ICM2010 SATELLITE CONFERENCE ON
VARIOUS ASPECTS OF DYNAMICAL SYSTEMS

Supported by

GUJCOST, DST and NBHM

Department of Mathematics
(DST – FIST SUPPORTED)
Faculty of Science
The Maharaja Sayajirao University of Baroda
Vadodara – 390002, India
(August 29 – September 01, 2010)

MESSAGE

It gives me immense pleasure to know that Department of Mathematics, Faculty of Science, The M.S. University of Baroda, Vadodara, is organizing an ICM 2010 Satellite Conference on Dynamical Systems during August 29 September 01, 2010.

I am confident that participation of more than 100 delegates from seventeen countries will make it a fruitful and memorable event.

I am sure that this conference will provide a strong platform to all the participants for having useful interactions among themselves to further strengthen their Mathematical knowledge especially it will provide tremendous opportunities to budding Mathematicians to grow more meaning fully.

I wish all success and convey my best wishes to the organizers for their sincere efforts and endeavor for hosting this significant event. I would also like to send my best wishes to all participants for extending their full support in making this event a grand success.

(Narendra Modi)

To,
The Dean
Department of Mathematics,
Faculty of Science,
The Maharaja Sayajirao
University of Baroda,
Vadodara

Narendra Modi
Chief Minister, Gujarat State

THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA

Mrunalini Devi Puar M.S., Ph.D.
CHANCELLOR

August 27, 2010

MESSAGE

Greetings to everyone attending the ICM Satellite Conference on Dynamical Systems.

I am delighted that the Department of Mathematics, Faculty of Science, of The Maharaja Sayajirao University of Baroda, Vadodara, is organizing this prestigious Satellite Conference. It is mater of great pride for all of us that India hosted the International congress of Mathematicians for the first time.

I congratulate the Department of Mathematics and Prof. Tarun Das and his team for their appreciable efforts to organize this focused International conference on Dynamical Systems as a Satellite Conference of International Congress of Mathematicians 2010 in which more than 100 delegates form 17 countries are expected to participate and which is no doubt going to be a memorable event.

I am sure that this conference will provide a strong platform to all the participants for having useful interactions among themselves to further strengthen their Mathematical knowledge and will provide tremendous opportunities to many a budding Mathematician to grow more meaning fully and understand the intricacies of Mathematics.

I wish this Satellite Conference all success and hope that it will be a scientifically rewarding one and give all of you opportunities to strong then your mutual ties and friendship.

Dr. (Smt) Mrunalini Devi Puar
CHANCELLOR

Indumati Mahal, Jawaharlal Nehru Marg, Vaododara - 390 001, Gujarat. INDIA
Tel. : +91–265–433082 (O) ; +91–265–431045 (R) Fax : +91-265-431516 E-mail : mrunalinipuar@hotmail.com

Prof. Ramesh K. Goyal
M.Sc. (Medical), Ph.D. (Pharmacy)
F.I.C., FAMS, FICN, FIPS, FIACS, FNASc.
Vice-Chancellor

सत्यं शिवं सुन्दरम्

The Maharaja Sayajirao University of Baroda

Office : University Road, Fatehgunj, Vadodara 390002 Gujarat, India

MESSAGE

It is indeed a matter of great pride and pleasure that Department of Mathematics of our University is organizing the focused International Conference on Dynamical Systems as a Satellite Conference of International Congress of Mathematicians 2010. As such it is heartening to note that this conference is being held in India for the first time and our University has become part of it. I congratulate them and also Dr. Tarun Das and his team for their appreciable efforts.

Department of Mathematics at this Faculty is one of the oldest departments and has a long and illustrious history to its credit. It has been catering to the maximum number of students in the Faculty of Science for a long time. This department has grown very well and it is visible in the national scenario also.

Under the leadership of Dr. Tarun Das, department conducted a National seminar during early 2009 and was successful in getting several programmes like FIST award from DST during 2009-2010, MTTS for students and Advanced Training Schools for research scholars and young mathematicians supported by NBHM are being planned at a regular intervals and in fact this is the first ever department in the State of Gujarat to organize these events.

I am sure this international meeting will provide excellent exposure to the students and faculty since delegates from 17 countries are participating in this event. I am sure there will be serious academic interactions during the conference and will provide International platform to the budding mathematicians. It is commendable to note that the proceedings of this conference will be published by American Institute of Mathematical Sciences.

I am sure that all the students and staff from Department of Mathematics shall take best advantage from the research leaders visiting our campus. Their presence will definitely enlighten many of them. On behalf of The Maharaja Sayajirao University of Baroda, I welcome delegates to this historical event at Baroda.

Although we have tried to make your stay comfortable but bear with us for any inconvenience, you might face during your stay. I wish this conference a great success and wish all delegates a fruitful and enjoyable time.

25/8/10

Prof Ramesh K. Goyal
Vice Chancellor

Phone : (+91-265) 2795600 Fax: : (+91-265) 2793693 e-mail: vc@msubaroda.ac.in goyalrk@msubaroda.ac.in
Resi. : " Dhanvantari", Prof. C.C. Mehta Road, Vadodara 390002 Gujarat, India Ph. (+91- 265) 2795499

Faculty of Science

The Maharaja Sayajirao University of Baroda

Lokmanya Tilak Road, Vadodara - 390 002, (Guj.) India

Phone : (+91-0265) 2795329

Ref. No. : FS /

Date :

MESSAGE

It is a great achievement on the part of Department of Mathematics to organize this focused International conference on Dynamical Systems as a Satellite Conference of International Congress of Mathematicians 2010. I congratulate them and also congratulate Dr. Tarun Das and his team for their appreciable efforts.

Department of Mathematics at this Faculty is one of the oldest departments and has served the society at large very efficiently. It caters to the maximum number of students in the Science Faculty campus. This department is doing very well. Many of its students are placed in several research Institutes in India and abroad. Several students are also serving in well established IT companies. The department, which is primarily focused on Pure Mathematics, could also get sizable support under DST FIST program. This international meeting should give its staff and students lot of exposure and encouragement.

I believe that all the students and staff of the department will have fruitful time during conference days and shall benefit from the expertise of various visiting scholars. Thank you all dear delegates for accepting our invitation and coming all the way to this historical University in the western part of our country.

I, on behalf of the Faculty of Science, welcome all delegates. We are in the process of renovation and make our campus a model in the entire University. Colleagues across various spectrums have already acknowledged it and we feel very happy for the same.

Though, we have tried our best, kindly bear with us for any inconveniency you might face during your stay. I wish this conference a great success and wish all delegates a fruitful and enjoyable time.

August 27, 2010

Professor Nikhil Desai
Dean, Faculty of Science
The Maharaja Sayajirao University of Baroda
Vadodara-390002

Advisory Committee

Ramesh K. Goyal
Vice–Chancellor, The Maharaja Sayajirao University of Baroda, Vadodara, India
Jacob Palis
Instituto Nacional de Matemática Pura e Aplicada (IMPA), Brazil
President, Brazilian Academy of Sciences
S. G. Dani
Chairman, National Board for Higher Mathematics,
Tata Institute of Fundamental Research, Mumbai, India

Organizing Committee

V. Kannan
Pro-Vice-Chancellor, Hyderabad University, Hyderabad, India
Keonhee Lee
Chungnam National University, Korea
Kazuhiro Sakai
Utsunomiya University, Japan
Nimish Shah
Tata Institute of Fundamental Research, Mumbai, India
C. S. Aravinda
Tata Institute of Fundamental Research, Bangalore, India
Tarun Das
The Maharaja Sayajirao University of Baroda, Vadodara, India

Local Advisory Committee

Nikhil Desai
Dean, Faculty of Science, The Maharaja Sayajirao University of Baroda
M. M. Beedkar
Registrar, The Maharaja Sayajirao University of Baroda

Local Organizing Committee

Ruchi Das
V. O. Thomas
H. R. Kataria
Ekta Shah
Sejal Shah

Members of Subcommittees

B. I. Dave
R. G. Vyas
B. M. Pamnani
S. G. Gupta
B. L. Ghodadra
Kamlesh Trivedi
Dharitri Rathod
Dhaval Thakkar
Piyush Patel
Rahul Singh

Office Assistance

Gopal Tandale

Supporting Staff

Shri S. Y. Bandagi
Shri M. B. Mali
Shri R. G. Jadhav

Accounts Management

Kaushik Gavade

About Vadodara

- As per the traditional belief based on archeological findings, today's **Vadodara** on the banks of the Vishwamitri river is the old **Vada Padra** – a village / small town developed near Banyan tree with the blessings from Maharishi Vishwamitri.
  Vadodara ← Vado-udara ← Vada-udar ← Vada-Padra
  (Vada : Banyan Tree ; Padra : a village / small town)
  (Vadodara : Baroda (English) ← Badode (Marathi) ← Badodah (Persian)**)**
- It was about fourteen to fifteen hundred years ago that the old Vadapadra town was developed around today's Kothi area as a suburb of the more than two thousand year old Ankottak town (today's Akota area of Vadodara)
  (Ankottak : Ankula Plant : Alanguim Lamarckii plant)
- Ruled by the king Karkasuvarnavarsha of Lat Region (today's Bharuch area), the people of the Ankottak – Vadopadra region appears to have trade relations as far as upto European Roman Empire.
- From around 1304, Gujarat (and Vadodara too) came under Delhi rule – Gujarat was captured by Khalji Sultans. During Fourteenth Century Vadodara had connections with Central Asia, Iran and even China.
- It was in 1511 that Khalilkhan Muzaffar II (son of Mahemud Begda) was crowned as a ruler of the region with today's Champaner as the capital. It was he who built the today's Mandvi Char Darwaja area. In fact, he named it as Killa-e-Daulatabad, but it didn't work.
- After Aurangazeb died, Gaekwads established their rule in around 1732 – 34 and from 1766 to 1949 Vadodara was the Capital of Gaekwad Rule.
- From 1772 onwards Britishers tried to bring Vadodara under their rule but Gaekwads established some understanding with Britishers and continued ruling Vadodara successfully. Sayairao – II, Malharrao and Sayajirao – III were by and large successful in not allowing interference from Britishers who had residency at Kothi in the beginning and then at today's Fatehganj area (specifically the university main office, halls of residence and university quarters area) from where Britishers administered many parts of Gujarat.
- Tradition of English Education system was introduced in Vadodara from the time of Malharrao and Principal Tate contributed a lot. Opposing the then government policies, at about 1878, he successfully made efforts to make Vadodara the center of Higher Education.
- On 27th May, 1875 Maharani Chimnabai Gaekwad brought young Sayajirao to Baroda State. The visionary Rajrishi Srimant Maharaja Sayajirao Gaekwad – III (1875 – 1939) developed many traditions of higher learning such as Museums, Library system with each village having a library, Educational buildings, Primary, Secondary and Higher Education systems, etc. He supported development of regional languages and Sanskrit Pathashalas; and built public utilities, like Roads, Lakes and Gardens, a zoo, Modern hospitals, Vyayam shalas, Administrative buildings, beautiful Towers, Rajmahels etc.

