic flows corresponding to $(d+1)$-dimensional manifolds of constant negative curvature and finite volume, generalizing the set of badly approximable numbers in $\mathbb{R}$. Furthermore, a condition on sets is described, which is fulfilled by a large class, ensuring large intersection with these Cantor-like sets.

3.3.3 Publications

(i) Research Papers in Refereed Journals

Year	Thrust Area	Other Areas	Total
2006	37	13	50
2007	37	14	51
2008	39	17	56
2009	41	12	53
2010	34	02	36
2011	13	05	18
Accepted for publication	30	11	41
Submitted for Publication	51	13	64
Total	**282**	**87**	**369**

(i.a) Published during 2006–2011

2006

• In the identified thrust area

1. Adimurthi, Grossi, M. and Santra, S.; Optimal Hardy-Rellich inequalities, maximum principle and related eigenvalue problem, *J. Funct. Anal.* **240** (2006), 36–83.

2. Agranovsky, M. L. and Narayanan, E. K.; Isotopic family of contact manifolds for elliptic PDE, *Proc. Amer. Math. Soc.* **134** (2006), 2117–2123.

3. Amritkar, R. E. and Rangarajan, G.; Spatial synchronization and extinction of species under external forcing, *Physical Review Letters* **96** (2006), 258102.

4. Baskar, S. and Prasad, P.; Formulation of the problem of sonic boom by a maneuvering aerofoil as a one parameter family of Cauchy problems, *Proc. Indian Acad. Sci.* (*Math. Sci.*) **116** (2006), 97–119.

5. Bég, O. Anwar, Takhar, H. S., Nath, G. and Chamkha, A. J.; Mathematical modelling of hydromagnetic convection from a rotating sphere with impulsive motion and buoyancy effects, *Nonlinear Anal. Model. Control* **11** (2006), 227–245

6. Bharali, G.; Polynomial approximation, local polynomial convexity, and degenerate CR singularities, *J. Funct. Anal.* **236** (2006), 351–368.

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330. Gudi, T. and Gupta, H.; A fully discrete C^0 interior penalty method for Extended Fisher-Kolmogorov Equation.

331. Gudi, T.; Finite element method for a nonlocal problem of Kirchhoff type.

332. Gupta, H. S.; A numerical study of variable coefficient elliptic Cauchy problem via projection method.

333. Gupta, H. S.; Numerical solutions of ill-posed elliptic inverse problems using iterated Tikhonov regularization.

334. Gupta, H. S. and Cao, Hui; A numerical study of iterated Tikhonov regularization for the elliptic Cauchy problem.

335. Hari. M. Varma, Nandakumaran, A. K. and Vasu, A. M.; Study of turbid media with light: Recovery of mechanical and optical properties from boundary measurement of intensity autocorrelation of light.

336. Jaikrishnan, J.; Proper holomorphic mappings between hyperbolic product manifolds.

337. Ben Said, S., Nandakumaran, A. K. and Ratnakumar, P. K.; Schrödinger propagator and the Dunkl Laplacian.

338. Ben Said, S. and Thangavelu., S.; Uniqueness of solutions to the Schrödinger equation on Heisenberg groups.

339. Iyer, S. K. and Thacker, D.; Connectivity in non-uniform random geometric graphs with location dependent radius.

340. Iyer, S. K. and Yogeshwaran, D.; Percolation and Connectivity in AB Random Geometric Graphs.

341. Iyer, S. K., Swapnil K., Nanda, S. and Srivastava, A.; An Empirical Comparison of Two Stochastic Volatility Models using Indian Market Data.

342. Korányi, A. and Misra, G.; A classification of homogeneous operators in the Cowen-Douglas class.

343. Krishnapur, M. and Virág, B.; The Ginibre ensemble and Gaussian analytic functions.

344. Muslim, M.; Existence and uniqueness results for some fractional order evolution problems.

345. Muslim, M. and Agarwal, R. P.; Approximations of solutions to impulsive functional differential equations, *J. Appl. Math. Comput.* **34** (2010), 101-112.

346. Muslim, M. and Mahmudov, N. I.; Approximate controllability of integro-differential equations in a Hilbert space with nonlocal conditions.

347. Parui, S., Ratnakumar, P. K. and Thangavelu, S.; Analyticity of the Schrödinger propagator on the Heisenberg group.

348. Pusti, S.; Bochner's theorem on Damek-Ricci spaces.

349. Sen, S.; Segal-Bargmann transform and Paley-Wiener theorems on Heisenberg motion groups.

350. Sikdar, K.; Waiting time analysis of a batch service GI/M/1/N queue with multiple working vacations.

351. Sikdar, K., Chaudhry, M. L. and Gupta, U. C.; Analyzing MAP/G/1/N queue under modified vacation policy.

352. Sikdar, K. and Gupta, U. C.; On the batch arrival batch service queue with finite buffer under server's vacation: MX/GY/1/N Queue.

353. Sikdar, K., Gupta, U. C. and Banik, A. D.; Performance analysis of a finite-buffer batch service queue with general input and exponential multiple vacations.

354. Srinivasa Rao, Ch. and Yadav, M. K.; Self-similar solutions of a p-Laplacian equation.

355. Yadav, M. K; Large time asymptotics of solutions of a system of forced Burgers equation.

356. Yadav, M. K; Large time behaviour of solutions of an inviscid generalized Burgers equation with linear damping.

- In other areas

357. Bagchi, B. and Datta, B.; A triangulation of $\mathbb{C}P^3$ as symmetric cube of S^2. arXiv: 1012.3235.

358. Bagchi, B. and Datta, B.; On stellated spheres and a tightness criterion for combinatorial manifolds. arXiv:1102.0856.

359. Chas, M. and Gadgil, S.; The Goldman bracket and Intersection numbers for Fuchsian groups.

360. Deraux, M. and Seshadri, H.; Almost quarter-pinching and Chern numbers.

361. Gadgil, S.; One-handles and Concordance Kernels for smooth 4-manifolds.

362. Gadgil, S.; Conjugacy invariant norms, Representability and RNA secondary structures.

363. Gadgil, S.; A triangulation of a homotopy-Deligne-Mumford compactification of the Moduli of curves.

364. Navilarekallu, T.; Equivariant Tamagawa number conjecture for noncommutative base change of elliptic curves.

365. Gadgil, S. and Pandit, S.; Geosphere laminations in Free groups.

366. Gadgil, S.; The Projective plane, Holomorphic Curves and Desargues theorem.

367. Vaidya, J. S. and Gadgil, S.; Estimation of the proportion of patients in whom a new treatment is effective.

368. Biswas, I., Mj, M. and Seshadri, H.; 3-manifold groups, Kahler groups and complex surfaces.

369. Gururaja, H. A., Maity, S. and Seshadri, H.; On Wilking's criterion for the Ricci flow.

(ii) Research Papers as Chapters in Books

370. Chakrabarti, A. and Martha, S. C.; Scattering of water waves by freely floating semi-infinite elastic plates on water of finite depth, *Frontiers of Applied and Computational Mathematics (FACM)*, Ed.: D. Blackmore, A. Bose and P. Petropoulos, pp. 83–94, World Scientific, 2008.

371. Chalishajar, D. N., George, R. K. and Nandakumaran, A. K.; Exact controllability of generalized Hammerstein type equation, *Industrial Mathematics*, Eds.: M. C. Joshi, *et al*, pp. 61–70, Narosa Pub. House, New Delhi, 2006.

372. Dasgupta, A. and Wong, M. W.; Spectral Invariance of SG Pseudo-Differential Operators on $L^p(R^n)$, In: *Pseudo-Differential Operators: Complex Analysis and Partial Differential Equations*, Eds.: B. Schulze and M. W. Wong, pp. 51–58, Birkhäuser, 2010.

373. Korányi, A. and Misra, G.; Multiplicity free homogeneous operators in the Cowen-Douglas class, *Perspectives in Mathematical Sciences*, Indian Statistical Institute, Eds.: N.S.N Sastry, T.S.S.R.K. Rao, M. Delampady and B. Rajeev, pp. 83–101, World Scientific, Singapore, 2009.

374. Srikanth, P. N. and Santra, S.; A note on the superlinear Ambrosetti-Prodi type problem in a ball, Contributions to nonlinear analysis, *Progr. Nonlinear Differential Equations Appl.* **66**, pp. 505–518, Birkhuser, Basel, 2006.

375. Thangavelu, S; Gutzmer's formula and the Segal-Bargmann transform, *Perspectives in Mathematical Sciences II*, Indian Statistical Institute, Eds.: N.S.N Sastry, T.S.S.R.K. Rao, M. Delampady and B. Rajeev, pp. 209–222, World Scientific, Singapore, 2009.

(iii) Research Papers in Conference Proceedings

376. Baskar, S. and Prasad, P.; Kinematical conservation laws, ray theories and applications, *Proc. of 10th Int. Conf. on Hyperbolic Problems: Theory, Numerics and Appl.*, 2006.

377. Baskar, S. and Prasad, P.; Calculation of the front part of the sonic boom signature for a maneuvering aerofoil, *Proc. of the 17th Int. Symp. on Nonlinear Acoustics (ISNA)*, Penn State University, 2006.

378. Iyer, S. K., Karamchandani, N. and Manjunath, D.; Evolving exponential random geometric graphs, *4th Int. Symp. on Modelling and Optimization in Mobile, Ad-hoc and Wireless Networks*, Boston, April 3–7, 2006.

379. Martha, S. C., Bora S. N. and Chakrabarti, A.; Oblique surface wave propagation over sinusoidally varying topography, *Proc. of 51st congress of the Indian Society of Theoretical and Applied Mechanics*, Andhra University, Visakhapatnam, pp. 23–30, December 28-31, 2006.

380. Martha, S. C., Bora S. N. and Chakrabarti, A.; Reflection of wave energy by small undulation of the sea-bed, Recent advances in Computational Mechanics and Simulations *Proc. 2nd Int. Congress on Computational Mechanics and simulation*, Vol.II, I.K. Int. Pub. House Pvt. Ltd. India, pp. 1483–1489, 2006.

381. Chakrabarti, A.; Trapped waves involving multi-layered fluid media, *Proc. of the Int. Conf. on Applications of Fluid Mechanics in Industry and Environment*, Indian Statistical Institute, Kolkata, August 28–31, 2006.

382. Rangarajan, G.; Long term stability studies of particle storage rings using polynomial maps, in *Proc. of the Int. Conf. on Industrial Mathematics*, eds. M. C. Joshi, A. K. Pani and S. V. Sabnis, pp. 357, 2006.

383. Arun, K. R., Raghurama Rao, S. V., Lukacova, M. M. and Prasad, P.; A Genuinely Multi-dimensional Relaxation Scheme for Hyperbolic Conservation Laws, in *Proc. of the 7-th Asian Computational Fluid Dynamics Conference*, Bangalore, paper no. 19.4, pp 1029–1039, November 26–30, 2007.

384. Biswas, I., Misra, G. and Varughese, C.; Some geometric invariants from resolutions of Hilbert modules along a multi dimensional grid, *Hot topics in operator theory*, Theta series in advanced mathematics, pp. 13–21, 2008.

385. Chakrabarti, A.; Singular Integral Equations arising in Water Wave Problems, in *Proc. of the fifteenth Ramanujan Symposium on Dynamic Equations* pp. 5–30, 2008.

386. Arun, K. R. and Raghurama Rao., S. V.; A Multi-dimensional Discrete Kinetic Scheme for Nonlinear Hyperbolic Problems, in *Proc. of* 19*th AIAA Computational Fluid Dynamics Conf.* (San Antonio, Texas, USA; 22 - 25 June 2009).

387. Arun K. R. and Phoolan P.; A mathematical model to describe evolution of curves and surfaces. In: *Recent Advances in Mathematical Science and Appl.*, Proc. of the RAMSA Int. Conf. (Visakhapatnam, December 19-22, 2009).

388. Patil, D. P.; On the blowing-up rings, Arf rings and type sequences, *Advances in Ring Theory, Trends in Mathematic*, (Proc. of the Int. Conf. on Algebra and its Appl. held at Ohio University during June 18-21, 2008.) pp. 269–282, Birkhäuser/Springer Basel AG, Basel, 2010.

389. Arun K. R. and Phoolan P.; Kinematical conservation laws (KCL): equations of evolution of curves and surfaces. In: *Mathematics in Science and Technology: Mathematical Methods, Models and Algorithms in Science and Technology* (Proc. of the Satellite Conf. of ICM 2010, ed. A. H. Siddiqi *et al.*), World Scientific Pub. Company, Singapore, 2011.

(iv) Research Papers Presented in Conferences/Workshops/Symposiums

2006

390. Amritkar, R. E. and Rangarajan, G.; Spatial synchronization and extinction of species under common external forcing, *International Congress of Mathematicians*, 2006.

391. Bharali, G.; On local polynomial complexity of surfaces around degenerate CR singularities, *Plurikomplexa Seminariet*, Stockholm University, June 2006.

392. Bhattacharyya, T.; Multipliers on the Arveson space, *Spaces of Analytic Functions and Their Operators*, CIRM, Marseille, France (invited talk), June 5–9, 2006.

393. Bhattacharyya, T.; Characteristic function of a commuting contractive tuple, *Operator Theory 21* at Timisoara, Romania (invited talk), June 30–July 4, 2006.

394. Iyer, S. K.; Age dependent branching particle systems and their scaling limits, *31st conference on Stochastic Processes and Applications*, University Rene Descartes, Paris, France, July 17–21, 2006.

395. Iyer, S. K.; Credit Risk Modelling, *Workshop on Qantitative Finance*, Indian Institute of Science, Bangalore, November 2006.

396. Nandakumaran, A. K.,; Schrödinger equation and the oscillatory semigroup for the Hermite operator, *Ramanujam Symposium on Nonlinear Differential Equations*, RIASM, Chennai, February 8–10, 2006.

397. Nandakumaran, A. K.; An Overview of Modern Concepts of Solutions of PDEs, *National Seminar on Recent Innovations in Mathematics (MATHSEM 2006)*, Department of Mathematics, Kongunadu Arts and Science College, Coimbatore, August 05, 2006.

398. Nandakumaran, A. K.; An introduction and Applications of Homogenization, *Second International conference on "Nonlinear Systems: Modelling simulation and Applications"*, NES Science College, Nanded, Maharashtra, December 19–22, 2006 .

399. Patil, D. P.; On the type sequences of the semigroups generated by an arithmetic sequences, *Int. Conf. on Effective Methods in Algebraic and Analytic Geometry*, Jagiellonian University, Kraków, Poland, September 4–9, 2006.

400. Phoolan Prasad; Promotion of applied mathematics, invited talk in the *Workshop on Prospectives and Future Prospects in Maths*, NIAS, Bangalore, December 25–26, 2006.

401. Phoolan Prasad; A model of non linear ray equations to study evolution of moving curve with kinks and applications, two invited lectures delivered at the *Winter School on Modelling, Computing and Simulation*, IIT, Madras, Dec. 11, 2006 to Jan. 12, 2007.

402. Rangarajan, G.; Synchronized extinction of species, to be presented at the *National Conf. on Applications of Mathematics* (invited talk).

403. Rangarajan, G.; Linear and nonlinear Granger causality, presented at the *Workshop on Nonlinear Phenomena and Techniques* (invited talk).

404. Rangarajan, G.; Brain-machine interface, presented at the *Symposium on Applied Mathematics in Engineering Technologies* (invited talk).

405. Thangavelu, S.; An introduction to Fourier Transform, *Advanced Instructional School on Harmonic and Functional Analysis*, jointly organised by ISI and IISc, Bangalore (8 lectures), July 3–28, 2006.

2007

406. Bhattacharyya, T.; Schur-Agler Class and Hilbert C^*-modules, invited talk at the special session on Operators and Systems at the *International Workshop on Operator Theory and Its Applications*, North-West University, Potchefstroom, South Africa, July 3–6, 2007.

407. Bhattacharyya, T.; Realization and Test Functions, invited talk at the special session on Dilations at the *28-th Conference on Quantum Probability and Related Topics*, CIMAT-Guanajuato, Mexico, September 2–8, 2007.

408. Muslim, M.; Application of Semigroup Theory to Fractional Order Evolution Equations, presented at the *National Symposium on Recent advances in Mathematical Sciences*, IIT, Kanpur, February 16–17, 2007.