(Compiled on the basis of an article by Professor R. N. Mehta)

About The Maharaja Sayajirao University of Baroda

- The Maharaja Sayajirao University of Baroda is the oldest university in Gujarat established on **30th April, 1949** with Dr (Smt.) Hansa Mehta as the first Vice Chancellor – at the time of the merger of the Baroda State with the State of Bombay. Prior to that it was the **Baroda College** affiliated to the Bombay University.
- The **Baroda College**, one of the oldest centres of learning in the Western India, was established in **1881** by the Great Visionary His late highness Shrimant Maharaja Sayajirao Gaekwad – III (1863 – 1939) of the erstwhile Baroda State – with its **Arts** and **Science** Units.
- The "**Bharatiya Sangita Vidyalaya**", perhaps the unique of its kind in the whole of India then, was founded by the Maharaja in 1886. It became full fledged constituent college of the University in 1950 as a part of the Faculty of Fine Arts and since 1984 it is accorded the status of the full fledged faculty known as the Faculty of Performing Arts.
- The "**Kalabhavan Technical Institute**" for the cause of Technical Education was established in 1890 under the able Stewardship of Principal T. K. Gajjar with the novel objective of producing skilled artisans and apprentices in many disciplines by imparting training in local language and taking assistance from German experts and foreign trained teachers. Principal C. H. Vora then consolidated the Institute into a Polytechnic till 1949. The Kalabhavan was converted into the Faculty of Technology and Engineering in 1949 after the University was established.
- The idea of the world renowned "**Oriental Research Institute**" was conceived by the Maharaja in 1893 for collecting and preserving Rare, Important and Illustrated books, especially the Indological books as also for encouraging publication and researches in oriental studies and was finally established on 1st September 1927.
- It was the consistent policy of the Government of Baroda State to subject its Educational System to periodical inquiries of a searching nature by educational experts of international repute. As a consequence, the Principal Dr. Jackson advocated in 1908 the idea of establishing a Science Institute at Baroda on an improved and independent basis. This subsequently lead to the idea of a University in Baroda as early as in 1927 after actions taken on the reports of several successive committees. Finally, the recommendations of the University Committee of 1947 headed by Shri K. M. Munshi were accepted by the Baroda State Legislature on 26th April, 1949 and the University was established.
- It is the only English medium university in the Gujarat State. Also, it is a **Residential University** in Baroda having its jurisdiction to the area within a radius of 10 miles of its office.
- It has about **32000 students** on its rolls, **13 faculties** in different disciplines and every year about **130 gold medals** are awarded for outstanding performances in various fields in these faculties. The faculties are : **Arts** (since 1949, it is sanctified by the name of the seer and philosopher Sri Aurobindo Ghosh who had been appointed to teach English and also as the Vice Principal of the Baroda College); **Commerce** (formerly, "Maharaja Pratapsinh College of Commerce and Economics" established in 1942) – taking care of almost half of the university students; **Education and Psychology** (formerly, "Secondary Teachers' Training College" established in 1935); **Fine Arts** (since around 1956); **Home Science** (since 1950); **Journalism and Communication** (since 1992); **Law** (since 1961); **Medicine** (since 1949); **Management Studies** (since around 1980); Performing Arts (since 1984); **Social work** (since 1951); **Science** (since 1949), **Technology and Engineering** (since 1949).

- The University also supports following :
  - **Smt. Hansa Mehta Library** (more than 8,00,000 titles; more than 1200 international journals and many journals and research material are available in full text access online; three big reading rooms and one research carrel for research students; open 8.00 a.m. to 10.00 p.m.; about 25,000 registered members; on an average 5000 visitors per day).
  - **Computer Centre** (Computer hub of the University; about 35 nodes with 2 Compaq Proliant Servers on Windows NT Platform for surfing; lease line of 196 kbps. Open about 15 hours a day).
  - **A.I.C.S. Training Center.**
  - **Baroda Sanskrit Mahavidyalaya.**
  - **Center for Continuing and Adult Education.**
  - **General Education Center and Auditorium.**
  - **Genome Research Center.**
  - **Halls of Residence** (12 Boys Hostels and 4 Girls Hostels).
  - **Health Center.**
  - **M. K. Amin Arts & Science College & College of Commerce, Padra.**
  - **Oriental Institute.**
  - **Polytechnic.**
  - **Population Research Center.**
  - **The University Press and stationary Unit.**
  - **Recreational Facilities** (Swimming pool, Gymnasium, Basket Ball and Tennis courts, Cricket and Athletics Pavilion).
  - **University Information and Employment Bureau.**

As are the crests on the heads of peacocks,
As are the gems on the hoods of cobras,
So is mathematics, at the top of the sciences.

....The Yajurveda, circa 600 B.C.

About the Department

- DST – FIST Supported Department of Mathematics at the Faculty of Science of The Maharaja Sayajirao University of Baroda is actively engaged in researches in Analysis, Classical Harmonic Analysis, Special Functions, Topology, Dynamical Systems, Classical General Relativity and Fluid Mechanics.
- As early as in nineteen thirties the B. Sc. and M. Sc. programmes in Mathematics were being offered in the Baroda College under the Leadership of Professor Pendse.
- After the establishment of the University in 1949, Professor S. D. Manerikar, a Senior Cambridge Wrengler, was appointed as the first Head of the Department of Mathematics. The Department catered to the teaching needs of Arts Faculty, Commerce Faculty, Home Science Faculty, Faculty of Technology & Engineering and the polytechnique in addition to the Science Faculty.
- Conscious efforts were made to develop Mathematics from the very beginning. In early fifties Professor P. R. Masani from Bombay, Professor S. M. Shah from Aligarh and Professor N. M. Shah were on the Board of Studies in Mathematics and under their direction, and more so that of Professor Masani, a course on “Modern Algebra” was introduced at the graduate level as early as 1954 and several teachers were deputed for advanced study / research to different places.
- With an aim to initiate researches in Mathematics, the Vice Chancellor Dr. (Smt.) Hansa Mehta, the Dean, Professor N. M. Bhatt and Professor S. M. Shah took initiative and invited Professor U. N. Singh, D.Sc. (Paris), to join the Department in January 1958.
- Researches in analysis began with the advent of Prof. U.N. Singh in January 1958 and since then many workers in the department have produced good amount of quality research work in the study of Fourier Series in general and lacunary Fourier Series in particular. While the work on general trigonometric Fourier Series, in connection with the convergence and summability problems, is noteworthy; in the area of lacunary Fourier Series, the department has put in significant research work regarding the problems of their absolute convergence, study of properties of Fourier coefficients and convergence and summability problems not only in the setting of circle group but currently in the setting of totally disconnected compact abelian groups as well.
- Since 1973 the department is actively engaged in the researches in the field of Special Functions also. The research work done and being done cover varied topics such as Hypergeometric functions and associated polynomial systems, multiple series and associated function viz, Lauricella functions, Appel’s functions H-functions, G-functions, of polynomial sets and their q-analogues.
- It is more than 20 years that the department is actively working towards researches in Topology. The work going on in topology can broadly be classified into two areas: Dynamical systems and Compactifications and Projective objects. Interesting problems in the area of dynamical systems includes studying the impact of robustly and persistently dynamical properties, like expansivity and shadowing, on compact invariant sets such as homoclinic classes, chain components and chain recurrent sets.

Multidimensional dynamics including Chaos is another area of interest. Work is also being done in the areas of G-spaces, Compactifications and Projective Objects.

- Another field of interest in the department, where research work is going on is the Classical General Theory of Relativity (GTR). GTR is the geometric study of gravitation. One of the important problems in GTR is to find exact solutions of Einstein's field equations. Work is going on in the field of construction of mathematical models of compact stars with associated space times having definite 3–space geometry.
- Some initiative attempt has been also made in Fluid Dynamics, particularly for the solutions of the problems arising in Fluid Flow through Porous Media. Efforts for the analytical solutions of the important phenomenon like Fingering, Imbibition, Ground water seepage are also in progress.
- Many department members have published their research work in several reputed National/International Journals. In fact, the quality researches done by the department members have earned the department prestigious research prizes, several visits abroad for carrying out post doctoral research projects and a prestigious UGC career award in Mathematics.
- Our department was first in the Gujarat State to introduce way back in 1975, job oriented courses like Operations Research, Linear Programming, Computer Programming and Numerical Analysis at the undergraduate level and subsequently at the post graduate level under the headship of Professor V. M. Shah.
- Our department is the first in the Gujarat State to introduce in 2006, an optional paper of "Application of Mathematics in Finance and Insurance" at the undergraduate level.
- There is a Departmental Library supported by National Board for Higher Mathematics (DST, DAE, GOI) consisting of advanced level text books, research monographs, and journals.
- Department has a Computer Laboratory used for practicals both at undergraduate and postgraduate level.
- Our student's achievement record is healthy. Several students have cleared UGC – CSIR NET Examination. Our students have also been selected for pursuing researches in recent past at various Institutes and organizations such as Indian Institute of Mathematical Sciences at Chennai, Indian Statistical Institute at Calcutta, Tata Institute of Fundamental Research at Mumbai. Harish Chandra Research Institute at Allahabad, DRDO and various IIT's. Several students have also won prizes at various mathematical completions. Few of our students have also been awarded NBHM research fellowships.

Programme Schedule

Sunday, August 29, 2010

Time	Details	Venue
09:00 to 10:30	**Registration and Inaugural Function**	Prof. C. C. Mehta Auditorium
10:30 to 11:00	**High Tea**	Lounge at Prof. C. C. Mehta Auditorium
Plenary Sessions		
Chairperson: Kazuhiro Sakai		
11:00 to 12:00	**Plenary Lecture-01** Welington De Melo The dynamics of circle maps	Prof. C. C. Mehta Auditorium
12:00 to 13:00	**Plenary Lecture-02** Sergei Yu Pilyugin Shadowing and structural stability in dynamical systems	
Lunch : 13:00 to 14:30		
Invited Talks		
Parallel Session – I		
Chairperson: Lubomir Snoha		
14:30 to 15:15	**Invited Talk-01** Zin Arai Hyperbolicity, monodromy and pruning fronts	Prof. C. C. Mehta Auditorium
15:15 to 16:00	**Invited Talk-02** M. G. Nadkarni Coordinatewise Decomposition of functions and ergodic theory	
Tea / Coffee Break 16:00 to 16:15		
Chairperson: Riddhi Shah		
16:15 to 16:45	**Invited Talk-03** Edson Vargas Dirac physical measures and transitive dynamics	Prof. C. C. Mehta Auditorium
16:45 to 17:15	**Invited Talk-04** Ji Gao Non Expansive Mapping, Normal Structure and Pythagorean Approach in Banach Spaces	
17:15 to 17:45	**Invited Talk-05** Lanyu Wang Some Results On One dimensional Nonuniformly Expanding maps	
Parallel Session – II		
Chairperson: Yoon Hoe Gu		
14:30 to 15:15	**Invited Talk-06** Hiroyuki Inou On a generalization of the self-similar property of the Mandelbrot set	Prof. S. S. Merh Seminar Hall
15:15 to 16:00	**Invited Talk-07** M. Guru Prem Prasad Iteration of Meromorphic Functions $f(z) = \left(z/\sinh(z)\right)^{2m-1}$	
Tea/Coffee Break 16:00 to 16:15		
Chairperson: Hiroyuki Inou		
16:15 to 16:45	**Invited Talk-08** A. Yu. Zhirov Algorithms for of the Topological Conjugacy problem solution for generalized pseudo-anosov homeomorphisms	Prof. S. S. Merh Seminar Hall
16:45 to 17:15	**Invited Talk-09** Marco Abate Dynamics of holomorphic maps tangent to the identity	
17:15 to 17:45	**Invited Talk-10** Mohammad Sajid On Iteration of a Function in the Cosine Family: $\lambda \cos z / z$	

Parallel Session – III		
Chairperson: Kil Woung Jun		
16:15 to 17:00	**Invited Talk-11** Namjip Koo Stability of Fractional Dynamic Systems	Mathematics Department
17:00 to 17:45	**Invited Talk-12** K. K. Azad Certain Methods identifying CIP and CIPH	
18:00 to 18:30	A visit to **Archeology Department Museum, Faculty of Arts**	
18:30 to 19:30	A visit to **Laxmi Vilas Palace**	
Dinner 20:00 to 21:30		

Monday, August 30, 2010

Time	Details	Venue
Plenary Sessions		
Chairperson: Keonhee Lee		
09:00 to 10:00	**Plenary Lecture-03** Christian Bonatti Towards a global view of dynamical systems, from the point of view of the C^1-topology	Prof. C. C. Mehta Auditorium
10:00 to 11:00	**Plenary Lecture-04** Flavio Abdenur Genericity and robust transitivity	
Tea / Coffee Break 11:00 to 11:30		
Chairperson: Welington De Melo		
11:30 to 12:30	**Plenary Lecture-05** Hillel Furstenberg Stationary Actions and a Szemeredi Theorem for SL(2;R)	Prof. C. C. Mehta Auditorium
Lunch : 12:30 to 14:00		
Invited Talks		
Parallel Session – I		
Chairperson: Sergei Yu Pilyugin		
14:00 to 14:45	**Invited Talk-13** Piotr Oprocha On recurrence in pairs	Mathematics Department
14:45 to 15:30	**Invited Talk-14** David Richeson Generating symbolic dynamics for non-hyperbolic discrete dynamical systems	
Tea / Coffee Break 15:30 to 15:45		
Chairperson: Christian Bonatti		
15:45 to 16:15	**Invited Talk-15** Tarun Das On C^1-persistently continuum-wise expansivity homoclinic classes and chain recurrent sets	Mathematics Department
16:15 to 16:45	**Invited Talk-16** Daniel Smania Linear response for deformations of generic nonuniformly hyperbolic unimodal maps	
Tea / Coffee Break 16:45 to 17:00		
Chairperson: Flavio Abdenur		
17:00 to 17:30	**Invited Talk-17** Ruchi Das Dynamical properties of maps on $G-$spaces	Mathematics Department
17:30 to 18:00	**Invited Talk-18** Manseob Lee Stably weak inverse shadowing and dominated splitting	
Parallel Session – II		
Invited talks		
Chairperson: A. S. Vasudeva Murthy		
14:00 to 14:45	**Invited Talk-19** S. D. Adhikari Fractional parts of powers, Pisot-Vijayaraghavan numbers & dynamics	Prof. S. S. Merh Seminar Hall
14:45 to 15:30	**Invited Talk-20** C. S. Aravinda A Khinchine type theorem for negatively curved manifolds	
Tea / Coffee Break 15:30 to 15:45		

Chairperson: M. Guru Prem Prasad		
15:45 to 16:15	**Invited Talk-21** A. P. Singh Some aspects of complex dynamical systems	Prof. S. S. Merh Seminar Hall
Short Presentations		
16:15 to 16:30	**Short Presentation-01** Rajeshwari Dubey Non-MSF wavelets in $L^2\left(R^2\right)$	Prof. S. S. Merh Seminar Hall
16:30 to 16:45	**Short Presentation-02** Niraj Shukla On wavelets and wavelet sets in $L_E^2\left(R^n\right)$	
Tea / Coffee Break 16:45 to 17:00		
Chairperson: A. P. Singh		
17:00 to 17:30	**Invited Talk-22** Valery A. Gaiko A Quartic Predator – Pray Model	Prof. S. S. Merh Seminar Hall
17:30 to 17:45	**Short Presentation-03** Sharan Gopal The set of periods of periodic points of a linear operator	
17:45 to 18:00	**Short presentation-04** P. Chiranjeevi How many kinds of monotonic contractions are there on the real line?	
Dinner 20:00 to 21:30		

Tuesday, August 31, 2010

Time	Details	Venue
Plenary Sessions		
Chairperson: V. Kannan		
09:00 to 10:00	**Plenary Lecture-06** Kazuhiro Sakai C^1- stably weakly shadowing homoclinic classes	Prof. C. C. Mehta Auditorium
10:00 to 11:00	**Plenary Lecture-07** Sergiy Kolyada On the Birkhoff center	
Tea / Coffee Break 11:00 to 11:30		
Invited Talks		
Parallel Session – I		
Chairperson: Jon Aaronson		
11:30 to 12:15	**Invited Talk-23** C. R. E. Raja Existence of ergodic automorphisms for ergodic actions	Prof. C. C. Mehta Auditorium
12:15 to 13:00	**Invited Talk-24** Riddhi Shah Dynamics of (semi)groups actions	
Invited Talks		
Parallel Session – II		
Chairperson: C. S. Aravinda		
11:30 to 12:15	**Invited Talk-25** A. S. Vasudeva Murthy On the slow manifold for the Lorenz-Krishnamurthy system	Mathematics Department
12:15 to 13:00	**Invited Talk-26** A. Nandakumaran Optimal control and homogenization	
Invited Talks		
Parallel Session – III		
Chairperson: Piotr Oprocha		
11:30 to 12:15	**Invited Talk-27** Hark Mahn Kim Stability of Fractional Dynamic Systems	Prof. S. S. Merh Seminar Hall
12:15 to 12:45	**Invited Talk-28** Le Huy Tien Perron Theorem for Dynamic Equations on Time Scales	
Short Presentations		
12:45 to 13:00	**Short Presentation-05** Ekta Shah On Dynamical Properties induced on Functional Envelopes	Prof. S. S. Merh Seminar Hall
13:00 to 13:15	**Short Presentation-06** Sejal Shah On Multidimensional Chaos	
Lunch : 13:15 to 15:00		
Plenary Sessions		
Chairperson: Petr Kurka		
15:00 to 16:00	**Plenary Lecture-08** Jon Aaronson On “complexity"of probability preserving transformations	Prof. C. C. Mehta Auditorium
16:00 to 17:00	**Plenary Lecture-09** Keonhee Lee Robustly Shadowable Chain Components of C^1- Vector Fields	
Tea / Coffee Break 17:00 to 17:15		
Open Problems Discussion Session		
17:15 to 18:15	Jon Aaronson, Christian Bonatti, V. Kannan, Sergiy Kolyada	Prof. C. C. Mehta Auditorium
Tea / Coffee Break 18:15 to 18:30		
18:30 to 20:00	Cultural Program (By the members of Faculty of Performing Arts, The M. S. University of Baroda)	Prof. C. C. Mehta Auditorium
Dinner 20:00 to 22:30		

Wednesday, September 01, 2010

Time	Details	Venue
Plenary Sessions		
Chairperson: K. K. Azad		
08.30 to 09.30	**Plenary Lecture-10** V. Kannan Periodic points and periods for operators on Hilbert space	Prof. C. C. Mehta Auditorium
09.30 to 10.30	**Plenary Lecture-11** Petr Kurka Moebius number systems	
Tea / Coffee Break 10:30 to 11:00		
Chairperson: Sergiy Kolyada		
11:00 to 12:00	**Plenary Lecture-12** Lubomir Snoha Minimal sets of fibre-preserving maps in graph bundles	Prof. C. C. Mehta Auditorium
12:00 to 13:00	**Plenary Lecture-13** Mahesh Nerurkar On Lyapunov Exponents of smooth SL(2;R) valued cocycles over minimal rotation ows	
Lunch : 13:00 to 14:30		
Invited Talks		
Parallel Session – I		
Chairperson: Daniel Smania		
14:30 to 15:15	**Invited Talk-29** Masayuki Asaoka Rigidity and Flexibility of group actions	Mathematics Department
15:15 to 16:00	**Invited Talk-30** Kari Eloranta Dynamical Vertex Models	
Parallel Session – II		
Chairperson: David Richeson		
14:30 to 15:15	**Invited Talk-31** Jim Wiseman Symbolic dynamics from partitions with overlapping elements	Prof. S. S. Merh Seminar Hall
15:15 to 15:45	**Invited Talk-32** TKS Moothathu Non-classical Li-Yorke pairs	
15:45 to 16:00	**Short Presentation-07** Ali Akbar Kamal Transitive Toral Automorphisms	
Closing Function		
16:00 to 16:30	**Valedictory Address by Hillel Furstenberg**	Prof. S. S. Merh Seminar Hall
Tea / Coffee 16:30		