409. Muslim, M.; Applications of functional analysis to Fractional Order Differential Equations, presented at the *Int. Conf. on functional analysis and its appl.*, Dept. of Mathematics, Scott Christian College Nagercoil, November 28 - December 01, 2007.

410. Nandakumaran, A. K.,; Tomography and Reconstruction, presented at the *National Conference on Applications of Partial Differential Equations*, Department of Mathematics, Bharathiar University, Coimbatore, January 24–25, 2007.

411. Nandakumaran, A. K.,; Tomography and Reconstruction via boundary measurement, International Conference on Scientific Computation and Differential Equations (SciCADE 2007), July 9 - July 13, 2007, Le Palais du Grand Large Saint-Malo, France.

412. Phoolan Prasad; Multi-dimensional relaxation scheme for hyperbolic conservation laws, *7th Asian Computational Fluid Dynamics Conf.*, Bangalore, November 26–30, 2007.

413. Rangarajan, G.; Synchronous extinction of species, presented at the *Int. Conf. on Assembly, Organization and Propulsion in Complex Systems* (invited talk).

414. Rangarajan, G.; Chaos and synchronization, presented at the *Workshop on Recent Trends in Basic Sciences and Mathematics* (invited talk).

415. Rangarajan, G.; Brain-Machine Interface, presented at the *Symposium on the Science of Life* (invited talk).

416. Rangarajan, G., Nedungadi, A. and Ding, M.; Granger causality analysis of multiple single unit spike trains, presented at the *Society for Neuroscience*.

2008

417. Bhattacharyya, T.; Completely bounded kernels, presented at *The XIX International Workshop on Operator Theory and its Applications*, College of William and Mary, USA, July 22–26, 2008.

418. Bhattacharyya, T.; Schur-Agler class and Hilbert C^*-modules, presented at the *Concentration Week On Multivariable Operator Theory*, Texas A & M University, USA, July 28–August 1, 2008.

419. A. Chakrabarti; Various mathematical aspects of mixed boundary value problems with applications, presented at the *Int. Conf. on Frontiers of applied Maths.*, Burdwan University, January 16-18, 2008.

420. A. Chakrabarti; Singular integral equations arising in water wave problems, presented at the *15th Ramanujan Symposium on Dynamic Equations*, Ramanujan Institute, Chennai, February 5-6, 2008.

421. Iyer, S. K.; Random Geometric Graphs with SINR and Fading, *Workshop on Complex Systems*, Indian Institute of Science Centenary Conference, December 14 –16, 2008.

422. Nandakumaran, A. K.; Introduction to Controllability and a Thermo-elastic System, National seminar on *Algebra, Analysis and Discrete Mathematics* at Dept. of Mathematics, Kerala University, Kerala during December 10-12, 2008.

423. Patil, D. P.; On the blowing-up rings, Arf rings and type sequences, presented in the *Int. Conf. on Algebra and its Appl.* at the Center of Ring theory and its Applications, Ohio University, USA during June 18-21, 2008.

424. Rangarajan, G.; Time series analysis using nonparametric Granger causality, presented at the *National Conference on Nonlinear Systems and Dynamics* (invited talk).

425. Rangarajan, G.; Stability of synchronized state and its applications, presented at the *15th Ramanujan Symposium on Dynamic Equations* (invited talk).

426. Rangarajan, G.; Time series analysis using nonparametric Granger causality, presented at the *Conf. on Recent Developments in Nonlinear Dynamics* (invited talk).

427. Rangarajan, G.; Applications of Lie perturbation theory to nonlinear Hamiltonian dynamics, presented at the *Workshop on Topological Dynamics and Diff. Equ.* (invited talk).

428. Rangarajan, G.; Stability of synchronized chaotic state in coupled nonlinear systems, presented at the *Workshop on Topological Dynamics and Diff. Equ.* (invited talk).

429. Rangarajan, G.; Time series analysis using nonparametric Granger causality, presented at the *First Indo-Brazilian Symposium on Mathematics* (invited talk).

430. Thangavelu, S.; On the unreasonable effectiveness of Gutzmer's formula, presented at the *Int. Conf. on Harmonic Analysis and PDE*, El Escorial, Spain, June 16-20, 2008.

431. Thangavelu, S.; Holomorphic Sobolev spaces associated to compact symmetric spaces, presented at the *Workshop and conf. on Real Analysis, Harmonic Analysis and appl.*, Oberwolfach, Germany, July 13-19, 2008.

2009

432. Iyer, S. K.; Random geometric graphs with SINR and fading at *International Symposium on Probability theory and Stochastic Processes*, CUSAT.

433. Iyer, S. K.; Credit Risk$^+$ model with general sector correlations at *International Finance Conference*, Indian Institute of Management, Kolkata.

434. Martha, S. C., Bora, S. N. and Chakrabarti, A.; Least-Squares Method for Solving Water Wave Problems, *36th Annual Conf. of Orissa Math. Soc. (OMS-2009)*, Institute of Math. and Appl., Orissa, India, February 7-8, 2009.

435. Martha, S. C. and Chakrabarti, A.; Energy-balance relations in problems involving scattering of flexural gravity waves and membrane coupled gravity waves by surface piercing vertical barriers, *Int. Conf. on Frontiers in Fluid Mech. (ICFFM-09)* held at Bangalore University during August 31 to September 1, 2009.

436. Nandakumaran, A. K.; Homogenization and Optimal Control Problems at the Indo-German Workshop-cum-Lecture Series on *Computational Models and Methods Driven by Industrial Problems*, IITM, Chennai, January 2009 (2 invited talks).

437. Nandakumaran, A. K.; Homogenization and Applications at the National seminar on *Analysis, Diff. Equations and Appl.*, MS University, Baroda, January 2009.

438. Nandakumaran, A. K.; On homogenization of PDEs at the *Int. Conf. on Math.*, HRI, Allahabad, March 2009 (invited talk).

439. Rangarajan, G.; Time series analysis at the *SERC School on Nonlinear Dynamics* (invited talk).

440. Rangarajan, G.; Nonlinear Granger causality at the *National Seminar on Advances in Nonlinear Systems* (invited talk).

441. Rangarajan, G.; Chaos and synchronization at the *National Workshop on Recent Developments in Theoretical Physics and Quantum Computation* (invited talk).

442. Rangarajan, G.; Granger causality at the *Irish Mathematics Summer School* (invited talk).

443. Rangarajan, G.; Brain machine interface at the *The Applications of Nonlinear Dynamics in Engineering and Technology* (invited talk).

444. Rangarajan, G.; Detecting functional connectivity in neuronal networks at the *Dynamics on Networks* (invited talk).

2010

445. Bhattacharyya, T.; Completely positive kernels, Hilbert C^*-modules and coherent states, *IWOTA 2010 July 12th-16th, 2010, Technische Universität Berlin* (semi-plenary talk).

446. Martha, S. C. and Chakrabarti, A.; Irrotational fluid flow in three layers of fluid in an infinite channel over an arbitrary topography, *37th Annual Conf. of Orissa Math. Soc. (OMS-2010) and National Seminar on Role of Math. in the Progress of Industrialization and Human Values*, Indira Gandhi Inst. of Tech. Sarang, Dhenkanal, Orissa, February 6-7, 2010.

447. Nandakumaran, A. K.; Tomographic Reconstruction via PDE models at the National Seminar on *Theory, Computation and Applications of Differential Equations*, Department of Mathematics, Madhurai Kamraj University, Madhurai, February 11-12, 2010 (Invited talk).

448. Nandakumaran, A. K.; Optimal Control Problems and Homogenization at the ICM Satellite Conference on *Aspects of Dynamical Systems* at MS university, Baroda during the period August 29 - September 01, 2010 (Invited talk).

449. Nandakumaran, A. K.; Imaging as an Inverse problem at NPS, California, USA, May 2010 (Invited Talk).

450. Nandakumaran, A. K.; Homgenization of an elliptic degenerate problem, Department of Mathematics, university of Delaware, Delaware, May 28, 2010 (Invited Talk).

451. Rangarajan, G.; Detecting functional connectivity in neuronal networks at the *Evolution of Complex Networks* (invited talk).

452. Rangarajan, G.; Brain machine interface, presented at the *Workshop on Brain Science Awareness* (invited talk).

453. Rangarajan, G.; Time series analysis using Granger causality, presented at the *25th Annual Conference of the Ramanujan Mathematical Society* (2010) (plenary talk).

454. Rangarajan, G.; Synchronized extinction of species under external forcing, presented at the Mid-Year Meeting of the Indian Academy of Sciences (invited talk).

455. Rangarajan, G.; Detecting functional connectivity in neuronal networks, presented at the *National Conference on Theoretical Biology and Biomathematics* (invited talk).

456. Rangarajan, G.; Synchronized extinction of species under external forcing, presented at the Symposium on Mathematical Ecology (invited talk).

2011

457. Bhowmik, B.; "On concave univalent functions" presented at the *Ahlfors-Bers Colloquium*, Rice University, Houston, TX, USA, March 24–27, 2011.

458. Datta. B.; On stellated spheres and a tightness criterion for combinatorial manifolds, presented at the *Workshop on Topological and geometric Combinatorics*, MFO, Oberwolfach, Germany, February 6 to 12, 2011.

459. Nandakumaran, A. K.; *Strichartz Type Estimates for Schrödinger Propagator with the Dunkl Laplacian* at the Conference on *Recent trends in Non - linear Elliptic Differential Equations*, TIFRCAM, Bangalore, January 06–08, 2011 (Invited Talk).

(v) Educational / Popular Articles

460. Bharali, G. and Ramadas, T. R.; Oded Schramm and the Schramm-Loewner evolution: In memoriam, *Current Science* **92** (2009) no. 2, 297–298.

461. Nandakumaran, A. K.; A view of Newton as a mathematician, *Resonance*, **11** (2006), no. 12, 45–55.

462. Patil, D. P.; The Riemann integration, *Resonance* **11** (2006), no. 11, 61–80.

463. Patil, D. P., Pranesachar, C. R. and Ravindran, R.; Joseph Louis Lagrange, *Resonance* **11** (2006), no. 4, 2–4.

464. Patil, D. P., Pranesachar, C. R. and Ravindran, R.; The work of Lagrange in number theory and algebra, *Resonance* **11** (2006), no. 4, 10–25.

465. Phoolan, P.; P. L. Bhatnagar and the BGK model, *Mathematics Students* **75** (2006), 123–136.

466. Shrihari, S.; Dichotomy of the Riemann sphere, *Mathematics Newsletter* **16** (2007), no. 4, 78–83.

(vi) Books / Monographs

1. Hough, J. B., Krishnapur, M., Peres, Y. and Virág, B.; *Zeros of Gaussian analytic functions and determinantal point processes*, American Mathematical Society, University Lecture Series, vol. **51**, 2009.

2. Mandal, B. N. and Chakrabarti, A.; *Applied singular integral equations*, CRC Press, Taylor and Francis Group, 2011.

3. Patil, D. P. and Storch, U.; *Introduction to Algebraic Geometry and Commutative Algebra*, IISc Lecture Notes Series, No. **1**, IISc Press/World Scientific Publishing Co. Pte. Ltd., Hackensack, NJ, 2010.

4. Venkatachala, B. J.; *Inequalities: An Approach Through Problems*, Hindustan Book Agency, TRIM Series, Vol. **49**, 2009.

3.4 Human resource training

3.4.1 The IISc Mathematics Initiative (IMI)

An Institute-wide Mathematics Initiative was started a few years ago. Twenty nine faculty members (including 6 from Mathematics Department) spread across 14 Departments are participating in the Initiative. A focus area of current interest to both mathematicians and scientists/engineers is identified every year. During this period, experts in the focus area (both from India and abroad) are invited to visit the Institute. Postdoctoral fellows are appointed in that area. Workshops and seminars are organized to catalyze interdisciplinary collaborations. Scientists and engineers from national laboratories and industry are encouraged to take part in these activities. An Institute Mathematics Colloquium is organized every semester.

During the academic year 2005-06, the focus area was "Coding Theory and Cryptography". Apart from running short courses and seminars on these (and related) topics, workshops and conferences were organized. (i) Workshop on Algebra and Coding Theory (November 21 - December 08, 2005), (ii) Symposium on Coding Theory (December 09, 2005), (iii) Indocrypt 2005 on Cryptography (December 10 - 12, 2005), (iv) Workshop on Number Theory and Cryptography (January 23 - February 11, 2006) and (v) National Conference on Mathematical Foundations of Coding, Complexity, Computation and Cryptography (July 20 - 22, 2006)

During the academic year 2006-07, the focus area was "Stochastic Processes and Applications". Three workshops were conducted which were attended by participants from all over India. Several compact courses were conducted and attended by many students and faculty. One International Conference was conducted which was attended by participants from India abroad. Also, there were many visitors (both short and long term) from India and abroad.

During the academic year 2007-08, the focus area was "Nonlinear Dynamical System and Turbulence". Five workshops and an international conference were organized. Several compact courses and seminars were held. Leading scientists and engineers working in this area (both from India and abroad) visited IMI and gave lectures.

During the academic year 2008-09, the focus area was on "Analysis and its Applications". Its aim was to bring together specialists in mathematical analysis – several of whom have worked with members of the strong analysis program at the IISc – for compact courses and workshops, and to expose younger mathematicians in India to the latest trends in the field. In keeping with the latter goal, compact courses were organized in the areas of (a) Complex Analysis in Several Variables, (b) Harmonic Analysis and (c) Operator Theory. The following Workshops/conferences were organized: (i) Workshop in Harmonic Analysis and PDE (December 05 - December 13, 2008), (ii) Workshop in Analysis and its Applications (May 14 - 23, 2009) and (iii) Conference in Analysis and its Applications (May 27 - 30, 2009).

During the academic year 2009-10, the focus area was "PDE Models Arising in Multi - Scale Problems, Control and Inverse Problems and Fluid Dynamics". This thematic year was devoted to various aspects of PDE models coming from Multi-scale, control, inverse and fluid problems incorporating multi-scale structures. IMI organized the following workshops/conferences during the thematic year. (i) Workshop on PDE and Related Analysis (August 31 - September 18, 2009), (ii) Workshop on Control and Inverse Problems (December 01 - 15, 2009), (iii) International Conference on Control and Inverse Problems (December 16 - 18, 2009), (iv) Workshop and Conference on Multi-scale Problems and Homogenization (June/July 2010). Compact Courses on the topic of the thematic year were also conducted.

During the academic year 2010-11, the focus area was on "Mathematical Biology". Its aim was to bring together specialists in the area of mathmatical biology and expose students from all across India to the latest developments in this area. The following Workshops/conferences were organized: (i) One Day Workshop on Topics in Quantitative Genetics & Genome Analysis (August 28, 2010), ii) Workshop and Conference on Modeling Infectious Diseases: (September 13 - 22, 2010), iii) Workshop - Symposium on Mathematics in Drug Discovery (September 25 - 29, 2010), iv) Workshop and Symposium on Mathematical Ecology (December 07 - 14, 2010), v) Workshop on Proteins: Structure, Function and Folding (December 20 - 24, 2010), vi) Workshop on Introduction to Mathematical Techniques in Life Sciences (January 04 - 12, 2011), vii) Workshop and Symposium on Mathematical Physiology (January 15 - 23, 2011), viii) Workshop on Stability & Bifurcation Analysis and Pattern Formation in Mathematical Ecology and Epidemiology (February 25 - March 02, 2011). It is proposed to organize an International Conference on Mathematical Biology (July 04 - 07, 2011) followed by a Mini-Symposium on Analysis and Simulation of Biomolecular Structures (July 08, 2011).

3.4.2 Indo-French Cyber University Project

An Indo-French Cyber University project was initiated some years ago under an MOU signed between IISc and Toulouse University Network, France. Faculty members from the Department were involved in teaching courses jointly with lecturers from France. Students from IISc and Toulouse University attended the courses which were taught using live two-way satellite communication.