List of Participants at the ICM2010 Satellite Conference "Various Aspects of Dynamical Systems"

Sr. No	Name	Affiliation	e-mail
Foreign Participants			
1	Jonathan Aaronson	Tel Aviv University, Israel	aaro@post.tau.ac.il
2	Marco Abate	Università di Pisa, Italy	abate@dm.unipi.it
3	Flavio Abdenur	PUC-Rio, Brazil	flavio@mat.puc-rio.br
4	Jiweon Ahn	Chungnam National University, Korea	Pm_zone@naver.com
5	Zin Arai	Hokkaido University, Japan	arai@cris.hokudai.ac.jp
6	Masayuki Asaoka	Kyoto University, Japan	asaoka@math.kyoto-u.ac.jp
7	Christian Bonatti	Universite de Bourgogne, France	bonatti@u-bourgogne.fr
8	Shivanand Dwivedi	Milan University, Milan, Italy	shivanand.dwivedi@gmail.com
9	Kari Eloranta	Helsinki, University of Technology, Finland	kve@math.tkk.fi
10	Xin-Chu Fu	Shanghai University, China	enxcfu@gmail.com
11	Hillel Furstenberg	The Hebrew University of Jerusalem, Israel	harry@math.huji.ac.il
12	Valery Gaiko	National Academy of Sciences of Belarus, Belarus	valery.gaiko@yahoo.com
13	Shao Bo Gan	Peking University, China	gansb@math.pku.edu.cn
14	Ji Gao	Community College of Philadelphia, USA	jgao@ccp.edu
15	Yoon Hoe Gu	Hanseo University, Korea	yhgoo@hanseo.ac.kr
16	Nicolai Haydn	University of Southern California, USA	nhaydn@usc.edu
17	Hiroyuki Inou	Kyoto University, Japan	inou@math.kyoto-u.ac.jp
18	Kil Woung Jun	Chungnam National University, Korea	kwjun@cnu.ac.kr
19	Bowon Kang	Chungnam National University, Korea	wldusbb@daum.net
20	Hark Mahn Kim	Chungnam National University, Korea	hmkim@cnu.ac.kr
21	Min Young Kim	Chungnam National University, Korea	mymy-v@daum.net
22	Masashi Kisaka	Kyoto University, Japan	kisaka@math.h.kyoto-u.ac.jp
23	Sergiy Kolyada	National Academy of Sciences of Ukraine, Ukraine	skolyada@googlemail.com
24	Namjip Koo	Chungnam National University, Korea	njkoo@cnu.ac.kr
25	Petr Kurka	Charles University in Prague, Czech Republic	Petr_Kurka@seznam.cz
26	Juri Lee	Chungnam National University, Korea	annans@hanmail.net
27	Keonhee Lee	Chungnam National University, Korea	Khlee2@u.washington.edu
28	Manseob Lee	Mokwon University, Korea	lmsds@mokwon.ac.kr
29	Welington De Melo	Instituto Nacional De Matematica Pura E Aplicada, Brazil	demelo@impa.br
30	Mahesh Nerurkar	Rutgers University, USA	nmahesh@camden.rutgers.edu
31	Jumi Oh	Chungnam National University, Korea	ohjumi@hanmail.net
32	Krerley Oliveira	UFAL, Brazil	krerley@gmail.com
33	Piotr Oprocha	AGH University of Science and Technology, Poland	oprocha@agh.edu.pl
34	Sergei Pilyugin	St. Petersburgh University, Russia	sp@spil.usr.pu.ru
35	David Richeson	Dickinson College, USA	richesod@dickinson.edu

Sr. No	Name	Affiliation	e-mail
Foreign Participants			
36	Sieye Ryu	Seoul National University, Korea	mandu0@snu.ac.kr
37	Mohammad Sajid	Qassim University, Saudi Arabia	msajid@qec.edu.sa msajidiit@yahoo.com
38	Kazuhiro Sakai	Utsunomiya University, Japan	kazsakai@cc.utsunomiya-u.ac.jp
39	Daniel Smania	Instituto de Ciencias Matematicas e de Computacao, Brazil	daniel.smania@gmail.com
40	Mitsuhiro Shishikura	Kyoto University, Japan	mitsu@math.kyoto-u.ac.jp
41	Lubomir Snoha	Matej Bel University, Slovakia	snoha@fpv.umb.sk
42	Eunyoung Son	Chungnam National University, Korea	Sey8405@daum.net
43	Toshi Sugiyama	Kyoto University, Japan	sugiyama@math.kyoto-u.ac.jp
44	Le Huy Tien	Chungnam National University, Korea	lehuytien78@yahoo.com
45	Edson Vargas	São Paulo University, Brazil	vargas@ime.usp.br
46	Lanyu Wang	Chinese Academy of Sciences, China	lanyu@amss.ac.cn
47	Lan Wen	Peking University, China	lwen@math.pku.edu.cn
48	Jim Wiseman	Agnes Scott College, USA	jwisema1@swarthmore.edu
49	Alexey Zhirov	Zhukovsky - Gagarin Air Force Academy, Russia	alexei_zhirov@mail.ru
Indian Participants			
50	S. D. Adhikari	HRI, Allahabad	adhikari@mri.ernet.in
51	C. S. Aravinda	TIFR, Bangalore	aravinda@math.tifrbng.res.in
52	K. K. Azad	University of Allahabad, Allahabad	kkazad@pphmj.com
53	P. H. Bhathawala	S. S. Aggrawal Institute of Management and Technology, Navsari	
54	Ravi Borana	Bhavan's College, Ahmedabad	
55	V V M Sarma Chandramouli	IIT, Rajasthan	chsarma@iitk.ac.in
56	Perikala Chiranjeevi	University of Hyderabad, Hyderabad	chiru.hcu@gmail.com
57	Meera H. Chudasama	Dr. Jivraj Mehta Institute of Technology Mogar, Anand	meera.chudasama@yahoo.co.in
58	Ruchi T. Das	The Maharaja Sayajirao University of Baroda, Vadodara	ruchid99@gmail.com
59	Tarun Das	The Maharaja Sayajirao University of Baroda, Vadodara	tarukd@gmail.com
60	B. I. Dave	The Maharaja Sayajirao University of Baroda, Vadodara	bidavemsu@yahoo.co.in
61	G. H. Dehri	Sardar Patel University, Vallabh Vidyanagar	
62	Rajeshwari Dubey	University of Allahabad, Allahabad	
63	Bhikha L. Ghodadra	The Maharaja Sayajirao University of Baroda, Vadodara	bhikhu_ghodadra@yahoo.com
64	Sharan Gopal	University of Hyderabad, Hyderabad	sharangopal@yahoo.co.in
65	Rajeev Gandhi	B. V. M. Engineering College, V. V. Nagar	rajiv55in@yahoo.com
66	Shilpa R. Gupta	The Maharaja Sayajirao University of Baroda, Vadodara	shilpamsu@yahoo.com
67	Atul Kadia	Hemchandracharaya North Gujarat University, Gujarat	kadiaav@gmail.com
68	Poonamba Kaliya	Shree M.& N. Virani Science College, Rajkot	Whitemoon08@yahoo.com

Sr. No	Name	Affiliation	e-mail
Indian Participants			
69	Ali Akbar Kamal	University of Hyderabad, Hyderabad	aliakbar.pkd@gmail.com
70	V. Kannan	University of Hyderabad, Hyderabad	vksm@uohyd.ernet.in
71	H. R. Kataria	The Maharaja Sayajirao University of Baroda, Vadodara	hrkmaths@yahoo.com
72	M. N. Mehta	SVNIT, Surat	Mnmehta_2001@yahoo.com
73	Hemant Modi	Bhavanagar University, Bhavanagar	
74	TKS Moothathu	University of Hyderabad, Hyderabad	tksm@uohyd.ernet.in
75	A. S. Vasudeva Murthy	TIFR, Bangalore	vasu@math.tifrbng.res.in
76	M. G. Nadkarni	IIT, Indore	nadkarni@math.mu.ac.in
77	A. K. Nandakumaran	IISc, Bangalore	nands@math.iisc.ernet.in
78	Bharti V. Nathwani	Charotar University of Science and Technology, Changa	Bharti.nathwani@yahoo.com
79	Bharti M. Pamnani	The Maharaja Sayajirao University of Baroda, Vadodara	bmpmsu@gmail.com
80	Purnima Pandit	The Maharaja Sayajirao University of Baroda, Vadodara	pkpandit@yahoo.com
81	Smaresh Pal	University of Kalyani, West Bengal	samaresp@yahoo.co.in
82	D. M. Patel	Sir P. T. Science College, Surat	
83	Piyush Patel	The Maharaja Sayajirao University of Baroda, Vadodara	piyushpatel002@gmail.com
84	Reena Patel	The Maharaja Sayajirao University of Baroda, Vadodara	reenapatel17@ymail.com
85	Sanjay Patel	St. Xavier's College, Ahmedabad	swpatel3@gmail.com
86	Nimisha Shailesh Pathak	The Maharaja Sayajirao University of Baroda, Vadodara	nimishasp@hotmail.com
87	Udayan Prajapati	St. Xavier's College, Ahmedabad	
88	M. Guru Prem Prasad	IIT, Rajasthan	mgpp@iitg.ernet.in
89	K. P. Mredula Pyarelal	SVIT, Vasad	
90	Rajesh Thakkar	Kutch University, Kutch	
91	C. R. E. Raja	Indian Statistical Institute, Bangalore	creraja@isibang.ac.in
92	M. V. Chakradhara Rao	Lakkireddy Balireddy College of Engineering, Mylavaram, Andhra Pradesh	chakrimv@yahoo.com
93	B. Sankara Rao	Adikavi Nannaya University, Rajahmundry	sankararao.b@gmail.com
94	Bharat S. Ratanpal	The Maharaja Sayajirao University of Baroda, Vadodara	bharatratanpal@yahoo.com
95	Dharitri Rathore	The Maharaja Sayajirao University of Baroda, Vadodara	rathoddharitri@yahoo.com
96	Ekta Shah	The Maharaja Sayajirao University of Baroda, Vadodara	ekta19001@gmail.com
97	Reshma T. Shah	Charotar University of Science and Technology, Changa	reshu_friend7@yahoo.co.in
98	Riddhi Shah	JNU, New Delhi	rshah@mail.jnu.ac.in
99	Sejal Shah	The Maharaja Sayajirao University of Baroda, Vadodara	sks1010@gmail.com
100	Trupti Pankaj Shah	The Maharaja Sayajirao University of Baroda, Vadodara	truptishah_appmath@yahoo.com

Sr. No	Name	Affiliation	e-mail
Indian Participants			
101	Jaita Sharma	The Maharaja Sayajirao University of Baroda, Vadodara	jaita.sharma@gmail.com
102	Kunal Sharma	ADIT, SPU	ksharma.math@gmail.com
103	Ramprakash Sharma	Sonepat Institute of Engineering & Management, Sonepat	Rpsharma68@yahoo.com
104	Niraj Kumar Shukla	University of Allahabad, Allahabad	o.nirajshukla@gmail.com
105	A. P. Singh	Central University of Rajasthan, Kishangarh	singhanandp@rediffmail.com
106	Dinesh Singh	Delhi University, Delhi	dineshsingh1@gmail.com
107	Rahul Kumar Singh	The Maharaja Sayajirao University of Baroda, Vadodara	rhlsngh498@gmail.com
108	Ravichandran Srinivasan	Saurashtra University, Rajkot	S_ravichandran2005@yahoo.co.in
109	Dhaval Thakkar	The Maharaja Sayajirao University of Baroda, Vadodara	dhaval220@yahoo.com
110	S. Jeeva Sathya Theesar	Gandhigram Rural Institute-DU, Tamil Nadu	sjstheesar@gmail.com
111	V. O. Thomas	The Maharaja Sayajirao University of Baroda, Vadodara	votmsu@gmail.com
112	Sanjay R. Tripathi	The Maharaja Sayajirao University of Baroda, Vadodara	sanjaymsupdr@yahoo.com
113	Kamlesh R. Trivedi	The Maharaja Sayajirao University of Baroda, Vadodara	ekamleshtrivedi@yahoo.com
114	Samir Vaidya	Saurashtra University, Rajkot	
115	D. C. Vakaskar	The Maharaja Sayajirao University of Baroda, Vadodara	dcvmsu@yahoo.co.in
116	Aparna Vyas	University of Allahabad, Allahabad	aparna.vyaas@gmail.com
117	R. G. Vyas	The Maharaja Sayajirao University of Baroda, Vadodara	drrgvyas@yahoo.com
118	Gyan Chandra S. Yadav	University of Allahabad, Allahabad	gcsyadav@gmail.com

ABSTRACTS

Jonathan Aaronson
Tel Aviv University, Israel

On "complexity"of probability preserving transformations

Sequences measuring the "complexity"of a probability preserving transformation with zero entropy have been considered e.g. by Blume, Ferenczi, Katok and Thouvenot.

I'll review some of these and introduce corresponding relative notions applied to a transformation over a factor (sequences of random variables).
There are interesting distributional limits for the relative complexity of certain zero entropy extensions. For example, random walks in random sceneries whose associated random walks satisfy the stable CLT (with index in (1,2]). The normalizing constants involved and the limit random variables give invariants for relative isomorphism of the random walks in random sceneries.

Marco Abate
Universita di Pisa, Italy

Dynamics of holomorphic maps tangent to the identity

One of the main open problems in local dynamics of several complex variable is to find a description of the (at least) topological dynamics of holomorphic germs tangent to the identity (that is, with identity differential at the fixed point) in a full neighbourhood of the fixed point. In this talk I shall survey what is known on this subject, up to some very recent results obtained mixing techniques coming from differential geometry, algebraic geometry, complex analysis and (discrete and continuous) dynamical systems.

Flavio Abdenur
PUC-Rio, Brazil

Genericity and robust transitivity

We discuss some recent and some ongoing works on the dynamics of C^1-generic (and C^1-robust) transitive diffeomorphisms.

Sukumar Das Adhikari
Harish-Chandra Research Institute, India

Fractional parts of powers, Pisot-Vijayaraghavan numbers and dynamics

For real numbers $\xi > 0, \theta > 1$, the study of the distribution of the sequence $\{\xi\theta^n\}_{n\geq 0}$, is one of the intriguing problems in number theory. After stating some classical results and narrating the related history, we describe some dynamics associated with this theme.

Zin Arai
Hokkaido University, Japan

Hyperbolicity, monodromy and pruning fronts

The focus of this talk is an interplay between two seemingly distinct areas of dynamical systems. One is the monodromy theory of polynomial maps with complex variables; the other is the so-called "pruning front" theory for dynamical systems with real variables. We see that the dynamics of a map with real variables is governed by the monodromy of the same map extended to complex variables, provided some hyperbolicity conditions. As an application, we determine several subshifts of finite type that appear in the Henon map.

Our main tool is a rigorous algorithm for proving the uniform hyperbolicity of dynamical systems. It is based on interval arithmetics and some graph theoretical algorithms. To avoid the difficulty of constructing hyperbolic splittings, we introduce quasi-hyperbolicity, which is computationally much more tractable than uniform hyperbolicity and equivalent to uniform hyperbolicity under the assumption of chain recurrence.

C. S. Aravinda
Tata Institute of Fundamental Research, Bangalore, India

A Khinchine type theorem for negatively curved manifolds

Given a closed negatively curved manifold M, we study the statistical asymptotic penetration behaviour of geodesic lines of M in small neighborhoods of a point q in M and we prove a Khinchine type theorem for the spiraling of geodesic lines around it.

Masayuki Asaoka
Kyoto University, Japan

Rigidity and flexibility of group actions

In this talk, we will discuss about two appliactions of the theory of Anosov flows to the rigidity problem of group actions. One is the complete classification of locally free actions of the affine group on three manifolds. The other is the local rigidity of homogeneous actions on the frame bundle of higher dimensional hyperbolic manifolds.

K. K. Azad
University of Allahabad, India

Certain methods identifying CIP and CIPH

Seven years after the appearance of a paper by H. Robbins in Israel J. Math. in 1967, wherein the converse to the Brouwer's fixed point theorem has been considered, the notion of "complete invariance property" got introduced and studied by L.E. Ward Jr. in the paper entitled "Fixed point sets" published in Pacific J. Math. A topological space is said to possess the complete invariance property (abbreviated, CIP) if each of its non-empty closed sets is a fixed point set of some self-continuous map. In case, the self-continuous map can be found to be a self-homeomorphism, the topological space is said to enjoy the property known as the "complete invariance property with respect to a homeomorphism, abbreviated CIPH". Among various techniques developed to study spaces with these properties, a specific action of a topological group on the space under consideration plays a significant role. This has been shown to be of considerable effect by A. Chigogidze. Karl H. Hofman and John R. Martin in their 1997 paper entitled "Compact groups and fixed point sets" appearing in Trans. Amer. Math. Soc. In this talk, we briefly sketch some techniques determining spaces possessing these properties.

Christina Bonatti
Universite de Bourgogne, France

Towards a global view of dynamical systems, from the point of view of the C^1-topology

I will propose a panorama of the space of diffeomorphisms of a compact manifold M by splitting this set in disjoint open subsets whose union is dense. This division of Diff(M) is obtained by considering dichotomies between global structures (filtrations, hyperbolic splitting or dominated splittings, ...) versus local phenomena (robust cycles, robusts homoclinic tangencies...). This is still just a program: the density part of many of these dichotomies remains open conjectures.

Perikala Chiranjeevi[*1], **V. Kannan, Sharan Gopal**
University of Hyderabad, India

How many kinds of monotonic contractions are there on the real line?

We prove that there are exactly 19 contractions which are strictly monotonic except at the ends up to topological conjugally and 31 such maps up to order conjugacy.

Ruchi Das
The Maharaja Sayajirao University of Baroda, India

Dynamical properties of maps on G-spaces

We shall study dynamical properties like expansivity, shadowing, transitivity for morphisims in the category of G-spaces and hyperspaces. We shall discuss some recent results including spectral decomposition theorem.

Tarun Das
The Maharaja Sayajirao University of Baroda, India

On C^1-persistently continuum-wise expansive homoclinic classes and chain recurrent sets

Introducing here notions of C^1-persistently continuum-wise expansivity, continuum-wise germ expansivity and the chain condition, we show that if the homoclinic class $H(p, f)$ is C^1-persistently continuum-wise expansive then (i) it admits a dominated splitting and (ii) it is hyperbolic provided it satisfies the chain condition, expansivity and continuum-wise germ expansivity.

This is joint work with T. Choi

Rajeshwari Dubey* and Aparna Vyas
University of Allahabad, India

Non-MSF wavelets in $L^2(\mathbb{R}^2)$

In this article, we provide two classes of non-MSF MRA wavelets in $L^2(\mathbb{R}^2)$. The first arose through one-dimensional dyadic wavelet sets having two components, is an uncountable family, while the second one arose through a special kind of MRA wavelet sets having three components, is a countable family.

[1]* indicates the name of presenter

Kari Eloranta
Helsinki University of Technology, Finland

Dynamical vertex models

We present an overview of the dynamical properties of the Six-Vertex Model of Statistical Mechanics and its relatives on planar uniform lattices. For these models there is a natural dynamics in the form of a probabilistic cellular automaton. Its equilibrium behavior on bounded domains reveals striking details leading to spatial phase transitions in the scaling limit. We characterize this boundary dependency in the measure of maximal entropy as well as its absence in one of the lattices. The methods used include height functions, entropy estimates and numerical simulations. Connections to other models, dimers in particular, are also discussed.

Xinchu Fu
Shanghai University, P. R. China

On global attractors for some singular nonhyperbolic systems

This talk discusses dynamical behaviors of a class of nonhyperbolic systems arising from signal processing, digital filters and modulator dynamics. Planar piecewise isometries may be discontinuous and/or non-invertible. First, attraction caused by singularity in planar piecewise isometries is considered. Namely, it is shown that the maximal invariant set can induce an invariant measure, and all the Lyapunov exponents are zero under this invariant measure. Second, various definitions of global attractors and their existence and uniqueness for maps with singularities are discussed, and a few examples in which the attractors are created due to discontinuity are introduced. Third, the relation between invariance and invertibility for various nonhyperbolic maps is studied, and finally decomposability of global attractors for certain singular nonhyperbolic systems is investigated.