3.4.3 Mathematical Olympiad

This is a unique department of mathematics in the country, which hosts the Mathematical Olympiad (MO) Cell formerly of the National Board for Higher Mathematics (NBHM), Department of Atomic Energy, Government of India, currently under Homi Bhaba Centre for Science Education (HBCSE), Tata Institute of Fundamental Research (TIFR), and funded by NBHM. The aim is to spot and nurture mathematics talent in India and train them for the International Mathematical Olympiads (IMO). The first MO in the country was organized by this department in 1968 for the students of Bangalore. Today, MO is a national activity for which all academic work is done by the MO Cell. The MO Cell members have authored 6 books meant for olympiads and one of them has authored 7th standard Geometry for Andhra Pradesh Govt. They are also bringing out a Mathematics Journal (Samasya) since 1994 meant for High School students. The MO Cell members have organized camps all over country to train teachers in material suitable for nurturing mathematics talent. Members of the department and MO cell have organised/participated in 20 IMO-Training Camps either at the IISc, Bangalore or at BARC/HBCSE, Mumbai. So far India has sent 120 (20 teams of six members each) students to participate in IMOs held in different countries where Indian students have bagged 8 Gold Medals, 49 Silver Medals and 41 Bronze Medals. The cell members have acted as leaders and deputy leaders of Indian teams since 1991. The MO Cell members acted as resource persons in the refresher courses (i) for College teachers, (ii) for High School teachers and (iii) for High School student programmes. The cell members have been involved in paper-setting, evaluation and selection of teams since 1989 for the regional, national and international MO's. They have also set papers for the NTS and KVPY. They have guided students under different projects. They have refereed theses for Ph.D. candidates and set papers for different universities. They have proposed and solved problems for Mathematics journals such as the American Mathematical Monthly and Crux Mathematicorum and published research articles as well as general articles in various journals. they are working as editors for science magazines. India Hosted IMO-96 in Mumbai. Problem Short-listing was done in Bangalore during May 1996. All MO Cell members were organisers. Institute Mathematics faculty members have acted as coordinators for all KRMO's since late 70's.

3.4.4 Olympiad training camps

Every year during the second/third week of January, the department organizes 5 day training camp for the "Karnataka Regional Mathematical Olympiad" awardees to prepare them for the National level talent search examination. These awardees are selected by a written test conducted through out Karnataka.

3.4.5 Visiting summer students

Every summer there are several students of different universities and colleges do their summer training under the guidance of the faculty members of the department. Here is a list of such students :

1. Mr. Sudip Paul, B. Stat. student, ISI, Kolkata, (under KVPY Summer Programme) did summer project under the guidance of B. Datta in May-June, 2006.
2. Mr. Tulsi Ram Reddy, B. Stat. student, ISI, Kolkata, (under KVPY Summer Programme) did summer project under the guidance of B. Datta in May-June, 2006.
3. Ms. Anuradha Ahuja, Anna University, (under the Summer Research Fellowship Programme of JNCASR) did a summer project under the guidance of G. Bharali in May-June, 2007.
4. Mr. Parichoy Pal Choudhary, ISI, Kolkata, did summer project under the guidance of B. Datta in June-July, 2007.
5. Ms. Mansi Prasad, IIT, Chennai, (under the Summer Research Fellowship Programme of JNCASR) did summer project under the guidance of B. Datta in May-July, 2007.
6. Mr. Tridip Sardar, IIT, Kanpur, did summer project under the guidance of B. Datta in June-July, 2007.
7. Ms. Akanksha Shrikant Kashikar, SBESCS, Aurangabad, (under IISc Young Science Fellowship) did summer project under the guidance of B. Datta in June-July, 2007.
8. Mr. Moulik K. Balasubramanian, CMI, Chennai, (under IISc Young Science Fellowship) did a summer project under the guidance of G. Bharali in June-July, 2009.
9. Mr. C. Jayanarayanan, Calicut University, (under IASc-INSA-NASI Summer Research Felloship) did a summer project under the guidance of E. K. Narayanan in May-June, 2009.
10. Ms. Eshita Mazumdar, IIT, Kharagpur, (under IASc-INSA-NASI Summer Research Fellowship) did summer project under the guidance of B. Datta in June-July, 2009.
11. Mr E. Prakash, KASC, Coimbatore, (under IASc-INSA-NASI Summer Research Fellowship) did a summer project under the guidance of E. K. Narayanan in May-June, 2009.

12. Ms. Arundhati Krishnan, Madras Christian college, (under IASc-INSA-NASI Summer Research Fellowship) did a summer project under the guidance of M. Krishnapur in May-June of 2009 and 2010.

13. Ms. Ayesha Fatima, IISER, Pune (under IASc-INSA-NASI Summer Research Fellowship) did summer project under the guidance of B. Datta during May 23-July 19, 2010.

14. Ms. Nikita Garg, IIT, Guwahati, (under IASc-INSA-NASI Summer Research Fellowship) did summer project under the guidance of M. K. Ghosh during May - June, 2010.

15. Mr. Joel Jose, NIT Warangal, (under IASc-INSA-NASI Summer research Fellowship) did a summer project under the guidance of E. K. Narayanan in May-June, 2010.

16. Ms. Jay Laxmi, Institute of Mathematics and Applications, Bhubaneswar (under IASc-INSA-NASI Summer Research Fellowship) did summer project under the guidance of S. Gadgil during May 17-July 16, 2010.

17. Mr. E. Prakash, MKU, Tamilnadu, (under IASc-INSA-NASI Summer Research Fellowship) did a summer project under the guidance of E. K. Narayanan in May-June, 2010.

18. Mr. Ramakrishnan, E., IMA, Bhubaneswar (under KVPY Summer Programme) did summer project under the guidance of B. Datta during June 16 – July 15, 2010.

19. Mr. Sujayam Saha, ISI Kolkata, (under IASc-INSA-NASI Summer Research Fellowship) did a summer project under the guidance of M. Krishnapur in May-June, 2010.

4 Infrastructure developed

Upgraded the computational laboratory with the following facilities: One server and 20 nodes (all Pentium IV).

A high-performance computational cluster delivering 4 teraflops was set up with 368 cores (each with 2.83 GHz Intel Xeon processor, 2 GB RAM, 500 GB hard disk), 20 Gbps infiniband switch and 1.5 Terabyte NAS storage server under the Mathematical Biology project.

5 Knowledge disseminated (in the thrust area identified)

5.1 Seminar Series for undergraduate students

- The Department of Mathematics, IISc is organizing several academic programs for undergraduate students from various colleges under the UGC support. The aim of this academic programme is to organize mini courses, seminar series and more intensive workshops on basic topics to create mathematical interest among the students. These would be helpful for their own curriculum.

- As part of the long term programme, the department had organized 5 seminar series on three different topics (Linear Algebra, Analysis and Multivariable Calculus) in 4 different colleges (St. Joseph College, National College (Basavanagudi), Jyoti Nivas College and Christ College) in Bangalore during August 2007 - July 2008.

5.2 Outreach activities for students and teachers

- A Workshop in Problem Solving in Mathematics for Students was conducted in the Department of Mathematics, IISc during August 8 - 10, 2008.
- A one day Orientation Programme for college teachers was organized in M. E. S. College, Malleswaram, Bangalore on September 20, 2008.
- A Workshop for Teachers of Mathematics was conducted in the Department of Mathematics, IISc during September 19 - 21, 2008.
- A two day Workshop on Mathematics was organized in National Degree College, Basavangudi, Bangalore during February 26 - 27, 2009.

6 Resource generation

1. **G. Bharali :** Sole investigator in a DST Fast-Track Project.

   Project Title : Polynomial convexity in higher dimensions and applications to complex approximation problems.

   Duration : 2008-2011.

   Grant : Rs. 3.96 lakhs.

2. **T. Bhattacharyya :** Sole investigator in a DST Project.

   Project Title : Ramanna Fellowship.

   Duration : 2006-2010.

   Grant : Rs. 34.8 lakhs.

3. **T. Bhattacharyya :** Co-investigator in a collaborative project between United Kingdom and India funded by UKIERI.

   Project Title : Quantum Probability, Noncommutative Geometry and Quantum Information.

   Duration : 2007-2011.

4. **B. Datta :** Principal investigator in a DST Project.

   Project Title: Study of degree-regular triangulations of surfaces and polyhedral structures of spheres.

   Duration : 2006-2009.

   Grant : Rs. 9.44 lakhs.

5. **M. K. Ghosh :** Sole investigator in a DST Project.

   Project Title: Controlled Semi-Markov Processes and Applications to Finance

   Duration : 2007-2010.

   Grant : Rs. 11.00 lakhs.

6. **S. K. Iyer :** Sole investigator in a DRDO Project.

Project Title : Coverage and Tracking in Sensor Networks.

Duration : 2006-2009.

Grant : Rs. 3.6 lakhs.

7. **S. K. Iyer :** Sole investigator in a DRDO Project.

   Project Title : Coverage and Connectivity in Random Geometric Graphs.

   Duration : 2009-2011.

   Grant : Rs. 1.6 lakhs.

8. **G. Misra :** Principal investigator from India in a collaborative DST-NSF project.

   Project Title : Homogeneous Operators.

   Duration : 2005-2007.

9. **G. Misra :** Sole investigator in a DST project.

   Project Title : Local and global properties of analytic Hilbert modules.

   Duration : 2008 -2010.

   Grant : Rs. 10,95,360

10. **G. Misra :** Principal investigator from India in a collaborative project with Swedish Research Council.

    Project Title : Hilbert modules, operator theory and complex analysis.

    Grant : SEK. 185,000

    Duration : 2009-2011.

11. **G. Misra :** Sole investigator in a DST project.

    Project Title : J C Bose Fellowship

    Duration : 2008-2012.

    Grant : Rs. 40 lakhs.

12. **A. K. Nandakumaran :** Investigator in a CEFIPRA (between France and India) Project.

    Project Title : Control Systems of partial differential equations.

    Duration : 2007-2010.

    Grant : As per requirement for Post-docs/visits.

13. **A. K. Nandakumaran :** Co-principal investigator in a project partially sponsored by DST.

    Project Title : Development of 'Ultrasound Assisted Optical System for Screening of Breast Cancer'.

    Duration : 2007 - 2009.

    Grant : Rs. 23.52 lakhs (DST contribution = Rs. 21.12 lakhs + Industry contribution = Rs. 2.40 lakhs).

14. **P. Prasad :** Sole investigator in AR&DB project.

    Project Title : Non Linear Hyperbolic waves in multi-dimensions with special reference to Sonic Boom.

    Duration : 2002-2006.

    Grant : Rs. 6.16 lakhs.

15. **P. Prasad :** Principal investigator from India in DST - DAAD collaborative project with Germany.

    Project Title : Theory and numerics of multi-dimensional hyperbolic Conservation laws and balance laws following bi-characteristics.

    Duration : 2006-2008.

    Grant : Rs. 3.36 lakhs and Euro 10,510.

16. **P. Prasad :** Sole investigator in CSIR project.

    Project Title : Hyperbolic Problems: Theory, Numerics and Applications.

    Duration : 2006-2009.

    Grant : Rs. 6 lakhs.

17. **G. Rangarajan :** Sole investigator in a DRDO Project.

    Project Title : Effect of noise on causality and a new denoising algorithm.

    Duration : 2005-2006.

    Grant : Rs. 2.28 lakhs.

18. **G. Rangarajan :** Sole investigator in a DRDO Project.

    Project Title : Block coherence and non-parametric Granger causality.

    Duration : 2006-2009.

    Grant : Rs. 3.25 lakhs.

19. **G. Rangarajan :** Principal investigator in an MHRD Project.

    Project Title : Indo-French cyber university project at IISc.

    Duration : 2003-2010.

    Grant : Rs. 1.64 crores.

20. **G. Rangarajan :** Principal investigator in a DRDO Project.

    Project Title : Enabling infrastructure for projects in computational mathematics.

    Duration : 2004-2007.

    Grant : Rs. 46.74 lakhs.

21. **G. Rangarajan :** Co-investigator in a DBT Project.

    Project Title : Experimental and computational studies on neurobiological systems.

    Duration : 2005-2008.

Grant : Rs. 1.28 crores.

22. **G. Rangarajan :** Co-investigator in a DST Project.

    Project Title : Characterisation of quaternary sediment from lower reaches of Narmada with special reference to climate variability and cultural evolution.

    Duration : 2005-2008.

    Grant : Rs. 7.78 lakhs.

23. **G. Rangarajan :** Principal investigator in a DRDO Project.

    Project Title : Autonomous navigation using Brain-Machine Interface.

    Duration : 2006-2011.

    Grant : Rs. 1.10 crores.

24. **G. Rangarajan :** Principal investigator in a DRDO Project.

    Project Title : Mathematics Initiative at the Indian Institute of Science.

    Duration : 2007-2010.

    Grant : Rs. 44.06 lakhs.

25. **G. Rangarajan :** Principal investigator in a DST Project.

    Project Title : Indian Institute of Science Mathematics Initiative.

    Duration : 2007-2012.

    Grant : Rs. 2.28 crores.

26. **G. Rangarajan, S. Gadgil and A. K. Nandakumaran :** Principal investigator and Co-investigators in a DST Project.

    Project Title : DST Centre for Mathematical Biology.

    Duration : 2007-2012.

    Grant : Rs. 4.11 crores.

27. **G. Rangarajan :** Co-investigator in a DST Project.

    Project Title : IRHPA Centre for Neuroscience.

    Duration : 2010-2015.

    Grant : Rs. 13.74 crores.

28. **G. Rangarajan :** Sole investigator in a DST project.

    Project Title : J C Bose Fellowship

    Duration : 2011-2016.

    Grant : Rs. 68 lakhs.

29. **S. Thangavelu :** Sole investigator in a DST project.

    Project Title : J C Bose Fellowship

    Duration : 2008-2012.

Grant : Rs. 40 lakhs.

30. **K. Verma :** Sole investigator in a DST Project.

    Project Title : SwarnaJayanti Fellowship.

    Duration : 2009-2014.

    Grant : Rs. 48.85 lakhs.

31. **K. Verma and H. Seshadri :** Principal investigator and co-investigator in a DST Project.

    Project Title : Holomorphic mappings and negative curvature

    Duration : 2005-2007.

    Grant : Rs. 2.04 lakhs.

7 Others

7.1 Awards/Distinctions

7.1.1 Awards

- G. Bharali was awarded the Indian National Science Academy (INSA) medal for young scientists in 2009.
- S. Gadgil was awarded the Indian National Science Academy (INSA) medal for young scientists in 2008.
- S. Gadgil was awarded the Platinum Jubilee Young Scientist medal by the National Academy of Sciences India (NASI), Allahabad in 2008.
- S. Gadgil was awarded the NASI-Scopus Young Scientist medal by Elsevier in 2010.
- G. Rangarajan was awarded Chevalier dans l'Ordre des Palmes Academiques (Knight of the Order of Palms) by the Government of France in 2006.
- K. Verma was awarded the B. M. Birla Prize in Mathematics for the year 2009-2010.

7.1.2 Fellowships and Honours

- G. Bharali was elected as an Associate of the Indian Academy of Sciences for the period 2006 - 2009.
- G. Bharali was selected as an Associate of the International Centre for Theoretical Physics (ICTP), Trieste, Italy in 2006.
- T. Bhattacharya was selected for DST Ramana Fellowship for the period 2006 - 2009.
- B. Datta was elected a Fellow of the Indian Academy of Sciences in 2009.
- S. Gadgil was elected an Associate of the Indian Academy of Sciences for the period 2003 - 2007.
- M. K. Ghosh was elected a Fellow of the National Academy of Sciences, India in 2006.

- Manjunath Krishnapur has become an Associate of Indian Academy of Sciences in 2009.
- G. Misra was awarded J. C. Bose National Fellowship, DST for the period 2008 - 2012.
- G. Misra was elected a Fellow of the Indian National Science Academy in 2009.
- G. Rangarajan was made Adjunct Professor, International Centre for Theoretical Sciences, Tata Institute of Fundamental Research in 2008.
- G. Rangarajan was elected a Fellow of the Indian Academy of Sciences in 2010.
- G. Rangarajan was awarded the J. C. Bose National Fellowship, DST for the period 2011-2016.
- S. Thangavelu was elected a Fellow of the Indian National Science Academy in 2006.
- S. Thangavelu was offered Adjunct Distinguished Professorship at HRI, Allahabad for the period 2007 - 2009.
- S. Thangavelu was awarded J. C. Bose National Fellowship, DST for the period 2008 - 2012.
- K. Verma was awarded the SwarnaJayanti Fellowship, DST for the period 2009 - 2014.
- S. Viswanath has become an Associate of Indian Academy of Sciences in 2009.