Hillel Furstenberg
The Hebrew University of Jerusalem, Israel

Stationary actions and a Szemeredi Theorem for $SL(2, R)$

Suppose G is a non-amenable group acting on a compact space M. There may not be an invariant measure on M, but if μ is a probability measure on G, we can find a measure ν on M, which "on the average" (with respect to μ) is invariant. We call the action on (M, ν) a "stationary action", and we develop a theory of these. When $G = SL(2, R)$ one can prove a multiple recurrence theorem here just as for the invariant measure situation. This leads to the Szemeredi type theorem referred to.

Valery A. Gaiko
National Academy of Sciences of Belarus, Belarus

A quartic predator–pray model

We study a quartic dynamical system which models the dynamics of the populations of predators and their prey that use the group defense strategy in a given epidemiological or immunological system and which is a variation on the classical Lotka–Volterra system:

$$\begin{aligned} \dot{x} &= \quad x((1-\lambda x)(\alpha x^2+\beta x+1)-y) \equiv P, \\ \dot{y} &= -y((\delta+\mu y)(\alpha x^2+\beta x+1)-x) \equiv Q, \end{aligned} \tag{1}$$

where $\alpha \geq 0$, $\delta > 0$, $\lambda > 0$, $\mu \geq 0$ and $\beta > -2\sqrt{\alpha}$ are parameters. Such a quartic dynamical model was studied earlier, for instance, in [**1**]. However, its qualitative analysis was incomplete, since the global bifurcations of limit cycles could not be studied properly by means of the methods and techniques which were used in the qualitative theory of dynamical systems. Applying to this system new bifurcation methods and geometric approaches developed in [**2**], we complete the global qualitative analysis of (1).

References

1. H. Zhu, S. A. Campbell and G. S. K. Wolkowicz, Bifurcation analysis of a predator-prey system with nonmonotonic functional response, *SIAM J. Appl. Math.* **63** (2002), 636–683.

2. V. A. Gaiko, *Global Bifurcation Theory and Hilbert's Sixteenth Problem*, Kluwer, Boston, 2003.

Ji Gao
Community College of Philadelphia, USA

Non expansive mapping, normal structure and pythagorean approach in Banach spaces

Let X be a Banach space and $S(X) = \{x \in X, \|x\| = 1\}$ be the unit sphere of X. The properties of parameters $E(X) = sup\{\alpha(x), x \in S(X)\}$, $e(X) = inf\{\alpha(x), x \in S(X)\}$, $F(X) = sup\{\beta(x), x \in S(X)\}$, and $f(X) = inf\{\beta(x), x \in S(X)\}$, where $\alpha(x) = sup\{\|x + y\|^2 + \|x - y\|^2, y \in S(X)\}$ and $\beta(x) = inf\{\|x + y\|^2 + \|x - y\|^2, y \in S(X)\}$ are studied. The values of these parameters in the l_p spaces and function spaces $L_p[0, 1]$ and other classical Banach spaces are estimated. The relationships among these parameters and other parameters: modulus of convexity, modulus of smoothness and modulus of squareness are considered. Finally, we proved that a Banach space X is uniform nonsquare or a Banach space X has uniform normal structure therefore has fixed point for a nonexpansive mapping if the values of these pythagorean parameters are bounded by some certain numbers.

K. Ali Akbar, V. Kannan, S. Gopal*[2] and P. Chiranjeevi
University of Hyderabad, India

The set of periods of periodic points of a linear operator

In this talk, subsets of N that can arise as sets of periods of linear operators on the spaces C^n, R^n and l^2 are characterized. There have been a lot of papers characterizing the sets of periods, for various classes of self maps,like (i)continuous self maps of the real line R (ii)polynomials on C (iii)toral automorphisms (iv)totally transitive maps on I and (v) degree one maps on S^1. In this paper, we determine the same for (a)linear operators on C^n (b)linear operators on R^n and (c)linear operators on the Hilbert space l^2.

Nicolai Haydn
University of Southern California, USA

Return times distribution for α-mixing dynamical systems

We prove that dynamical systems that are α-mixing have in the limit Poisson distributed return times almost everywhere. We use the Chen-Stein method to also obtain rates of convergence. Our theorem improves on previous results by allowing for infinite partitions and dropping the requirement that the invariant measure have finite entropy with respect to the given partition. As has been shown elsewhere, the limiting distribution at periodic points is not Poissonian (but compound Poissonian), therefore our result applies to cylinder neighbourhoods that don't exhibit local periodic behaviour. We also prove that Lai-Sang Young's Markov Towers are α-mixing and thus have Poisson distributed limit distribution of return times. In this case the rate of convergence is determined by the decay rate of the 'tail distribution' of the tower.

Hiroyuki Inou
Kyoto University, Japan

On a generalization of the self-similar property of the Mandelbrot set

It is well-known that the Mandelbrot set contains countably many homeomorphic copies of itself. We discuss to what extent such a self-similar property holds for the parameter spaces of higher degree polynomials.

[2]* indicates the name of presenter

Ali Akbar Kamal
University of Hyderabad, India

Transitive toral automorphisms

In this talk, we study the transitive property of a 2-dimensional continuous toral automorphism, and we produce examples of zero entropy dynamical systems having Lyapunov function such that every fiber is of empty interior. The torus T^2 is here viewed as $[0,1) \times [0,1)$ as a group under coordinatewise addition modulo 1.

V. Kannan
University of Hyderabad, India

Periodic points and periods for operators on Hilbert space

We characterize the sets of periodic points of bounded linear operators on a Hilbert space H. We also find the pairs (A, M), where A is a subset of N (the set of natural numbers) and M is a subset of H such that there exists a bounded linear operator f on H with A as the set of periods and M as the set of periodic points.

Hark-Mahn Kim
Chungnam National University, Korea

Stability of fractional dynamic systems

Let E_1 and E_2 be linear spaces. In this paper we extend a classical quadratic functional equation to more general equations of two types. In addition we solve the generalized Hyers-Ulam-Rassias stability problem for the functional equations, and thus obtain asymptotic properties of quadratic mappings as an application.

The talk is based on joint work with K. Jun, J. Lee and E. Son.

Sergiy Kolyada
National Academy of Sciences of Ukraine, Ukraine

On the Birkhoff center

In the first part of the talk we will present a survey of some known facts on the Birkhoff center of a dynamical system. Then we will concentrate on some recent results obtained jointly with Matviichuk Mykola.

Namjip Koo
Chungnam University, Korea

Stability of fractional dynamic systems

In this talk, we briefly recall the fractional calculus: Riemann-Liouville integrals and derivatives of arbitrary order. Then we discuss some results on stability of solutions for fractional-order dynamic systems using fractional Lyapunov direct method and fractional comparison principle, and furthermore give the converse Lyapunov theorems.

The talk is based on joint work with S. Choi and B. Kang.

Petr Kurka
Charles University in Prague, Czech Republic

Moebius number systems

Moebius number systems generalize both positional number systems and continued fractions. The are given by systems $(F_a : \bar{R} \to \bar{R})_{a\in A}$ of real Moebius transformations indexed by a finite alphabet A and a system of expansion intervals $(W_a \subset \bar{R})_{a\in A}$ which cover the extended real line $\bar{R} = R \cup \{\infty\}$. Under some conditions there exists a subshift $\Sigma \subset A^N$ and a continuous surjective map $\Phi : \Sigma \to \bar{R}$, so we get a symbolic representations of real numbers. If the system is redundant, i.e., if each $x \in \bar{R}$ has many preimages under Φ, then effective arithmetical algorithms exist which act on Σ.

Keonhee Lee
Chungnam National University, Korea

Robustly shadowable chain components of C^1 vector fields

Chain components and homoclinic classes are natural candidates to replace the Smale's hyperbolic basic sets in non-hyperbolic theory of dynamical systems. It is known by Bonatti and Crovisier [BC] that, in the C^1-generic context, every chain component with a periodic point is a homoclinic class. Many recent papers, most of which are for diffeomorphisms only, have explored their hyperbolic-like properties such as dominated splitting, partial hyperbolicity and hyperbolicity. For instance, Sakai *et al.* [Sak, WGW] proved that if the chain component $C_f(p)$ of a diffeomorphism f on a closed C^∞ manifold M containing a hyperbolic periodic point p is robustly shadowable (i.e., there is a C^1 neighborhood $\mathcal{U}(f)$ of f such that the chain component $C_g(p_g)$ of $g \in \mathcal{U}(f)$ containing the continuation p_g is shadowable for g), then $C_f(p)$ is hyperbolic. In this paper, we are going to study the hyperbolic structure on the chain components of (C^1) vector fields on a closed C^∞ manifold M. More precisely, our main problem can be formally stated as follows.

Problem: *If the chain component $C_X(\gamma)$ of a vector field X containing a hyperbolic periodic orbit γ is robustly shadowable, then is it hyperbolic?*

Many of the dynamic results for diffeomorphisms can be extended to the case of vector fields, but not always. In particular, the results involving the hyperbolic structure or shadowing property may not be extended to the case of vector fields. For example, it is well known that if a diffeomorphism f has a C^1 neighborhood $\mathcal{U}(f)$ such that every periodic point of $g \in \mathcal{U}(f)$ is hyperbolic, then the nonwandering set $\Omega(f)$ is hyperbolic. Though the statement is true for the case of nonsingular star fields (see [GW]), it is not true in general for the case of vector fields. Moreover it is known that the C^1 interior of the set of diffeomorphisms with the shadowing property coincides with the set of structurally stable diffeomorphisms. Recently, Pilyugin and Tikhomirov claimed in [PT] that the statement is not true for the case of vector fields (see also [LS]). Finally we prove that every C^1 roubstly shadowable chain component $C_X(\gamma)$ is hyperbolic if it does not contain a non-hyperbolic singularity.
The talk is based on joint work with L. Tien and X. Wen.

References

[BC] C. Bonatti and S. Crovisier, Récurrence et généricité, Invent. Math. 158 (2004), 33-104.
[GW] S. Gan, L. Wen, Nonsingular star flows satisfy Axiom A and the no-cycle condition, Invent. Math. 164 (2006) 279–315.
[LL] K. Lee, M. Lee, Hyperbolicity of C^1 stably expansive homoclinic classes, Discrete Contin. Dyn. Syst. 27 (2010), 1133–1145.
[LS] K. Lee, K. Sakai, Structural stability of vector fields with shadowing, J. Differential Equations 232 (2007) 303–313.
[PT] S.Yu. Pilyugin, S.B. Tikhomirov, Vector fields with the oriented shadowing property, J. Differential Equations 248 (2010), 1345–1375.
[Sak] K. Sakai, C^1-stably shadowable chain components, Ergodic Theory Dynam. Systems 28 (2008) 987–1029.
[WGW] X. Wen, S. Gan, L. Wen, C^1-stably shadowable chain components are hyperbolic, J. Differential Equations 246 (2009) 340–357.

(*) K. Lee is currently visiting the University of Washington in Seattle.

Manseob Lee
Mokwon University, Korea

Stably weak inverse shadowing and dominated splitting

Let f be a diffeomorphism of a closed C^∞ manifold M. In this talk, we introduce the notion of C^1 stably weak inverse shadowing for a closed f-invariant set, and show that if f has the C^1-stably weak inverse shadowing property on a transitive set Λ, then Λ admits a dominated splitting.

The talk is based on joint work with J. Ahn and L. Gang.

Welington De Melo
Instituto Nacional De Matematica Pura E Aplicada, Brazil

The dynamics of circle maps

I will discuss several recent results on the dynamics of circle maps and also some open problems. One of the results is that any two smooth critical circle maps with the same irrational rotation number are C^1 conjugate.

TKS Moothathu
University of Hyderabad, Hyderabad

Non-classical Li-Yorke pairs

For us, a dynamical system is a pair $(X; f)$ where X is a compact metric space and $f : X \to X$ is a continuous map. We make some investigations about the speed with which an orbit approaches a limit point. As an application we establish the following. If X is infnite and f is totally transitive, then there is a dense subset $S \subset X$ which is a countable union of Cantor sets such that $limsup_{n\to\infty} d(f^{rn}(x), f^{sn}(y)) > 0$ and $limin f_{n\to\infty} d(f^{rn}(x), f^{sn}(y)) = 0$ for any two distinct $x, y \in S$ and any two distinct $r, s \in N$.

A. S. Vasudeva Murthy
Tata Institute of Fundamental Research, Bangalore, India

On the slow manifold for the Lorenz-Krishnamurthy system

Lorenz and Krishnamurthy derived a system of five ODE's from the Shallow water equations on a sphere in 1987. The first three solution components of these ODE's oscillate on a slow time scale compared to the remaining two. A slow manifold is a three dimensional manifold in the five dimensional phase space containing only the slowly oscillating trajectories. The existence of such a slow manifold has been intensely debated and has not been settled. In this study we construct a slow manifold based on minimizing evolution rates that was proposed by Girimaji in a different context.

M. G. Nadkarni
Indian Institute of Technology, Indore, India

Coordinatewise decomposition of functions and ergodic theory

Let X and Y be non-empty sets and let S be a subset of the cartesian product of X and Y. We say that S is additive if every real valued function on S is a sum of a function on X and a function on Y. We will discuss some question of such sets and functions, especially when X and Y are Borel spaces, S a Borel set and f is a Borel function. Dynamics and descriptive set theory naturally plays a role in answering the question we raise.

A. K. Nandakumaran
Indian Institute of Science, Bangalore, India

Optimal control and homogenization

Homogenization is the study asymptotic analysis of heterogeneous media where the heterogeneities (small, but in large numbers) oscillates rapidly which causes high oscillations in the solutions. Such solutions are difficult to compute and thus the idea is to look for a limiting procedure and hence a homogenization is called for. Therefore the analysis of homogenization appears in almost every field of science and engineering. In this talk, we wish to discuss the homogenization of certain optimal control problems. Initially, we discuss some earlier work on such problems where the oscillations are due to the coefficients and/or due to the domain like porous media. But the main aim in this lecture is to discuss some ongoing work, where we consider a domain with oscillating boundary. There are plenty of physical situations where the problems are posed on domains with rough boundary. We present a sample problem of Laplacian in a domain with oscillating boundary together with a simple cost functional, but our aim is to study more interesting situations of parabolic and hyperbolic equations like heat, wave, Fluid flow equations etc. We write down the optimality system and study the convergence of the state, co-state, cost functional and the optimal control. We also present some error estimates which are known as corrector results in the literature.

Mahesh Nerurkar
Rutgers University, USA

On Lyapunov exponents of smooth $SL(2,\mathbb{R})$ valued cocycles over minimal rotation flows

Consider the class of C^r-smooth $SL(2,\mathbb{R})$ valued cocycles, (with $r \in \mathbb{N}$), based on the rotation flow on the two torus with irrational rotation number α. We show that in this class, (i) cocycles with positive Lyapunov exponents are dense and (ii) cocycles that are either uniformly hyperbolic or proximal are generic, if α satisfies the following super Liouville type condition: $|\alpha - \frac{p_n}{q_n}| \leq C\exp(-q_n^{r+1+\kappa})$, where $C > 0$ and $0 < \kappa < 1$ are some constants and $\frac{P_n}{q_n}$ is some sequence of irreducible fractions. We also show that a generic $SL(2,\mathbb{R})$ valued cocycle in the class of C^r, $(0 < r < 1)$ cocycles based on a rotation flow on the d-torus, is either uniformly hyperbolic or has zero Lyapunov exponents provided that the components of winding vector $\overline{\gamma} = (\gamma^1, \cdots, \gamma^d)$ of the rotation flow are rationally independent and satisfy

$$|\gamma^i - \frac{p_n^i}{q_n}| \leq Ce^{-q_n^{1+\delta}} \quad 1 \leq i \leq d\,, n \in \mathbb{N}$$

where $C > 0$ and $\delta > 0$ are some constants and $p_n^i\,, q_n$ are some sequences of integers with $q_n \to \infty$. A result of this type was known in the class of C^0 cocycles but is yet unknown in the class of C^1 cocycles.

Piotr Oprocha
AGH University, Poland

On recurrence in pairs

A point x in a topological dynamical system (X,T) is said to be *product recurrent* if for every topological dynamical system (Y,S) and for every recurrent point $y \in Y$, the pair (x,y) is recurrent for $(X \times Y, T \times S)$. If in the above definition we consider only points y from a smaller class of uniformly recurrent points then we say that x is *weakly product recurrent*.
In 1994, Auslander and Furstenberg asked the following natural question: *Does weak product recurrence imply product recurrence?*
Recently it was proved by Haddad and Ott that the class of weakly product recurrent points is essentially larger than the class of product recurrent points. In this talk we will show how results of Haddad and Ott can be extended, highlighting relations between weak product recurrence and other notions known from topological dynamics. We will also present a few questions related to weak product recurrence which, so far, remain unanswered.

Sergei Yu. Pilyugin
St. Petersburg State University, Russia

Shadowing and structural stability in dynamical systems

In this talk, we discuss several relations between various shadowing properties of dynamical systems with discrete and continuous time and structural stability.
Main topics:

1. C^1-interiors of sets of discrete dynamical systems having various shadowing properties [1, 2];
2. shadowing properties of smooth vector fields and structural stability [3-5];
3. shadowing properties equivalent to structural stability [6, 7];
4. relations between periodic shadowing and Ω-stability [8].

References

1. K. Sakai. Pseudo orbit tracing property and strong transversality of diffeomorphisms of closed manifolds. *Osaka J. Math.*, **31**, 373-386 (1994).
2. S. Yu. Pilyugin, A. A. Rodionova, and K. Sakai. Orbital and weak shadowing properties. *Discrete Contin. Dyn. Syst.*, **9**, 287-308 (2003).
3. S. Yu. Pilyugin. Shadowing in structurally stable flows. *J. Differential Equations*, **140**, 238-265 (1997).
4. S. Yu. Pilyugin and S. B. Tikhomirov. Sets of vector fields with various shadowing properties. *Doklady Ros. Akad. Nauk*, **422**, 30-31 (2008).
5. S. Yu. Pilyugin and S. B. Tikhomirov. Vector fields with the oriented shadowing property. *J. Differential Equations*, **248**, 1345-1375 (2010).
6. S. Yu. Pilyugin. Variational shadowing. *Discrete Contin. Dyn. Syst.*, **14**, 733-737 (2010).
7. S. Yu. Pilyugin and S. B. Tikhomirov. Lipschitz shadowing implies structural stability (submitted).
8. A. V. Osipov, S. Yu. Pilyugin and S. B. Tikhomirov. Periodic shadowing and Ω-stability. *Regular and Chaotic Dynamics*, **15**, 404-417 (2010).

M. Guru Prem Prasad
Indian Institute of Technology, Rajasthan, India

Iteration of meromorphic functions $f(z) = (z/\sinh(z))^{2m-1}$

Let $\mathcal{M} = \{f \ : \ f(z) = (z/\sinh(z))^{2m-1} \text{ for } z \in \mathbb{C}\}$ where m is a natural number. For each $f \in \mathcal{M}$, the set of singularities of the inverse function of f is an unbounded set of the real line $\mathbb{R}$. The iteration of functions in one parameter family $\mathcal{S} = \{f_\lambda \equiv \lambda f \ : \ \lambda \text{ is a non-zero real parameter } \}$ is investigated for each $f \in \mathcal{M}$. It is proved that there is a critical parameter $\lambda^* > 0$ (depending on f) such that a period doubling bifurcation occurs in the dynamics of functions in $\mathcal{S}$ when the parameter $|\lambda|$ passes through λ^* [Ergod. Th. & Dynam. Sys (2010), **30**, 877-891].

C. R. E. Raja
Indian Statistical Institute, Bangalore, India

Existence of ergodic automorphisms for ergodic actions

We consider algebraic Z^d-action on a compact metrizable group K. We adddress the question of when ergodic Z^d-action contains ergodic automorphisms. We discuss our recent result where the question has affirmative answer if the center of the action has descending chain condition. To explain that the condition on the center of the action is not restrictive, we discuss certain abelian groups which, in particular, provide new proofs to the theorems of Berend and Schmidt. If time permits we would review the corresponding result for nilpotent actions.