7.1.3 Awards/Distinctions conferred on students

- Anindya Goswami received the Shyama Prasad Mukherjee Fellowship, instituted by the CSIR during 2005 - 2008.
- The Shyama Prasad Mukherjee Fellowship, instituted by the CSIR, was awarded to H. A. Gururaj in 2006.
- The Shyama Prasad Mukherjee Fellowship was awarded to G. P. Balakumar in 2007.
- The Shyama Prasad Mukherjee Fellowship was awarded to Suparna Bhattacharya in 2007.
- The Shyama Prasad Mukherjee Fellowship was awarded to Subhamay Saha in 2009.

7.1.4 In Editorial Boards

- T. Bhattacharyya, Member of the Editorial Board, Mathematics Newsletter of Ramanujan Mathematical Society, 2004–2007.
- A. Chakrabarti, Member of the Editorial Board, the Bulletin of Calcutta Mathematical Society since 1998.
- B. Datta, Member of the Editorial Board, Lecture Notes Series, Ramanujan Mathematical Society since 2005.
- M. K. Ghosh, Member of the Editorial Board, Differential Equations and Dynamical Systems since 2008.

- G. Misra, Editor of the Proceedings of the Indian Academy of Sciences (Math. Sci.) since 2005.
- G. Misra, Member of the Editorial Board, Lecture Notes Series, Ramanujan Mathematical Society during 2005 – 2008.
- G. Misra, Editor in Chief, IISc Lecture Notes Series, IISc Press since 2008.
- G. Misra, Member of the Editorial Board, Research Monograph Series, IISc Press since 2008.
- G. Misra, Associate Editor of the Journal of Complex Analysis and Operator Theory since 2006.
- G. Misra, Member of the Editorial Board of Current Science since 2008.
- A. K. Nandakumaran, Member of the Editorial Board, Journal of the Korea Society Mathematics Education (Series B) since 2005.
- A. K. Nandakumaran, Member of the Editorial Board, Non Linear Studies since 2010.
- D. P. Patil, Member of the Editorial Board of the journal Beiträge zur Algebra und Geometrie since 1998.
- D. P. Patil, An Associate Editor, Editorial board of the Science Education Journal - *Resonance* since January 2003.
- D. P. Patil, Guest Editor of the IISc Journal, Vol. 91, Jan.-March, 2011.
- P. Prasad, Member of the Editorial Board, Indian Journal of Pure and Applied Mathematics since 2003.
- P. Prasad, Member of the Editorial Board, Proceedings of the Indian Academy of Sciences since 1985.
- G. Rangarajan, Member of the Editorial Board, International Journal of Nonlinear Science & Numerical Simulations since 2011.
- S. Thangavelu, Member of the Editorial Board, Birkhauser book series on 'Pseudodifferential Operators: theory, applications and related topics', 2008.
- S. Thangavelu, Member of the Editorial Board, Journal of pseudodifferential operators and applications, Birkhauser, since 2010.
- S. Thangavelu, Member of the Editorial Board, The Journal of Analysis, since 2010.
- S. Thangavelu, Member of the Editorial Board, Journal of Ramanujan Math. Soc., since 2011.

7.2 National/International conferences organized

1. International Workshop and Conference on Geometric Methods in Topology, June 12 - 14, 2006.
2. National Conference on Mathematical Foundations of Coding, Complexity, Computation and Cryptography, July 20 - 22, 2006.
3. Workshop on Quantitative Finance, November 20 - 24, 2006.
4. Golden Jubilee Instructional Workshop and Conference on Analysis and Applications (2006).
5. Symposium on Stochastic Algorithms and Machine Learning (2006).
6. International Conference on Discrete Mathematics (2006).
7. Workshop on Mathematical Aspects of Neuroscience, July 09 - 14, 2007.
8. International Conference on Stochastic Processes and Applications, July 16 - 21, 2007.
9. Workshop on Communication Networks, July 23 - 28, 2007.
10. Workshop on Dynamical Systems October 22 - November 3, 2007.
11. AAECC-17 Symposium and IWAA workshop on Coding and Cryptography (2007).
12. International Conference on Harmonic Analysis, December 28, 2007 to January 1, 2008.
13. Workshop on Turbulence, January 07 - 31, 2008.
14. Workshop on Integrable Systems, February 18 - 29, 2008
15. Symposium on Nonlinear Evolution Equations, April 18 - 19, 2008.
16. DST-SERC School on Nonlinear Dynamics, June 26 - July 16, 2008.
17. International Conference on Nonlinear Dynamical Systems and Turbulence, July 17 - 22, 2008.
18. Workshop in Harmonic Analysis and PDE, December 05 - 13, 2008.
19. Olympiad Training Camp, December 29, 2008 - January 02, 2009.
20. Workshop on Financial Mathematics-Stochastic Volatility and Credit Risk, May 9 - 16, 2009.
21. Workshop in Analysis and its Applications, May 14 - 23, 2009.
22. Conference in Analysis and its Applications, May 27 - 30, 2009.
23. Workshop on PDE and Related Analysis, Aug 31 - Sept. 18, 2009.
24. IISc-CSIC Workshop on Mathematics, November 16 - 18, 2009.
25. International Workshop on Control and Inverse Problems, December 01 - 15, 2009.
26. International Conference on Control and Inverse Problems, December 16 - 18, 2009.

27. One Day Workshop on Topics in Quantitative Genetics & Genome Analysis (August 28, 2010)

28. Workshop and Conference on Modeling Infectious Diseases: (September 13 - 22, 2010)

29. Workshop - Symposium on Mathematics in Drug Discovery (September 25 - 29, 2010)

30. International Conference on "Commutative Algebra and Algebraic Geometry –CAAG 2010", December, 6 - 10, 2010.

31. Workshop and Symposium on Mathematical Ecology (December 07 - 14, 2010)

32. Workshop on Proteins: Structure, Function and Folding (December 20 - 24, 2010)

33. Workshop on Introduction to Mathematical Techniques in Life Sciences (January 04 - 12, 2011)

34. Workshop and Symposium on Mathematical Physiology (January 15 - 23, 2011)

35. Workshop on Stability & Bifurcation Analysis and Pattern Formation in Mathematical Ecology and Epidemiology (February 25 - March 02, 2011)

7.3 Lecture Series in the Department

1. Prof. Uwe Storch, Ruhr University, Bochum, Germany, gave a series of 8 lectures on Elliptic Curves during 14th February to 10th March, 2008.

2. Prof. Zindine D Jadli, Universite Grenoble, France, gave a series of three lectures on "Some recent progress in conformal geometry" on October 28, 29 & 30, 2008.

3. Prof. Uwe Storch, Ruhr University, Bochum, Germany, gave a series of lectures on "Galois Theory" during November 09 to december 23, 2009.

4. Prof. Adam Shwartz, Technion, Israel, gave a series of three lectures on "Large Deviations" during February 1st to 8th, 2010.

5. Prof. Angela Pasquale, University Paul Verlaine-Metz, France, gave a series of six lectures on "Harmonic Analysis of the Theta-hypergeometric Functions" during 7th to 16th September, 2010.

6. Prof. M. S. Narasimhan, Dept. of Mathematics, IISc., Bangalore, gave a series of three lectures on "Borel-Weil Theorem" during 29th November, 2010 and 1st December, 2010.

7.4 Seminars/Colloquia in the Department

1. Prof. A. K. Nandakumaran, Dept. of Mathematics, IISc, gave a talk on "An Overview of Homogenization" on 10.3. 2006.

2. Dr. V. V. K. Srinivas Kumar, Dept. of Mathematics, IISc, gave a talk on "Multiresolution analysis (MRA) and Wavelets" on 4.4.2006.

3. Prof. Phoolan Prasad, Dept. of Mathematics, IISc, gave a talk on "Extended Lemma on Bicharacteristics" on 18.4.2006

4. Prof. M. K. Ghosh, Dept. of Mathematics, IISc, gave a talk on Ergodic Control of Diffusion Processes" on 21.4.2006.
5. Mr. Prabal Paul, Dept. of Mathematics, IISc, gave a talk on Mathematics of Signalling" on 25.4.2006.
6. Prof. R. Narasimha, Engineering Mechanics Unit, JNCASR, Bangalore, gave a talk on "Minimal Composite Equations - A new way to analyse nonparallel Flow instability" on 28.4.2006.
7. Prof. Siddhartha Gadgil, Dept. of Mathematics, IISc, gave a talk on "One cannot hear the shape of a drum" on 2.5.2006.
8. Dr. D. Narayana, Dept. of Mathematics, IISc, gave a talk on "Strong proximinality in $C(K)$" on 16.5.2006.
9. Prof. A.R. Shastri, Dept. of Mathematics, IIT, Mumbai, gave a talk on "Gauss elimination method and Lagrange-Beltrami formula" on 23.5.2006.
10. Dr. Sunil Chebolu, University of Washington, USA, gave a talk on "Stable homotopy theory - A gateway to modern Mathematics" on 29.5.2006.
11. Mr. Sanjiban Santra, Dept. of Mathematics, IISc, gave two talks on "An introduction to finite dimensional degree and its applications" on 30.5.2006 & 6.6.2006.
12. Ms. Anuradha Narasimhan, Dept. of Mathematics, IISc, gave two talks on "Linear codes over finite fields" on 20.06.2006 & 27.6.2006.
13. Dr. David Wilson, Microsoft Research, USA, gave a talk on "Mixing times of lozenge tiling and card shuffling Markov chains" on 7.7.2006.
14. Mr. Jaydeb Sarkar, Dept. of Mathematics, IISc, gave a talk on "Characteristic Function for a Tuple of Commuting Operators" on 11.7.2006.
15. Dr. Valentino Tosatti, Harvard University, USA, gave a talk on "The Calabi flow and constant scalar curvature Kahler metrices" on 14.7.2006.
16. Mr. Sanjiban Santra, Dept. of Mathematics, IISc, gave a talk on "On a Class of Superlinear Elliptic Problems in Symmetric Domains and a Fourth Order Singular Eigen Value Problem" on 14.7.2006.
17. Prof. K. Varadarajan, Univ. of Calgary, Canada, gave a talk on "Hopficity of polynomial rings" on 17.7.2006.
18. Prof. Fransesco Pappalardi, University of Rome, Italy, gave a talk on "Introduction to exponential sums Event" on 24.7.2006.
19. Prof. Alpan Raval, Keck Graduate Institute, gave a talk on "Gene function Prediction and evolutionary variability from interactome analysis" on 25.7.2006.
20. Prof. Fransesco Pappalardi, University of Rome, Italy, gave a talk on "Some classical results on exponential sums Event" on 25.7.2006.
21. Dr. Jayadev Athreya, Yale University, gave a talk on "Billiards on Moduli space" on 26.7.2006.

22. Prof. Fransesco Pappalardi, University of Rome, Italy, gave a talk on "Finite fields, permutation polynomials and applications of exponential sums" on 26.7.2006.

23. Dr. Ajay Ramadoss, University of Oklahoma, USA, gave a talk on "Some Applications of the big Chern classes" on 27.7.2006.

24. Prof. Fransesco Pappalardi, University of Rome, Italy, gave a talk on "Further application of exponential sums to cryptography Event" on 27.7.2006.

25. Prof. K. B. Athreya, Iowa State University, USA, gave a talk on "Growth rates for random graphs" on 11.8.2006.

26. Prof. N. Hemachandra, Industrial Engg. and Operations Research, IIT, Mumbai, gave a talk on "Sensitivity analysis and optimal ultimately stationary policies in some Markov decision models" on 17.8.2006.

27. Prof. R. L. Karandikar, Cranes Software, Bangalore, gave a talk on "Martingale Problem Approach to Markov Processes" on 18.8.2006.

28. Dr. Karabi Sikdar, Dept. of Mathematics, IISc, gave two talks on "Queueing Theory - An Introduction" on 22.8.2006 & 29.8.2006.

29. Prof. Siddhartha Gadgil, Dept. of Mathematics, IISc, gave a talk on "The Poincare Conjecture" on 31.8.2006.

30. Dr. Tejaswi Navilarekallu, Dept. of Mathematics, IISc, gave a talk on "Special values of zeta-functions " on 7.9.2006.

31. Mr. D. Yogeshwaran, Dept. of Mathematics, IISc, gave two talks on "Introduction to the theory of Coverage Processes and Applications" on 5.10.2006 & 12.10.2006.

32. Prof. T. N. Shorey, TIFR, Mumbai, gave a talk on "Extensions of a theorem of Euler on four squares" on 6.10.2006.

33. Dr. Tejaswi Navilarekallu, Dept. of Mathematics, IISc, gave a talk on "Birch and Swinnerton-Dyer Conjecture" on 13.10.2006.

34. Dr. Kaushal Verma, Dept. of Mathematics, IISc, gave a talk on "Introduction to Elliptic functions" on 26.10.2006.

35. Prof. Gadadhar Misra, Stat-Math Unit, ISI, Bangalore, gave a talk on "Vector bundles homogeneous under the universal covering group of $SL(2, \mathbb{R})$" on 27.10.2006.

36. Prof. S. Thangavelu, Dept. of Mathematics, IISc, gave a talk on "Gutzmers formula" on 3.11.2006.

37. Dr. Harish Seshadri, Dept of Mathematics, IISc, gave a talk on "The Schwarz Lemma in Kahler Geometry" on 10.11.2006.

38. Prof. V. Sharma, ECE, IISc, gave a talk on "An optimal decision feedback equalizer using stochastic approximation" on 15.11.2006.

39. Prof. N. Hemchandra, Industrial Engg. and Operations Research, IIT, Mumbai, gave a talk on "Learning algorithms for some Asset management models" on 15.11.2006.

40. Prof. Bhaskar Bagchi, Stat-Math Unit, ISI, Bangalore gave a talk on "The lower bound theorem for combinatorial manifolds: a hopefully accessible proof" on 17.11.2006.

41. Prof. Basudeb Datta, Dept. of Mathematics, IISc, gave a talk on "Minimal triangulations of non-simply connected manifolds" on 24.11.2006.

42. Dr. S. Viswanath, University of California, Davis, USA, gave a talk on "Stable limit representation theory of Kac-Moody algebras" on 28.11.2006.

43. Dr. Sachi Srivastava, Dept. of Mathematics, IISc, gave a talk on "Maximal regularity for second order Evaluation equations" on 1.12.2006

44. Dr. K. Sandeep, TIFR Center, Bangalore, gave a talk on "A semi-linear elliptic equation with Partial Symmetry equations" on 8.12.2006.

45. Prof. Venkataramana, TIFR, Mumbai, gave a talk on "Rigid Subgroups of semi-simple Lie Groups" on 15.12.2006.

46. Dr. Siva Athreya, Stat-Math Unit, ISI, Bangalore, gave a talk on "Conditioned Super-Brownian Motion" on 18.12.2006.

47. Dr. Abhinav Kumar, Microsoft research, gave a talk on "Universally optimal distribution of points on spheres" on 19.12.2006.

48. Mr. Sucharit Sarkar, Princeton University, USA, gave a talk on "A combinatorial description of some Heegaard Floer homologies" on January 02, 2007.

49. Dr. Prakash Belkale gave a talk on "The strange duality conjecture for generic curves" on January 04, 2007.

50. Dr. Brian Conrad, University of Michigan, USA, gave a talk on "Class numbers for algebraic curves over finite fields" on January 09, 2007.

51. Prof. Shiva Shankar, CMI, Chennai, gave a talk on "Elimination for PDE " on January 11, 2007.

52. Mr. Anindya Goswami, Dept. of Mathematics, IISc, gave a talk on "Basics of Game Theory" on January 17, 2007.

53. Prof. Sashikumar Ganesan, Otto-von-Guericke Universitaet, Magdeburg, gave a talk on "Finite element simulation of free surface and two-phase flows using moving meshes" on January 18, 2007.

54. Prof. Niranjan Ramachandran, University of Maryland, USA, gave a talk on "Special values of zeta functions" on January 23, 2007.

55. Dr. Olivier Dudas, Ecole Normale Superieure, Paris, France, gave a talk on "Methods in representation theory of finite reductive groups" on January 29, 2007.

56. Prof. Amiya Mukherjee, ISI, Kolkata, gave a talk on "Foliations and rational Pontrjagin class " on January 31, 2007.

57. Prof. Urmie Ray, Universite de Reims, France, gave a talk on "Groups, Lie algebras and Number Theory" on February 02, 2007.

58. Prof. Heinrich Begehr, Free University, Berlin, Germany, gave a talk on "Polyharmonic boundary value problems" on February 05, 2007.

59. Dr. C. S. Dalawat, HRI, Allahabad, gave a talk on "Congruent numbers" on February 09, 2007.

60. Dr. C. R. Pradeep, Dept. of Mathematics, IISc, gave a talk on "Swan's Theorem on Vector Bundles and Projective Modules" on February 14, 2007.

61. Prof. K. B. Sinha, JNCASR, Bangalore, gave a talk on "Quantum Mechanics - Its Impact on Modern Mathematics" on February 16, 2007.

62. Prof. Mokshay Madiman, Yale University, USA, gave a talk on "Entropy Power inequalities and monotonicity in central limit theorems" on February 23, 2007.

63. Dr. Anupam Kumar Singh, TIFR, Mumbai, gave a talk on "Real vs. Strongly Real Elements in Algebraic Groups" on February 27, 2007.

64. Prof. Jean-Pierre Raymond, Universit Paul Sabatier, Toulouse, France, gave a talk on "Mathematical issues for some control problems in fluid mechanics" on Feb. 28, 2007.

65. Prof. Dilip Patil, IISc, gave a talk on "Zariski-Lipman Conjecture" on March 08, 2007.

66. Prof. M. Lukacova, Hamburg University of Technology, gave a talk on "Numerical Modelling of Hyperbolic Balance Laws using Bicharacteristics" on March 14, 2007.

67. Dr. Mainak Poddar, ISI, Kolkata, gave a talk on "How interesting are orbifolds?" on March 23, 2007.

68. Dr. G. V. Ravindra, IISc, gave a talk on "Characterization of complete intersection curves in generic hypersurfaces of dimension 3" on March 26, 2007.

69. Dr. E. K. Narayanan, IISc, Gave a talk on "Harmonicity on families of circles" on March 28, 2007.

70. Dr. Mrinal Kanti Das, Indian Statistical Institute, Kolkata, gave a talk on "Projective modules over affine algebras" on April 2, 2007.

71. Dr. Gautam Bharali, IISc, gave a talk on "Local polynomial convexity of real surfaces in $\mathbb{C}^n$ near complex tangencies" on April 13, 2007.

72. Prof. V. Pati, ISI, Bangalore, gave a talk on "Diagonal Subschemes and Vector Bundles" on April 16, 2007.

73. Dr. Tejaswi Navilarekallu, IISc, gave a talk on "Tamagawa number conjecture" on April 23, 2007.

74. Prof. M. S. Narasimhan, IISc/TIFR, Bangalore, gave a talk on "Arakelov Bundles on Arithmetic curves" on April 30, 2007.

75. Prof. Siddhartha Gadgil, IISc, gave a talk on "Higher linking of knots" on May 9, 2007.

76. Prof. Gerald Warnecke, Magdeburg, Germany, gave a talk on "Numerical approximation of population balance equations in process engineering" on May 14, 2007.

77. Prof. Gerald Warnecke, Magdeburg, Germany, gave a talk on "Adaptive Numerical Solution of Intracellular Calcium Dynamics" on May 21, 2007.

78. Ms. Geetanjali Kachari, IISc, gave a talk on "Higher linking of Knots: Stallings theorem" on June 11, 2007.

79. Dr. Manjunath Krishnapur, University of Toronto, gave a talk on "An overview of random matrices" on June 14, 2007.

80. Prof. S. S. Sritharan, University of Wyoming, gave a talk on "Harmonic analysis approach to the Navier-Stokes equation" on June 15, 2007.

81. Prof. G. Godefroy, University of Paris VI, France, gave a talk on "Lipschitz isomorphisms between Banach spaces" on June 19, 2007.

82. Dr. Manoj Kummini, University of Kansas, gave a talk on "Multiplicity Conjectures" on June 28, 2007.

83. Dr. Sunder Sethuraman, Iowa State University, gave a talk on "On a scaling limit for a tagged particle in some zero-range interacting systems" on June 29, 2007.

84. Prof. Indranil Biswas, TIFR, Mumbai, gave a talk on "On holomorphic Hermitian Bundles" on July 27, 2007.

85. Dr. Ritabrata Munshi, Rutgers University, USA, gave a talk on "The arithmetic of elliptic surfaces" on August 1, 2007.

86. Prof. Himadri Mukherjee, North-Eastern Hill University, Shillong, gave a talk on 'Classification problems in topology - some approaches" on August 2, 2007.

87. Dr. Marcus Kraft, Hamburg Univ. of Tech., Germany, gave a talk on "On the numerical approximation of nonconservative hyperbolic balance laws" on August 10, 2007.

88. Dr. A. Prabhakar Rao, University of Missouri. St. Louis, gave a talk on "Vector bundles on hypersurfaces" on August 8, 2007.

89. Dr. B. Baskar, Brandeis University, gave a talk on "Overconvergent modular symbols" on August 31, 2007.

90. Prof. S. D. Adhikari, HRI, Allahabad, gave a talk on "Some Combinatorial Group Invariants and their genaralisations with weights" on September 5, 2007.

91. Prof. Probal Chaudhari, ISI, Kolkata, gave a talk on "Multivariate Distributions, Quantiles and their Monotonicity Properties" on September 7, 2007.

92. Prof. Jacob Katriel, Israel Institute of Technology, Haifa, gave a talk on "Combinatorial approach to the conjugacy-class algebra of the symmetric group" on September 14, 2007.

93. Prof. Carsten Carstensen, Humboldt Univ., Germany, gave a talk on "Some Remarks on the Convergence of Adaptive Finite Element Methods" on September 24, 2007.

94. Prof. Katrin Wendland, Univ. Augsburg, Germany, gave a talk on "Quantum field theory as an aid to geometers Finite Element Methods" on September 24, 2007.

95. Prof. Asha Rao, RMIT, Melbourne, Australia, gave a talk on “Quantum Cryptography, Mutually Unbiased Basis and what is wrong with Classical Cryptography” on September 28, 2007.
96. Dr. Harish Seshadri, IISc, gave a talk on “Positive isotropic curvature and the fundamental group” on October 26, 2007.
97. Prof. Michel Waldschmidt, Institut de Mathmatiques de Jussieu, Paris, gave a talk on “History of irrational and transcendental numbers” on November 6, 2007.
98. Dr. Jaya Iyer, IMSc, gave a talk on “Cycles on complete intersections” on November 12, 2007.
99. Dr. Jaya Iyer, IMSc, gave a talk on “Chern-Cheeger-Simons theory of secondary classes” on November 13, 2007.
100. Dr. Gautam Bharali, IISc, gave a talk on “Spectral Pick interpolation from a complex-geometric viewpoint” on November 16, 2007.
101. Dr. N. Tejaswi, IISc, gave a talk on “Galois action on L-values” on November 23, 2007.
102. Dr. Kaushal Verma, IISc, gave a talk on “Domains with non-compact automorphism group” on November 30, 2007.
103. Dr. Parthanil Roy, ETH Zurich and Michigan State University gave a talk on “Ergodic theory, abelian groups, and point processes associated with stable random fields” on December 7, 2007.
104. Prof. Daniel Stroock, MIT, gave a talk on “Some queer diffusions” on December 7, 2007.
105. Prof. Sriram Abhyankar, Purdue University, gave a talk on “The Newton Polygon” on December 14, 2007.
106. Prof. T. R. Ramadas, ICTP, Trieste, gave a talk on “The Hodge Conjecture for certain abelian four-folds: a tentative gauge theoretic approach” on December 18, 2007.
107. Prof. M. Lakshmanan, Bharathidasan University, Tiruchirapalli gave a talk on “Landau-Lifshitz-Gilbert Equation of Ferromagnetism: A Challenging Nonlinear Evolution Equation in Applied Mathematics” on December 19, 2007.
108. Dr. Debraj Chakrabarti, University of Western Ontario, gave a talk on “Holomorphic extension of CR functions from hypersurfaces with singularities” on December 20, 2007.
109. Dr. Sagun Chanillo, Rutgers University, USA, gave a talk on “Regularity of the Solutions and the Free Boundary in the Composite Membrane Problem” on December 26, 2007.
110. Mr. D. Yogeshwaran, Ecole Normale Superieure, Paris, France, gave two talks on “Directionally convex ordering of random measures, shot-noise fields and some applications to wireless networks” on January 4 & 7, 2008.
111. Dr. Ajay Ramadoss, University of Oklahoma, USA, gave a talk on “Hochschild homology of rings of differential operators and integration over complex manifolds” on January 8, 2008.

112. Dr. Anirban Banerjee, Max-Planck Institute, Leipzig, Germany, gave a talk on "Graph spectra: a tool for analyzing networks" on January 17, 2008.

113. Prof. Ambar Sengupta, Louisiana State University, USA, gave a talk on "Mathematical aspects of 2-dimensional Yang-Mills theory" on January 18, 2008.

114. Prof. Srikanth Iyengar, University of Nebraska, USA, gave a talk on "Finite group actions and commutative Algebra" on January 21, 2008.

115. Mr. Anindya Goswami, IISc, gave a talk on "Semi-Markov processes in dynamic games and finance" on January 22, 2008.

116. Dr. Kinkar Ch. Das, Sungkyunkwan University, Republic of Korea, gave a talk on Recent results on Laplacian eigenvalue of graph on 31.1.2008.

117. Prof. Rakesh, University of Delaware, USA, gave a talk on "The spherical mean value operator for functions supported in a ball" on February 1, 2008.

118. Dr. P. Dehornoy, ENS, Paris, France, gave a talk on "Lorenz knots and modular knots" on February 4, 2008.

119. Prof. Rajesh P. N. Rao, University of Washington, USA, gave two talks on "Brain-computer interfaces: an introduction" on February 5 & 8, 2008.

120. Prof. Siddhartha Gadgil, IISc, gave a talk on "Watson-Crick pairing for RNA and Milnor's link invariants" on February 6, 2008.

121. Prof. Rama Mishra, IISER, Pune, gave a talk on "A spanning tree model for Khovanov homology" on February 8, 2008.

122. Prof. H. N. Mhaskar, California State University Los Angeles, USA, gave a talk on "Edge detection and local approximation using spectral data" on February 11, 2008.

123. Dr. Anna Zaušková, Hamburg University of Technology, Germany, gave two talks on "Mathematical modelling in hemodynamics" on February 15 & 28, 2008.

124. Dr. S. Viswanath, Department of Mathematics, IISc, gave a talk on Embedding hyperbolic Dynkin diagrams into E_{10} on 19.02.2008.

125. Prof. Takeo Takahashi, Institut Élie Cartan de Nancy, France, gave a talk on "Observability to inverse source problems for linear systems" on February 20, 2008.

126. Prof. Phoolan Prasad, IISc, gave a talk on "3-D kinematical conservation laws: equations of evolution of a surface" on February 22, 2008.

127. DR. Pralay Chatterjee, IMSc., Chennai gave a talk on "Power maps and exponentiality in p-adic algebraic Groups" on 20.03.2008.

128. Prof. Micheal Dritschel, gave a talk on "The Fejer-Riesz Theorem and Related sums of Squares Problems" on 28.3.2008.

129. Prof. Ralph Greenberg, University of Washington gave a talk on "The Behaviour of the mordell-well groups for an Elliptic Curve" on 3.04.2008.

130. Prof. Sergei Pereverzyev, Institute for Computational & Applied Mathematics, Austria gave a talk on "The balancing principle for the regularization of elliptic Cauchy problems" on 8.04.2008

131. Dr. Eli Lebow, NCBS, Bangalore gave a talk on "Embedded contact Homology of Torus bundles with hyperbolic Monodromy" on 11.4.2008.

132. Prof. S. Ramasubramanian, ISI, Bangalore, gave a talk on Lindberg risk processes with investment gave a talk on 24.4.2008.

133. Prof. Rahul Roy, ISI, Delhi, gave a talk on "Brownian Web and Poisson Trees" on 24.4.2008.

134. Dr. Pranday Goel, National Institute of Health, USA gave a talk on "Random geometric graphs and coverage processes" on 21.5.2008.

135. Dr. Ayan Mahalanobis, Stevens Institute, New Jersey, USA gave a talk on "The MOR cryptoystem and special linear groups over finite fields" 21.5.2008.

136. Prof. Paul Binding, University of Calgary, Canada, gave a talk on "Eigencurve methods for some generalized eigen value problems" on 23.5.2008.

137. Mr. Ananth Hariharan, University of Kansas, Lawrence gave a talk on "A local algebraist commuting in Bangalore" on 24.6.2008.

138. Dr. Ameya Pitale, University of Oklahoma gave a talk on "L-functions" on 8.7.2008

139. Dr. Jayadev Athreya, Yale University, USA gave a talk on "Lattice Point Asymptotics and volumes Growth on Teichmuller space" on 16.7.2008

140. Dr. Aftab Pande, Cornell University, USA gave a talk on "Modular Forms, Elliptic curves and Galois Representations" on 23.7.2008.

141. Mr. Anindya Goswamy, Department of Mathematics, IISc gave a talk on "Semi-Markov processes in dynamic games and finance" on 29.7.2008.

142. Dr. Manjunath Krishnapur, University of Toronto, Canada gave a talk on "Conformal invariance in probability and statistical physics" on 29.7.2008.

143. Prof. K. B. Athreya, Iowa State University, gave a talk on "Preferential attachment Random graphs with general weight function and General input sequence" on 4.8.2008.

144. Prof. K. B. Athreya, Iowa State University, gave a talk on 'Continuity properties of translation and similar operations on L^p spaces on $\mathbb{R}$ for $p \in [1, \infty]$" on 5.8.2008.

145. Dr. Malambika Pramanik, University of British Columbia, gave a talk on "Three terms progression in search of Hausdorff dimension" on 11.8.2008.

146. Prof. Moulinath Banerjee, University of Michigan, gave a talk on "Estimation of function thresgolds using multistage adaptive procedures" on 12.8.2008.

147. Prof. Moulinath Banerjee, University of Michigan, gave a talk on "Inconsistency of the Bootstrap in Problems exhibiting cube Root Asymptotics" on 13.8.2008.

148. Prof. Marius Tucsnak, Nancy Universites gave a talk on "Self-Propelled Motions of Solids in Viscous Fluids: Mathematical Analysis and Control Problems" on August 22, 2008.

149. Prof. Ali Baklouti, University of Sfax, Tunisia gave two talks on "Some uncertainty principles on solvable Lie groups" on August 22 & 27, 2008.

150. Prof. Siddhartha Gadgil, Department of Mathematics, IISc. gave a talk on "Contructions of Manifolds" on 25.8.2008.

151. Dr. Harish Seshadri, Department of Mathematics, IISc. gave a talk on "Contructions of manifolds" on 25.8.2008.

152. Dr. Pranav Pandit, University of Pennsylvania, USA gave a talk on "Noncommutative geometry and mirror symmetry" on 25.8.2008.

153. Prof. G. D. Veerappa Gowda, TIFR-CAM, Bangalore gave a talk on "Conservation laws admitting delta shock wave type solutions" on 29.8.2008.

154. Dr. Mark Agranovsky, Barllan University, gave a talk on "Complex dimensions, attached analytic discs and parametric argument principle" on 19.9.2008.

155. Prof. Siddhartha Gadgil, Department of Mathematics, IISc. gave a talk on "Foliations of manifolds" on 6.10.2008.

156. Dr. Amit Apte, TIFR Centre, Bangalore, gave a talk on "Sampling the Posterior : A Bayesian Approach to data simulation" on 6.11.2008.

157. Dr. Shiva Athreya, ISI, Bangalore gave a talk on "Survival of contact Process on the Hierarchical Group" on 6.11.2008.

158. Prof. A. K. Nanda, IIT, Kharagpur gave a talk on "Reversed Hazardrate function" on 11.11.2008.

159. Dr. Shanta laisram, University of Waterloo, Canada, gave a talk on "Squares in Arithmetic Progresin" on 2.12.2008.

160. Dr. Kavita Ramanan, Carnegie Mellon University, gave a talk on "Dirichlet Processes and reflected Diffusions" on 16.12.2008.

161. Dr. Approrva Khare, U. C. Riverside, USA gave a talk on "Infinitesimal Hecke algebras" on 17.12.2008.

162. Prof. J. Demailly, Institute Fourier, France gave a talk on "Approximation of currents and applications to complex geometry" on December 23, 2008.

163. Prof. K. R. Parthasarathy, Indian Statistical Institute, Delhi gave two talks on "Comparitive description of Circuits in Classical and Quantum Computers" on December 23 & 26, 2008.

164. Prof. G. Pisier, University Of Paris 6 and Texas A & M University gave a talk on "Complex Interpolation for Banach Spaces of Operators" on December 24, 2008.

165. Prof. K. N. Raghavan, IMSc, Chennai, gave a talk on "KRS bases or rings of invariants" on 26.12.2008.

166. Prof. K. R. Parthasarathy, Indian Statistical Institute, Delhi gave a talk on "Estimation Of Density Operators in finite level Quantum Systems" on December 30, 2008.

167. Dr. Gautam Iyer, Standford University, USA gave a talk on "Stochastic Lagrangian Particle systems for the Navier-Stokes and Burgers equations" on Jan. 2, 2009.

168. Prof. Hans D. Mittelmann, Arizona State University gave a talk on "Optimization Software for Financial Mathematics" on January 05, 2009.

169. Prof. Hans D. Mittelmann, Arizona State University gave a talk on "Support Vector Machines in Machine Learning" on January 06, 2009.

170. Prof. A. Korányi, Lehman College, CUNY, gave a talk on "Homogeneous Vector bundles in Operator theory" on Jan. 15, 2009.

171. Prof. D. W. Stroock, MIT, USA gave a talk on "Analysis of the Wright Fisher Equation" on January 16, 2009.

172. Prof. Hans G. Feichtinger, University of Vienna gave a talk on Austria "Modulation Spaces and Banach Gelfand Triples" on January 19, 2009.

173. Prof. Francesco Mainardi, University of Bologna, Italy gave a talk on "Anomalous Diffusion via a Fractional Calculus Approach" on January 27, 2009.

174. Prof. Roger Howe, Yale University gave a talk on "Recent Trends in Invariant Theory" on February 10, 2009.

175. Prof. S. R. S. Varadhan, Courant Institute, USA gave a talk on "An unusual problem in large deviation" on February 12, 2009.

176. Prof. Jean-Pierre Raymond, University Paul Sabatier, Toulouse, gave a talk on "Null controllability of a fluid-structure model" on February 25, 2009.

177. Prof. Maneesh Thakur, ISI, Delhi gave a talk on "On a conjecture of Tits and Weiss" on March 20, 2009.

178. Prof. Edwige Godlewski, Laboratoire Jacques-Louis Lions, Universite Pierre et Marie Curie - Paris gave a talk on "Godunov-type schemes for hyperbolic systems with parameter dependent source; the case of Euler system with friction" on March 23, 2009.

179. Prof. K. B. Athreya, Iowa State University, gave a talk on "Size biasing with applications to Markov chains and branching processes" on March 19, 2009.

180. Prof. C. S. Rajan, TIFR, Mumbai, gave a talk on "On spectrum and arithmetic" on March 20, 2009.

181. Prof. M. Dritschel, Newcastle University, UK gave a talk on "Completely bounded kernels" on April 09, 2009.

182. Prof. R. L. Karandikar, Craner Software International Limited, Bangalore gave a talk on "Martingale Problems and Markov Processes" on May 19, 2009.

183. Prof. S. S. Kannan, CMI, gave a talk on "Quotient Varieties modulo Finite Groups" on July 1, 2009.

184. Prof. Sunder Sethuraman, Iowa State University, gave a talk on “Large deviations for a tagged particle in one dimensional simple exclusion” on July 7, 2009.

185. Dr. Jayadev Athreya, Yale University, gave a talk on “Horocycles on the modular surface and Diophantine approximation” on July 20, 2009.

186. Dr. V. Sreekar, gave a talk on “Gaussian Minkowski functionals: an overview of infinite dimensional geometry in Winener space” on July 24, 2009.

187. Dr. Arijit Chakrabarty, Cornell University, gave a talk on ”Understanding heavy tails in a bounded world” on July 30 2009.

188. Dr. Soumik Pal, University of Washington, Seattle gave a talk on “Interacting diffusion models and the effect of size” on August 4, 2009.

189. Prof. K. B. Athreya , Iowa State University, gave a talk on ”Gibbs measure asymptotics” on August, 14, 2009.

190. Dr. Tathagatha Basak, PMU, Japan gave a talk on “A complex hyperbolic reflection group and the Bimonster” on August 21, 2009.

191. Mr. D. Yogeshwaran, Ecole Normale Superieure, Paris gave a talk on “Comparison of critical percolation radii of directionally convex ordered point processes” on Sept 1, 2009.

192. Prof. S. D. Adhakari, HRI, Allahabad gave a talk on ”Weighted zero-sum problems: recent progress” on September 1, 2009.

193. Dr. Esha Chatterjee, Mathematics Department, Bryant University, USA gave a talk on “Global behaviour of some nonlinear difference equations” on October 14, 2009.

194. Dr. Hemangi shah, IISc. gave a talk on “Buseman functions in a harmonic manifold” on October 19, 2009.

195. Prof. Arup Bose, ISI, Kolkata gave a talk on “Limiting spectral distribution of large dimensional random matrices: Another look at the moment method” on Oct. 21, 2009.

196. Prof. B. Jefferies, University of New South Wales, Australia gave a talk on “The connection between Clifford analysis and operator theory” on November 30, 2009.

197. Prof. M. Dritschel, Newcastle University, UK gave a talk on “Realization and interpolation in the Schur class of the polydisk” on December 1, 2009.

198. Prof. Xunyu Zhou, Nomura Centre for Mathematical Finance, University of Oxford, U.K. gave a talk on “Finding Quantiles” on December 7, 2009.

199. Prof. Alan Huckleberry, Ruhr University, Bochum, Germany gave a talk on “Hyperbolicity of cycle spaces and Automorphism groups of flag domains” on Dec. 11, 2009.

200. Prof. Moria Chas, Stony Brook, gave a talk on “Algebraic structures related to the intersection of curves on surfaces” on December 21, 2009.

201. Prof. Dennis Sullivan, Stony Brook, gave a talk on “String Topology” on December 21, 2009.

202. Dr. Shankar Bhamidi, University of North Carolina, Chapel Hill, gave a talk on "Two philosophies for random graphs and networks: Local weak convergence and scaling limits" on December 31, 2009.

203. Dr. J. Faruat, Universite Pierre et Marie Curie, Paris gave a talk on "The Wigner semi-circle law and the Heisenberg group" on January 13, 2010.

204. Prof. Siddhartha Gadgil, Department of Mathematics, IISc. gave a talk on "Can Computers do Mathematics? Ventures in Topology/Geometry" on January 11, 2010.

205. Dr. Rituparna Sen, Univ. of California at Davis, USA, gave a talk on "Option pricing and hedging in incomplete markers" on January 12, 2010.

206. Dr. Tejaswi Navilarekallu, Vrije University, The Netherlands gave a talk on "On p-adic techniques in number theory" on January 15, 2010.

207. Prof. Diganta Mukherjee, Usha Martin Academy, Kolkata gave a talk on "Wooing Voters: Stochastic Dynamic Models for Political Regime Change and Economic Performance in a Democracy" on January 19, 2010.

208. Dr. Kaneenika Sinha, Univ. of Alberta, Canada, gave a talk on "Factoring Jacobians of Modular Curves" on January 29, 2010.

209. Prof. Antar Bandyopadhyay, ISI, Delhi, gave a talk on "Hard-core Models on Random Graphs" on 19th February, 2010.

210. Dr. Bappaditya Bhowmik, Dept. of Mathematics , IISc, gave a talk on "On Concave Univalent Functions" on 25th February, 2010.

211. Prof. Siddhartha Gadgil, Dept. of Matheamtics, IISc., gave a talk on "The Word Problem" on 26th Februaty 2010.

212. Prof. M. K. Ghosh, Dept. of Mathematics, IISc., Bangalore, gave a talk on "The Games People Play" on 26th February, 2010.

213. Prof. Rajendra Bhatia, ISI, Delhi, Gave two talk on "Matrix Diagonals, Fourier Series, perturbation Bounds - I, II" on March, 9th and 10th, 2010.

214. Prof. Rajendra Gurjar, TIFR, Mumbai, gave a talk on "Several Complex Variables and Algebraic Geometry-I" on 11th March, 2010.

215. Prof. Shobha Madan, IIT, Kanpur, gave a talk on "Fugled's Conjecture, Tilings and Spectra" on 15th March, 2010.

216. Prof. B. Rajeev, ISI, Bangalroe, gave a talk on "SDE's with Coefficients in the Tempered Distributions: Uniqueness" on 22nd March 2010.

217. Prof. Siva Athreya, ISI, Bangalore, gave a talk on "Brownian Motion on R-trees" on 22nd March, 2010.

218. Prof. Parameswaran Sankaran, IMSc, Chennai, gave a talk on "Generalized Calabi-Eckmann Manifolds" on 13th April, 2010.

219. Dr. Suhas Pandit, IISER, Pune, gave a talk on "Intersection Numbers, Embedded spheres and Geosphere Laminations for Free Groups" on 13th March, 2010.

220. Dr. Simone Borghesi, Universita di Milano-Bicocca, gave a talk on “Brody Hyperbolicity and Homotopy Theory” on 16th April, 2010.

221. Dr. James Pickering, Newcastle University, UK, gave a talk on “Test Functuion Rralizations and Agler-Herglotz Representations” on 19th April, 2010.

222. Ms. Prachi, Dept. of Mathematics, IISc., gave a talk on “Some Aspects of the Kobayashi and Caratheodory Metrics on Pseudoconvex Domains” on 21st April, 2010.

223. Prof. S. Ramasubramanian, ISI, Bangalore, gave a talk on “Sensitive Control of Diffusions with Bounded Cost” on 26th April, 2010.

224. Dr. Anup Biswas, TIFR, Bangalore, gave a talk on “Sensitive Control of Diffusions with Bounded Cost” on 26th April, 2010.

225. Dr. Manjunath Krishnapur, Dept. of Mathematics, IISc., gave a talk on “Schramm-Lowner Evolutions (SLE)” on 6th May, 2010.

226. Mr. K. R. Arun, Dept. of Mathematics, IISc., gave a talk on “Kinematical Conservation Laws and Propagation of Nonlinear waves in Three Dimensions” on 11th May, 2010.

227. Dr. Manish Kumar, Michigan State University, USA, gave a talk on “Etale Fundamental Groups of Curves over Positive Characteristic Fields” on 13th May, 2010.

228. Dr. Martin Deraux, Fourier Institute, Grenoble, France, gave a talk on “Arithmaticity of complex Hyperbolic Lattices-II” on 26th May, 2010.

229. Ms Rishika Rupam, Department of Mathematics, IISc., Bangalore, gave a talk on “Bounded Analytic Functions” on 25th May, 2010.

230. Ms. Purvi Gupta, Dept. of Mathematics, IISc., Bangalore, gave a talk on “Some Generalizations of Hartogs’Lemma on Analytic Continuation” on 4th June, 2010.

231. Mr. Prasanna Muralidharan, Dept of Mathematics, IISc., Bangalore, gave a talk on “Hand-Movement Prediction Using LFP Data” on 9th June, 2010.

232. Prof. Swagato Ray, IIT, Kanpur, gave a talk on ”Certain Convolution Inequalities on Rank-one Symmetric spaces of Noncompact Type” on 14th June, 2010.

233. Dr. Manoj Kummini, Purdue University, USA, gave a talk on “Arithmetic Rank of Ideals” on 25th June, 2010.

234. Mr. Hari Shanker Gupta, Dept. of Mathematics, IISc., gave a talk on “Numerical Study of Regularization Methods for Elliptic Cauchy Problems” on 26th June, 2010.

235. Prof. Sudesh Khanduja, Punjab University, Chandigarh, gave a talk on “Factorization of Primes in Algebraic Number Fields and the Dedekind Criterion” on th July, 2010.

236. Dr. Ashwin Pande, Australian National University, Australia, gave a talk on “Topological T-Duality” on 7th July, 2010.

237. Mr. Diganta Borah, Dept. of Mathematics, IISc., Bangalore, gave a talk on “A study of the Metric Induced by the Robin Function” on 9th July, 2010.

238. Dr. Michael Grabchak, Cornell University, USA, gave a talk on "Do Financial Returns have or Infinite Variance? A Paradox and an Explanation" on 13th July, 2010.

239. Mr. Sushil Gorai, Dept. of Mathematics, IISc., Bangalore, gave a talk on "Exploring Polynomial Converxity of Certain Classes of Sets" on 14th July, 2010.

240. Prof. Siddharta Gadgil, Dept. of Mathematics, IISc., Bangalore, gave a talk on "Triangulating the Deligne-Mumford Compactification of Riemann Surfaces" on 17th August, 2010.

241. Prof. Sashikumaar Ganesan, Weierstrass Institute for Appl. Analysis and Stochastics, gave a talk on "A Priori Error Analysis for Heterogeneous Finite-Element Discretizations of Population Balance Equations" on 17th August, 2010.

242. Prof. Dr. G. M. Ziegler, TU Berlin, Germany, gave a talk on "3N-colored Points in a Place" on 18th August, 2010.

243. Prof. Detlef Mueller, C. A. University, Kiel, Germany, gave a talk on "Harmonic Analysis for the Hodge Laplacian on the Heisenberg Group" on 26th August, 2010.

244. Prof. H. Araki, Kyito University, Japan, gave a talk on "Algebraic Theory of Quantum Fields-I" on 6th September, 2010.

245. Prof. H. Araki, Kyito University, Japan, gave a talk on "Algebraic Theory of Quantum Fields-II" on 9th September, 2010.

246. Prof Siddhartha Gadgil, Dept. of Mathematics, IISc, Bangalore, gave a talk on "Distinguishing Knots" on 17th September, 2010.

247. Ms. Suparna Sen, Dept. of Mathematics, IISc., Bangalore, gave a talk on "Segal-Bargmann transform and Paley Wiener theorems on motion groups" on 29th September, 2010.

248. Prof. Siddhartha Gadgil, Dept. of Mathematics, IISc, Bangalore, gave a talk on "Projective Geometry and Holomorphic Curves, on 22nd September, 2010.

249. Prof. Marius Tucsnak, Universite Nancy-I, France, gave a talk on "An iterated observer method for recovering the initial state for a class of PDEs" on 24th November, 2010.

250. Prof. Jeam-Pierre Gazeau, Universite Paris-7 Denis Diederot, France, gave a talk on "Hilbert Spaces Based on Complex Hermite Polynomials and Related Quantizations" on 13th December, 2010.

251. Dr. Niranjan Balachandran, Caltech, USA, gave a talk on "Forbidden Configurations, Extremal Set Systems, and Steiner Designs" pm 14th December, 2010.

252. Prof. Arnab Sen, Statistical Laboratory, University of Cambridge, gave a talk on "Coalescing Systems of Non-Brownian Particles" on 20th December, 2010.

253. Prof. Charles Bordenave, Universite de Toulouse, gave a talk on "Spectrum of Non-Hermitian Heavy-tailed Random Matrices" on 20th December, 2010.

254. Dr. Murali Vemuri, Chennai Mathematical Institute, Chennai, gave a talk on "The Brylinski Beta Function" on 10th January, 2011.

255. Dr. Dilip Raghavan, University of Toronto, USA, gave a talk on "Cofinal types of ultrafilters" on 21st January, 2011.

256. Prof. B. Rajeev, ISI, Bangalore, gave a talk on "On the Connections between Stochastic PDE and PDE" on 28th January, 2011.

257. Prof. S. S. Sitharan, Naval Postgraduate School, Monterey, USA, gave a talk on "Stochastic Navier-Stokes Equation with Levy noise-where Harmonic Analysis and Stochastic Analysis Meet" on 11th February, 2011.

258. Prof. Michael Demuth, University of Clausthal, Gernamy, gave a talk "On the distribution of the eigenvalues of non-self adjoint operators" on 1st March, 2011.

259. Dr. Shrihari Sridharan, Chennai Matheamtical Institute gave a talk on "SRB-measure leaks" on 7th March, 2011.

7.5 List of Visitors in the Department

1. Dr. S. Baskar, Université Pierre et Marie Curie-Paris, France, visited the department from 15th to 20th May, 2006.

2. Dr. Sunil Chebolu, Univ of Washington, USA, visited the department from 29th to 30th May, 2006.

3. Dr. K. S. Mallikarjuna Rao, Univ. of Texas, USA, visited the department from May 8 to June 7, 2006.

4. Prof. K. P. Das, University of Calcutta, Kolkata, visited the department from 16th to 19th May 2006.

5. Dr. P. K. Das, IICT, Hyderabad, visited the department from May 18 to June 17, 2006.

6. Dr. M. Sundari, IIT, Roorkee, visited the department from May 22 to June 21, 2006.

7. Dr. Jayprakash Panda, Orissa Engg. College, Bhubaneswar, visited the department from 7th to 8th June, 2006.,

8. Prof. E. V. Krishnamurthy, Australian National University, Canbera, Australia, visited the department from 11th to 18th June, 2006.

9. Prof. Dhananjay A. Sant, Dept. of Geology, University of Baroda, Vadodara, visited the department from 12th to 22nd June, 2006 and from 20 to 25 March, 2007.

10. Prof. Daryl Cooper, University of California at Santa Barbara, USA, visited the department from 12th to 24th June, 2006.

11. Dr. Chang-Wan Kim, Korea Institute for Advanced Study, School of Mathematics, Seoul Republic of South Korea, visited the department from 12th to 23rd June, 2006.

12. Dr. Chanyoung Sung, Korea Institute for Advanced Study, School of Mathematics, Seoul, Republic of South Korea, visited the department from 12th to 23rd June, 2006.

13. Prof. Rolando Jimenez Benitez, UNAM, Mexico, visited the department from 12th to 25th June, 2006.

14. Prof. Pedro Ontaneda, SUNY Binghamton, USA, visited the department from 12th to 25th June, 2006.

15. Prof. G. Besson, Institute Fourier, Grenoble, France, visited the department from 12th to 25th June, 2006 and from 8th to 22nd August, 2010.

16. Prof. K. Varadarajan, University of Calgary, Canada, visited the department from 12th June to 25th July, 2006 and from 11th to 14th November, 2007.

17. Dr. Frank H. Lutz, Technische Universität Berlin, Institut für Mathematik, Berlin, Germany, visited the department from the period from 17th June to 25th July, 2006.

18. Prof. Viktor Schroeder, Institut für Mathematik, Universität Zürich, Zürich, Switzerland, visited the department from the period from 17th June to 25th July, 2006.

19. Dr. Shrihari Shridharan, Institute of Mathematical Sciences, Chennai, visited the department for the period from 1st to 31st July, 2006 and from 2nd to 8th March, 2011.

20. Prof. B. N. Mandal, ISI, Kolkata, visited the department from 8th to 15th July, 2006.

21. Dr. Arnab Basu, TIFR, Mumbai, visited the department from 20th August to 17th September, 2006 and May 27 to June 19, 2007.

22. Dr. Tejaswi Navilarekallu, Pasadena, USA, visited the department from August 16 to October 15, 2006.

23. Dr. A. M. S. Ramaswamy, Pondicherry University, visited the department from 16th to 20th October, 2006.

24. Dr. K. Suresh Kumar, IIT, Mumbai, visited the department on November 11, 2006.

25. Dr. J. Osher Stanley, UCLA Dept of Maths, Los Angeles, USA, visited the department from 9th to 16th December, 2006.

26. Prof. Gopal K. Basak, ISI, Kolkata, visited the department from December 25, 2006 to January 2, 2007.

27. Dr. Oliver Pudar, Paris, visited the department from 28th to 29th January 2007.

28. Dr. Charles Vial, Paris, visited the department from 28th to 29th January 2007.

29. Dr. Sashikumar Ganesan, Institute fur Analysi and Numerik, Otto-Von Guerick University, Maageliburg, visited the department from 17th to 19th January, 2007.

30. Prof. Heinrich Begehr, Free University Berlin, Germany visited the department from 3rd to 6th February, 2007.

31. Dr. Asha Gopinathan, Consultant Gen Sci-Tech, Trivandrum, visited the department from Feb. 5 to March 9, 2007.

32. Adam Koranyi, CUNY, USA, visited the department during 8th February 2007 – 2nd March 2007, 4th – 23rd January, 2008, December 28, 2008 - January 15, 2009 and 28th December 2009 – 27th January 2010.

33. Prof. J. P. Raymond, Mathematics for Industrial Physics Group, France, visited the department from 10th February to 2nd March, 2007.

34. Dr. Anupam K. Singh, School of Mathematics, TIFR, Mumbai, visited the department from 21st to 28th February, 2007.

35. Prof. Lorenzo Robbiano, University of Genova, Italy, visited the department from 14 to 27 February, 2007.

36. Dr. P. Dhanumjaya, BITS, Goa, visited the department from 26th February to 4th March, 2007 and from June 26 to July 12, 2008.

37. Prof. Maria Lukacova, TU Hamburg, Germany, visited the department during February 26 – March 17, 2007 and from 16th February – 16th March, 2008.

38. Prof. R. E. Amritkar, PRL, Hyderabad, visited the department from 27th to 28th February, 2007.

39. Dr. P. K. Ratnakumar, HRI, Allahabad, visited the department during 7th – 31st May, 2007 and 15th – 25th July, 2008.

40. Dr. K. Sreenath, IIT, Delhi, visited the department from June 5 to July 4, 2007.

41. Dr. Vitali Moroz, Univ. of Bristol, UK, visited the department from 11 to 21 May, 2007.

42. Prof. Gerald Warnecke, Universität Magdeburg, Germany, visited the department from 10 to 26 May, 2007.

43. Dr. Sivaguru Sritharan, University of Wyoming, visited the department from 3 to 21 June, 2007.

44. Dr. Madhu Raka, Punjab University, Chandigarh, visited the department from 6 to 20 June, 2007.

45. Dr. Vivek M. Mallick, TIFR, Mumbai, visited the department from 15 to 21 July, 2007.

46. Prof. Diganta Mukherjee, ICFAI, Kolkata, visited the department from 8 to 22 July, 2007 and 26th February to 10th March, 2008.

47. Dr. Joydeep Dutta, IIT, Kanpur, visited the department from 15 to 22 July, 2007.

48. Dr. S. Baskar, IIT, Mumbai, visited the department from 15 to 20 July, 2007.

49. Dr. Ritabrata Munshi, Rutgers University, USA, visited the department from July 30 to August 2, 2007.

50. Prof. A. Prabhakar Rao, University of Missouri, visited the department from 6 to 9 August, 2007.

51. Prof. Stephan R. Kabelac, Univ. of the Federal Armed Forces, Hamburg, Germang, visited the department from 19 to 24 August, 2007.

52. Prof. S. D. Adhikari, HRI, Allahabad visited the department during 5th – 7th September, 2007 and 31st August – 1st September 2009.

53. Prof. Cartsen Carstensen, Humboldt University, Germany, visited the department from 23 to 26 September, 2007.

54. Prof. J. Katriel, Technion, Haifa, Israel, visited the department from September 2 to October 31, 2007.

55. Prof. Vivek S. Borkar, TIFR, Mumbai visited the department from 14 to 15 September, 2007.

56. Prof. R. V. Ramamoorthi, Michigan State University, USA, visited the department from 8 to 22 October, 2007.

57. Dr. Martin Dereaux, Institute Fourier, Grenoble, France, visited the department from October 27 to November 11, 2007.

58. Dr. Jaya Iyer, IMSc, Chennai, visited the department from 11 to 14 November, 2007.

59. Prof. Gerald B. Folland, University of Washington, Seattle, USA, visited the department from December 26, 2007 to January 3, 2008.

60. Prof. Yuan Xu, University of Oregon, USA, visited the department from December 22, 2007 to January 1, 2008.

61. Prof. Giancarlo Travaglini, University of Milan, Italy, visited the department from December 27, 2007 to January 3, 2008.

62. Prof. Indranil Biswas, TIFR, Mumbai, visited the department during Dec. 25, 2007 – Jan. 3, 2008, 4th – 18th August, 2008 and 22nd – 24th December, 2009.

63. Prof. Lorenzo Robbiano, Universita di Genova, Italy, visited the department from 13th January to 4th February, 2008.

64. Dr. Anirban Banerjee, Max-Planck Institute, Leipzig, Germany, visited the department from 16th to 18th January, 2008.

65. Dr. Kinkar Chandra Das, Korea, visited the department from 30th January to 2nd February, 2008.

66. Prof. Rakesh, University of Delaware, USA, visited the department from 31st January to 2nd February, 2008.

67. Prof. Rama Mishra, IISER, Pune, visited the department from 3rd to 11th February, 2008 and from 20th to 25th December, 2010.

68. Dr. Anna Zauskova, Hamburg University of Technology, Germany, visited the department from 6th to 29th February, 2008.

69. Prof. Divakar Viswanath, University of Michigan, USA, visited the department from 17th to 28th March, 2008.

70. Prof. Michael Dritschel, Newcastle University, UK, visited the department from 17th to 28th March, 2008.

71. Dr. Pralay Chatterjee, IMSc., Chennai, visited the department from 19th to 23rd March, 2008

72. Prof. Ralph Greenberg, Univ. of Washington, USA, visited the department from March 30 to April 5, 2008.

73. Dr. Minhyong Kum, University College, London, visited the department from 3rd to 4th April, 2008.

74. Dr. K. Saurabh, IIT Kanpur, visited the department from 17th to 21st April, 2008.

75. Dr. Debhasis Bose, IIT Kanpur, visited the department from 17th to 21st April, 2008.

76. Prof. Rahul Roy, ISI Delhi, visited the department on 24.4.2008.

77. Prof. G. C. Das, Instt. of Adv. Study in Sci & Tech., Guwahati, visited the department from 1st to 7th May, 2008.

78. Prof. Gerald Warnecke, Universität Magdeburg, Germany, visited the department from 10th to 26th May, 2008.

79. Dr. A. Mahalanobis, Steven Instt. of Technology, USA, visited the department from 20th to 22nd May, 2008.

80. Dr. Pranay Goel, National Inst. of Health, USA, visited the department on 20.5.2008.

81. Prof. Paul Binding, Univ. of Calgary, Canada visited the department from 21 to 26 May, 2008.

82. Prof. Gregory Gutin, Royal Holloway, London, visited the department from 13 to 14 June, 2008.

83. Dr. Jayanta K. Pal, Duke University, USA visited the department from 1st to 10th July, 2008.

84. Dr. Aftab Pande, Cornel University, USA visited the department from 13th to 27th July, 2008.

85. Prof. Didier Bresh, Univ. of Savoie, France, visited the department from Oct. 24 to Nov. 11, 2008

86. Prof. Zindine D. Jadli, Universite Grenoble, France visited the department from Oct. 24 to Nov. 11, 2008.

87. Prof. J. K. Verma, IIT, Mumbai visited the department from 1st to 2nd Nov., 2008.

88. Prof. Alan McIntosh, Australian National University, Australia visited the department from 1st to 15th November, 2008.

89. Prof. A. K. Nanda, IIT Kharagpur visited the department from 10th to 12th Nov., 2008.

90. Dr. Sachin S. Talathi, Univ. of California, Sandiego, USA visited the department from 13th to 14th Nov., 2008.

91. Dr. Pablo Ares Gastesi, TIFR, Mumbai, visited the department from Nov. 24 to Dec. 6, 2008.

92. Dr. Shanta Laishram, Univ. of Waterloo, UK, visited the department from Nov. 30 to Dec. 12, 2008.

93. Prof. Kavita Ramanan, Carnegie Melon University, USA visited the department on Dec. 16, 2008.

94. Prof. G. Pisier, Texas A & M, USA visited the department during Dec. 16 - 26, 2008.

95. Dr. Apoorva Khare, Univ. of California, USA, visited the department from 17th to 18th Dec., 2008.

96. Prof. K. R. Parthasarathy, ISI, Delhi visited the department during Dec. 19 - 31, 2008.

97. Prof. David Wright, Washington Univ., USA visited the department from 21st to 23rd Dec., 2008.

98. Prof. Nessim Sibony, Universite Paris-Sud, Orsay, France visited the department during Dec. 21, 2008 - Jan 06, 2009.

99. Dr. Gautam Iyer, Standford University, California, USA, visited the department from 1st to 3rd January, 2009

100. Prof. Ajay Kumar, University of Delhi visited the department from 1st to 7th January, 2009.

101. Prof. Ajit Iqbal Singh, ISI, Delhi visited the department from 1st to 9th January, 2009.

102. Prof. H. Garth Dales, Leeds University, UK, visited the department from 1st to 20th January, 2009.

103. Prof. Haresh Dedania, Sardar Patel University, Gujarat visited the department from 2nd to 7th January, 2009.

104. Prof. Hans Mittelmann, Arizona State University, USA visited the department during Jan. 02 - 12, 2009.

105. Dr. Amol Sasane, London School of Economics, UK, visited the department from 3rd to 4th January, 2009.

106. Prof. Anthony O'Farrell, National University of Ireland at Maynooth, Ireland visited the department from 4th to 20th January, 2009.

107. Prof. E. T. Quinto, Tufts, USA visited the department during Jan. 05 - Feb. 05, 2009.

108. Prof. T. R. Ramadas, ICTP, Italy, visited the department from 7th to 9th January, 2009.

109. Dr. Hans Feichtinger, University of Vienna, Austria visited the department during Jan. 18 - 20, 2009.

110. Prof. S. Gindikin, Rutgers, USA visited the department during Jan. 18 - Feb. 27, 2009.

111. Prof. Alexander Isaev, Australian National University, Australia visited the department during Jan. 25 - Feb. 09, 2009.

112. Prof. Z. Blocki, Jagellonian Univ., Krakow, Poland visited the department during Jan. 28 - Feb. 21, 2009.

113. Prof. Zbigniew Blocki, Jagiellonian University Krakow, Poland visited the department during Feb. 03 - 20, 2009.

114. Prof. Jean Pierre Raymond, Institute of Mathematics, France, visited the department from 11th to 28th February, 2009.

115. Prof. Nikolay Shcherbina, University of Wuppertal, Germany visited the department during Feb. 20 - March 06, 2009.

116. Dr. Ranja Sarkar, University of Pune, visited the department from 23rd to 26th February, 2009.

117. Dr. Deepayan Sarkar, Fred Hutchinson Cancer Res. Centre, USA, visited the department from 1st to 3rd March, 2009.

118. Prof. Michael Dritschel, Newcastle University, UK, visited the department from 27th March to 10th April, 2009.

119. Prof. Victor Vinnikov, Ben Gurion University, Isarael, visited the department from 21st March to 3rd April, 2009.

120. Dr. Soumya Dasgupta, ANZ Operations & Technology Pvt. Ltd. Bangalore, visited the department from 8th to 22nd April, 2009.

121. Prof. M. K. Vemurim, CMI, Chennai, visited the department from 17th to 21st April, 2009.

122. Dr. Sanjay Parui, NISER, Bhubaneswar visited the department from 7th June to 6th July, 2009.

123. Dr. Shakir Ali, Aligarh Muslim University, visited the department from 15th to 20th June, 2009.

124. Dr. Sanjay Pani, Deen Dayal College, Delhi, visited the department from 6th to 10th July, 2009.

125. Dr. Arijit Chakraborty, Cornvel University, USA visited the department from 26th to 31st July, 2009.

126. Dr. Soumik Pal, University of Washington, USA, visited the department from 31st July, 2009 to 11th August, 2009.

127. Dr. Tathagata Basak, University of Chicago, USA, visited the department freom 19th to 24th Ausust, 2009.

128. Dr. Hemangi Shah, University of Mumbai, visited the department from 1st to 11th October, 2009.

129. Dr. Sanjib Mishra, SCB Medical College, Cuttack, Orissa, visited the department from 9th to 13th October, 2009.

130. Prof. Arup Bose, Indian Statistical Institute, Kolkata, visited the department on 21st October, 2009.

131. Prof. Brain Jefferies, University of New South Wales, Australia, visited the department from 17th November to 7th December, 2009.

132. Prof. M. S. Raghunathan, TIFR, Mumbai, visited the department from 2nd to 4th December, 2009.

133. Prof. Xunju Zhan, University of Oxford, UK, visited the department from 6th to 8th December, 2009.

134. Prof. Michael Dritschel, Newcastle University, UK, visited the department from 27th November to 8th December, 2009.

135. Prof. A. Hucklebury, Ruhr University, Germany, visited the department from 10th to 13th December, 2009.

136. Prof. Dennis P. Sullivan, Sunny, Stony Brook, USA, visited the department from 18th to 31st December 2009.

137. Prof. Moria Chas, Sunny, Stony Brook, USA, visited the department from 18th to 31st December 2009.

138. Prof. Mahan Maharaj, Vivekananda University, West Bengal, visited the department from 22nd to 24th December, 2009.

139. Dr. Sanjay Pant, Deendayal Upadhyaya College, Delhi University, visited the department from 1st to 15th January,2010.

140. Dr. J. Faraut, Universite Pierre et Marie Curie, Paris, visited the department from 11th to 14th January, 2010.

141. Prof. Adam Koranyi, Lehman College, CUNY, visited the department from 28th December to 27th January, 2010.

142. Prof. Diganta Muikherjee, Usha Martin Academy, Kolkata visited the department from 18th to 20th January, 2010.

143. Prof. S. S. Sane, University of Mumbai, visited the department from 30th January, 2010 to 3rd February, 2010.

144. Dr. Subhroshekhar Ghosh, University of california, Berkeley, USA, visited the department from 14th to 19th January, 2010.

145. Dr. Tejaswi Navilarekalu, Vrije University, The Netherlands, visited the department on 15th January, 2010.

146. Prof. Rituparna Sen, University of California, Davis, USA, visited the department on 12th January, 2010.

147. Dr. Kaneenika Sinha, University of Alberta, Canada, visited the department from 27th to 29th January, 2010.

148. Prof. Antar Bandyopadhyay, ISI, Delhi, visited the department from 18th to 22nd February, 2010.

149. Dr. Arijit Chakravarti, Cornell University, USA, visited the department from 13th to 21st February, 2010.

150. Prof. Siva Athreya, ISI, Bangalore, visited the department on 22nd March, 2010.

151. Prof. B. Rajeev, ISI, Bangalore, visited the department on 22nd March, 2010 and on 28th January, 2011.

152. Prof. Alexander Belton, Lancaster University, UK, visited the department from 2nd to 12th April, 2010.

153. Prof. Maretin Lindsay, University of Lancester, Uk, visited the department from 3rd and 4th April, 2010.

154. Prof. Parameshwaran Sankaran, IMSc, Chennai, visited the department on 13th April, 2010.

155. Dr. Michael Dritschel, Newcastle University, UK, visited the department from 4th to 20th April and 28th July to 12th August, 2010.

156. Dr. James Pickering, Newcastle University, UK, visited the department from 2nd to 20th April, 2010.

157. Prof. S. Ramasubramanian, ISI, Bangalore, visited the department from 20th to 26th April, 2010.

158. Prof. Rama Rawat, IIT, Kanpur, visited the department from 12th to 26th May, 2010.

159. Prof. P. K. Rathnakumar, HRI, Allahabad, visited the department from 12th to 26th May, 2010.

160. Prof. Martin Deraux, Institute Fourier, France, visited the department from 14th to 29th May, 2010.

161. Dr. Priyanka Grover, ISI, New Delhi, visited the department from 25th April to 2nd June, 2010.

162. Dr. Subrata Shyam Roy, IISER, Kolkata, visited the department from 12th to 29th May, 2010.

163. Dr. Manish Kumar, Michigan State University, USA, visited the department from 12th to 14th May, 2010.

164. Dr. Ashish Kumar Upadhyay, Indian Institute of Technology, Patna, visited the department from 21st June to 03 July, 2010.

165. Prof. S. K. Khanduja, Punjab University, Chandigarh, visited the department on 5th July, 2010.

166. Dr. Michael Grabchak, Cornell University, USA, visited the department on 13th July, 2010.

167. Prof. Günter M. Ziegler, TU Berlin, Germany, visited the department on 18th August, 2010.

168. Prof. Angela Pasquale, Universite Paul Verlaine-Metx, France visited the department from 26th to 28th August and 3rd to 17th September, 2010.

169. Dr. Sashikumar Ganesan, Weierstrass Institute, Germany, visited the department from 17th to 19th August, 2010.

170. Dr. Anindyo Goswami, INRIA, France, visited the department from 29th 31st August, 2010.

171. Prof. Detlef Mueller, C. A. University, Kiel, Germany, visited the department from 22nd to 28th August, 2010.

172. Dr. M. Sunderi, IMSc. Chennai, visited the department from 6th to 8th September, 2010.

173. Prof. Huzihiro Araki, RIMS and Kyoto University, Japan, visited the department from 6th to 8th September, 2010.

174. Prof. Marius Tucsnak, Universite Nancy-1, France, visited the department on 24th November, 2010.

175. Prof. Uwe Storch, Ruhr Universität, Germany, visited the department on 30th November to 16th December, 2010.

176. Prof. Hartmut Wiebe, Ruhru Universität, Germany, visited the department from 30th November to 16th December, 2010.

177. Prof. Juergen Stukard, University of Leipzig, Germany, visited the deaprtment from 30th November to 20th December, 2010.

178. Dr. Debraj Chakrabarti, Indian Institute of Technology, Bombay, visited the department from 16th to 18th November, 2010.

179. Dr. Mathias Waack, University of Leipzig, Germany, visited the department from 12th to 17th Novermber, 2010.

180. Dr. Rajesh Kumar Srivastava, HRI, Allahabad, visited the department from 23rd November, to 5th December, 2010.

181. Dr. Kreuzer Martin, University of Passau, Germany, visited the department from 5th to 19th December, 2010.

182. Dr. Robbiano Lorenzo, University of Genova, Italy, visited the department from 5th to 18th December, 2010.

183. Prof. Jean-Pierre Gazeau, Universite Paris-7 Denis Diederot, France, visited the department from 10th 15th December, 2010 and 28th December, 2010 to 21st January, 2010.

184. Dr. Arnab Sen, Cambridege University, UK, visited the department from 17th to 22nd December, 2010.

185. Dr. Dilip Raghavan, University of Toronto, visited the department from 20th to 22nd January, 2011.

186. Prof. S. S. Sitharan, Naval Postgraduate School, Monterey, USA, visited the department on 11th February, 2011.

187. Prof. Michael Demuth, University of Clausthal, Germany, visited the department on 1st March, 2011.

7.6 Other activities

G. Bharali has been on the Doctoral Guidance Committee of Mr. N.Magesh, who is a research scholar at the Vellore Institute of Technology, from 2008 till the present.

T. Bhattacharyya served in the committee for interviewing candidates for admission to Ph.D. program at Indian Statistical Institute, Bangalore.

T. Bhattacharyya was a member of the Organizing Committee for the Meeting of the General Assembly of the IMU to be held at Bangalore during August 16 - 17, 2010.

B. Datta is the moderator for the Mathematics papers for B. Math. and M. Math. at ISI, Bangalore in the Final Semester Examinations 2005-06, 06-07, 07-08, 08-09, 10-11 and in the 1st Semester Examinations 2009-10.

B. Datta was the Coordinator of the NBHM Regional Library Users Advisory Committee for the JRD Tata Library, IISc, Bangalore from January 2005 to January 2011.

B. Datta was an IISc Coordinator at Kolkata Centre for the KVPY Interviews - 2007.

B. Datta was the external examiner for the viva-voce examination of one student for the award of the Ph. D. degree of ISI in February 2008.

B. Datta was a member of the Selection Committee, NIT, Trichy in October, 2008.

B. Datta was a Member in the Expert Committee for selection of BOYSCAST fellows (of DST) for the year 2008-2009.

B. Datta was an examiner for a Ph. D. thesis of one student of Harish-Chandra Research Institute, Allahabad in 2009.

B. Datta was a member of the KVPY-2009 (SP) interviews committee in February 2010.

B. Datta was a member of the Selection Committee, IIT, Patna in February, 2010.

S. Gadgil was the external thesis examiner for a thesis at the Department of Mathematics, University of Goa, 2006.

S. Gadgil was a member of the Board of Post Graduate Studies for the North-Eastern Hill University, Shillong.

M. Krishnapur was an examiner for a Ph. D. thesis of a student from ISI in 2011.

G. Misra is a member, National Board for Higher Mathematics since 2006.

G. Misra is a member, Executive Organizing Committee of the International Congress of Mathematicians 2010.

G. Misra is the Chairman of the Organizing Committee for the Meeting of the General Assembly of the IMU to be held at Bangalore during August 16 - 17, 2010.

G. Misra is a member, Council of the Indian Academy of Sciences during 2007–2009.

G. Misra was a member of the Selection committee at

Institute for Mathematical Sciences, Chennai in 2007.

IIT, Kanpur in 2007 & 2008.

IIT, Guwahati in 2008.

JNU in 2008.

University of Goa in 2008.

G. Misra delivered Invited talk at "Operator theory with Application to Geometry and Topology: In Honor of Ronald Douglas' Seventieth Birth-day", June 2-6, 2008, Qinhuangdao, China.

G. Misra delivered Plenary lecture at the Annual Meeting of Ramanujan Mathematical Society, IIT - Kanpur, May 19-21, 2008.

G. Misra delivered Invited talk at the First Indo-Brazilian Symposium on Mathematics, July 28 - Aug 1, 2008

E. K. Narayanan was a thesis examiner for a student from Calicut University, Kerala, 2010.

A. K. Nandakumaran : Thesis examiner for

Department of Mathematics, IIT Roorkee, 2006, 2010.

Department of Mathematics, Bharathiar, University, Coimbatore, 2006.

Department of Mathematics, Gandhigram Rural University, Dindigul, 2006, 2009.

Department of Mathematics, Bharathidasan University, Trichy 2006.

Department of Mathematics, University of Baroda, 2007, 2008.

Department of Mathematics, IITB Mumbai, 2008, 2010.

Department of Mathematics, IITM, Chennai, 2008, 2010.

Department of Mathematics, Calicut University 2010

A. K. Nandakumaran : Member, Board of Studies for

Department of Mathematics and Physics, Amrita Viswa Vidyapeetham, Coimbatore (2005).

Department of Studies and Research in Mathematics, Gulbarga University, Gulbarga (2004-07).

Department of Mathematics, Bharathiar University, Coimbatore (2006-).

Department of Mathematics, National College, Jayanagar (2008 -)

Department of Mathematics, Christ College, Bangalore (2008 -)

Department of Mathematics, Amrita Viswa Vidyapeetham, (2010-)

A. K. Nandakumaran was a member of the Selection committee, IIST, Trivandrum in 2009.

A. K. Nandakumaran was a member of the KVPY (SP) interviews committee in February 2010, 2011.

A. K. Nandakumaran is the Coordinator of the NBHM Regional Library Users Advisory Committee for the JRD Tata Library, IISc, Bangalore since February 2011.

D. P. Patil was a member of the interview committee for the KVPY Programme in 2006.

D. P. Patil assistance provided to the UPSC, New Delhi, in interviews to the position of Reader in Mathematics in 2007.

D. P. Patil provided assistance for conducting UGC review for Panjab University Chandigarh in 2009.

D. P. Patil was a examiner for a Ph. D. thesis of one student of Centre of Advanced Studies in Mathematics, Panjab University, Chandigarh.

C. R. Pranesachar's Solutions for the following AMM Problems published in American Mathematical Monthly: (i) 11160, 2007 May, p. 454 and (ii) 11261, 2008 June-July, pp. 569–571.

C. R. Pranesachar is one of the problem solver for the following American Mathematical Monthly Problems: (i) 11108, 2006 May, pp. 466–467, (ii) 11109, 2006 June-July, p. 573, (iii) 11106, 2006 Aug-Sept, pp. 656-657, (iv) 11166, 2006 Aug-Sept, p. 657, (v) 11154, 2007 Mar, pp. 265–266, (vi) 11164, 2007 April, pp. 364–365, (vii) 11183, 2007 June-July, pp. 551–552, (viii) 11195, 2007 Aug-Sept, pp. 648-649 (stronger inequality mentioned), (ix) 11199, 2007 Nov, pp. 837-838, (x) 11228, 2008 Jan, p. 77, (xi) 11263, 2008 April, pp. 371–372, (xii) 11245, 2008 May, pp. 467–468 and (xiii) 11259, 2008 Nov, p. 862.

C. R. Pranesachar's solutions published for the Problem: Crux Mathematicorum, 3125, pp. 175–77, 2007.

G. Rangarajan was a member of the Board of Studies, School of Mathematics and Computer/Information Sciences, University of Hyderabad (2007-2010).

G. Rangarajan was a member of the Board of Studies, School of Mathematics and Computer/Information Sciences, University of Pondicherry (2007-2010).

G. Rangarajan is a member, Advisory Committee of the UGC SAP of Department of Mathematics, Visva-Bharati University.

G. Rangarajan was a member, Faculty Selection Committee of the Indian Institute of Space Science and Technology, Trivandrum in 2007 and 2010.

G. Rangarajan was a member, Faculty Selection Committee of NIT, Trichy in 2008.

G. Rangarajan was a member, Faculty Selection Committee of the Indian Statistical Institute, Kolkata in 2008.

G. Rangarajan was a member, Faculty Selection Committee of the Indian Institute of Science Education and Research, Trivandrum in 2008, 2009 and 2010.

G. Rangarajan was a member, Faculty Selection Committee of the Indian Institute of Science Education and Research, Pune in 2008, 2009 and 2010.

G. Rangarajan was a member, Faculty Selection Committee of the Indian Institute of Science Education and Research, Bhopal in 2009.

G. Rangarajan was a member, Faculty Selection Committee of the Pondicherry University in 2010.

G. Rangarajan was a member, Faculty Promotion Committee of the National Brain Research Centre, Manesar in 2009.

G. Rangarajan was a member, Faculty Selection Committee of the IIIT, Kancheepuram in 2009.

G. Rangarajan is a member, Mathematical Sciences Research Committee, Council of Scientific & Industrial Research since 2009.

G. Rangarajan is a member, Indian National Committee for Mathematics of the International Mathematical Union.

G. Rangarajan was a member, Executive Organizing Committee of the International Congress of Mathematicians 2010.

G. Rangarajan was a member of the Organizing Committee for the Meeting of the General Assembly of the IMU to be held at Bangalore during August 16 - 17, 2010.

G. Rangarajan is a member, Inter-Academy Advisory Panel on INSPIRE.

G. Rangarajan is a member, National Programme Steering Committee on Accelerator Science and Technology.

G. Rangarajan is a member, National Board for Higher Mathematics, Department of Atomic Energy.

G. Rangarajan is a member, Project Approval Board for National Mission on Education through ICT, MHRD.

G. Rangarajan is a member, Programme Management Board for PURSE, Department of Science and Technology.

G. Rangarajan delivered Plenary lecture at the Annual Meeting of Ramanujan Mathematical Society, 2010.

S. Thangavelu delivered Plenary lecture ("Holomorphic Sobolev spaces for the Hermite expansions") at the International conference on Harmonic Analysis and Orthogonal Systems, Miraflores de la Sierra, Madrid, Nov. 21-25, 2007.

S. Thangavelu was member of the following Selection Committee : NIT Surathkal in 2007, ISI (Kolkata) in 2009, University of Hyderabad in 2010, IMSc (Chennai) in 2010.

S. Thangavelu was a member, Sectional Committee of the Indian Academy of Sciences for the period 2007 - 2009.

S. Thangavelu was a member, Sectional Committee of the Indian National Science Academy for the period 2008 - 2010.

S. Thangavelu was a member, Mathematical Sciences Research Committee, CSIR in 2008.

S. Thangavelu was a member, Expert Panel under Fast Track Scheme for young scientists, DST in 2009.

S. Thangavelu was a member, Board of Studies, Anna University, Chennai in 2009.

S. Thangavelu was a examiner for a Ph. D. thesis of one student of University of Delhi in 2010.

S. Thangavelu was a examiner for a Ph. D. thesis of one student of IIT, Kanpur in 2010.

B. J. Venkatachala's solutions published for the Olympiad Problem: Crux Mathematicorum, Solution to Problem 4, The Olympiad Corner, pp. 374–375, 2006.