David Richeson
Dickinson College, Carlisle, USA

Generating symbolic dynamics for non-hyperbolic discrete dynamical systems

We introduce index systems, a tool for studying isolated invariant sets of dynamical systems that are not necessarily hyperbolic. The mapping of the index systems mimics the expansion and contraction of hyperbolic maps on the tangent space, and they may be used like Markov partitions to generate symbolic dynamics. Every continuous dynamical system satisfying a weak form of expansiveness possesses an index system. Because of their topological robustness, they can be used to obtain rigorous results from computer approximations of a dynamical system. (This is joint work with Jim Wiseman)

Mohammad Sajid
Qassim University, Saudi Arabia

On iteration of a function in the cosine family: $\lambda cosz/z$

A one parameter family $\mathcal{M}_s \equiv \{f_\lambda(z) = \lambda\frac{cosz}{z} : z \in \hat{C} \text{ and } \lambda > 0\}$ is considered and the chaotic behaviour in the iteration of function $f_\lambda \in \mathcal{M}_s$ is investigated. It is found that there exist several parameter values such that bifurcations in the iterations of $f_\lambda \in \mathcal{M}_s$ occur at these parameter values. Moreover, the dynamical properties of $f_\lambda \in \mathcal{M}_s$ are investigated on the real line and in the complex plane. The results found here are compared with the results on the dynamics of one parameter cosine families $\lambda cosz$ and $\lambda cos(\sqrt{z})$ for $\lambda > 0$.

Kazuhiro Sakai
Utsunomiya University, Japan

C^1-stably weakly shadowing homoclinic classes

Let f be a diffeomorphism of a closed n-dimensional C^∞ manifold, and p be a hyperbolic saddle periodic point of f. In this talk, we introduce the notion of C^1-stably weakly shadowing for a closed f-invariant set, and prove that for the homoclinic class $H_f(p)$ of p, if $f_{|H_f(p)}$ is C^1-stably weakly shadowing, then $H_f(p)$ admits a dominated splitting. Especially, on a 3-dimensional manifold, the splitting on $H_f(p)$ is partially hyperbolic, and if in addition, f is far from homoclinic tangency, then $H_f(p)$ is strongly partially hyperbolic. This is joint work with S. Gan and L. Wen.

Ekta Shah
The Maharaja Sayajirao University of Baroda, India

On dynamical properties induced on functional envelopes

Functional Envelope [**2**] of a dynamical system (X, f) is a dynamical system $(C(X), F_f)$, where $C(X)$ is a space of all continuous self - maps on X and for $\varphi \in C(X)$, $F_f(\varphi) = f \circ \varphi$. We study relationship between certain dynamical properties such as expansivity, shadowing, mixing, etc of (X, f) and $(C(X), F_f)$. Through examples we justify the necessity of hypothesis.

References

1. N. Aoki, K. Hiraide, *Topological Theory of Dynamical Systems*, North Holland, Amsterdam, 1994.
2. J. Auslander, S. Kolyada, Lubomir Snoha, *Functional envelope of a dynamical system*, Nonlinearity 20, 2245 - 2269, 2007.

The talk is based on joint work with Tarun Das.

Riddhi Shah
Jawaharlal Nehru University, India

Dynamics of (semi)groups actions

We will discuss dynamics of distal and ergodic actions on groups. We will also discuss properties of distal actions and connect distality of conjugation action to behaviour of convolution powers of measures on the group.

Sejal Shah
The Maharaja Sayajirao University of Baroda, India

On multidimensional chaos

We define and study the notion of chaos for a Z^d-action. In particular, we define the notion of distributional chaos for a Z^d-action and prove that a Z^d-action on compact metric space with no isolated points satisfying specification property is distributionally chaotic.

The talk is based on joint work with Tarun Das.

Niraj Shukla
University of Allahabad, India

On wavelets and wavelet sets in $L^2_{\mathbb{E}}(\mathbb{R}^n)$

In this paper, we study scaling sets, generalized scaling sets, MSF wavelets and non-MSF wavelets for a closed subspace $L^2_{\mathbb{E}}(\mathbb{R}^n)$ consisting of those members of $L^2(\mathbb{R}^n)$, the supports of whose Fourier transforms are contained in $\mathbb{E}$, where $\mathbb{E}$ is a set of $\mathbb{R}^n$ with positive measure. We construct H^2-scaling sets having n-intervals which provide H^2-MRA wavelet sets possessing finitely many intervals. It has been noticed that these H^2-MRA wavelet sets include various families of H^2-wavelet sets obtained by Arcozzi, Behera, and Madan [*J. Geom. Anal.* **13**(4) (2003), 557–579]. Also, we provide methods to construct ($L^2_{\mathbb{E}}$, A)-scaling sets, ($L^2_{\mathbb{E}}$, A)-wavelet sets and non-MSF ($L^2_{\mathbb{E}}$, A)-wavelets from ($L^2_{\mathbb{E}}$, A)-wavelet sets.

A. P. Singh
Central University of Rajasthan, India

Some aspects of complex dynamical systems

Complex dynamics discusses the behaviour of analytic functions under iteration. Let f be a meromorphic function. The set $\mathcal{F}$=$\{z \in \hat{\mathbb{C}} : (f^n)_{n\in\mathbb{N}}$ is defined and normal in some neighbourhood of $z\}$
is called the **Fatou** set and its complement $\hat{\mathbb{C}} - \mathcal{F}$ denoted by $\mathcal{J}$ is called the **Julia** set. If $U_n \cap U_m = \phi$ for $n \neq m$ where U_n denotes the component of $\mathcal{F}(f)$ which contains $f^n(U)$, then U is called a **wandering domain**, else U is called a **pre-periodic domain**, and if $U_n = U$ for some $n \in \mathbb{N}$, then U is called **periodic domain**. The set

$$I(f) := \{z \in \mathbb{C} : f^n(z) \to \infty \text{ as } n \to \infty\}$$

is called **escaping set** of f.

In this lecture we plan to give an introduction to the subject on some aspects of complex dynamical system, specially dealing with wandering domains, permutable entire functions, permutable entire functions which semiconjugate with another entire function and on the escaping sets.

Daniel Smania
Instituto de Ciencias Matematicas e de Computacao, Brazil

Linear response for deformations of generic nonuniformly hyperbolic unimodal maps

In collaboration with Viviane Baladi, we obtained linear response results for deformations of certain nonuniformly hyperbolic unimodal maps.

Lubomir Snoha
Matej Bel University, Slovakia

Minimal sets of fibre-preserving maps in graph bundles

Minimal sets are studied for a compact dynamical system given by a fibrepreserving continuous map F in a graph bundle E (i.e., F is a skew product map). For minimal sets of such systems a kind of dichotomy holds, which can be described in terms of what we call end-points of a set: The set of end-points of a minimal set M is either dense in M (and then M is nowhere dense in E), or it is empty (and then M has nonempty interior in E). Since minimal sets of fibre-preserving maps in tree bundles have end-points, these sets are nowhere dense. In general graph bundles, we partially describe the structure of minimal sets having no end-points.

Le Huy Tien
Chungnam National University, Korea

Perron Theorem for dynamic equations on time scales

We prove the well-known Perron theorem for dynamic equations on time scales. Here underlying time scale has bounded graininess and coefficient operators are not necessary regressive.

The talk is based on joint work with T. Choi, N. Koo and J. Oh.

Edson Vargas
Sao Paulo University, Brazil

Dirac physical measures and transitive dynamics

The preferable picture in dynamics is that the asymptotic behavior of orbits, for Lebesgue almost all initial conditions, is described by finitely many ergodic measures. But life is not always like we prefer and looking for situations where this picture fail we found two interesting phenomenons which are the subject of my talk: the first one is related to persistence of homoclinic tangencies and appeared in a joint work with E. Colli. The second one is related to 'bad' rotations on the circle and appeared in a joint work with R. Saghin and W. Sun.

Lanyu Wang
Chinese Academy of Sciences, P. R. China

Some results on one dimensional nonuniformly expanding maps

In this talk we state some results on one dimensional nonuniformly expanding map. We give topological condition, metrical condition and some abundance results for nonuniformly expanding multi-modal maps.

Jim Wiseman
Agnes Scott College, Decatur, USA

Symbolic dynamics from partitions with overlapping elements

Let $f : X \to X$ be a continuous map of a compact metric space, and $\{N_1, \ldots, N_n\}$ a collection of nonempty compact sets such that $\bigcup Int(N_i) = X$. We say that $(s_0, s_1, \ldots)$ is an *itinerary* for a point x if $f^i(x) \in N_i$ for all i. In the classical case of a Markov partition, the sets N_i overlap only on their boundaries and map across each other nicely under f; in this case the itineraries give symbolic dynamics in the form of a subshift of finite type. We study the case where the sets N_i can overlap nontrivially and map across each other in a more complicated way, and discuss ways to extract useful information about the dynamics of f from the itineraries in this case. (This is joint work with David Richeson.)

A. Yu. Zhirov
Zhukovsky - Gagarin Air Force Academy, Russia

Algorithms for of the topological conjugacy problem solution for generalized pseudo-Anosov homeomorphisms

The algorithms in the title of talk are based on manipulations with Markov partitions of generalized pseudo-Anosov (GPA) homeomorphism. More concrete, Markov partitions of some special type called *band partitions* are used. Band partitions may be constructed for given GPA - homeomorphism $f : M \to M$ in different ways, for example beginning with its train-track. On the other hand some finite collection of data called *the code* of GPA - homeomorphism with respect to given band partition completely (and constructively) defines f up to conjugacy. The data composing the code characterize the structure of band partition itself and the action of f on its elements. There is algorithm which enables to calculate the code with respect to band partition obtained from train-track.

The set of codes corresponding to all possible band partitions of given GPA - homeomorphism is its complete invariant, i.e. two GPA - homeomorphism are conjugent if and only if corresponding sets of codes coincide. The problem is that this set is infinite, but it

is possible to extract some finite subset of it which is complete invariants too. This subset may be defined in different ways, but in some sense canonically. For example such is the set of codes defined by all band partitions with fixed number of elements. The main algorithm enables to calculate finite set of codes chosen as the complete invariant beginning with the code corresponding to arbitrary band partition.

This algorithm is based on the following geometric idea. Every band partition of given GPA - homeomorphism may be obtained beginning with one of them via sequence of some elementary reconstructions. There are subalgorithms that make the code conversions, which occur at the elementary reconstructions. Despite the fact that the procedure of band partitions reconstructing is infinite, organized properly procedure of code conversations loops in such a way that all codes arranging chosen complete invariant being obtained by doing. These procedure may be realized as the computer program. Besides of the main algorithm above there is the algorithm which testes the formally written code to be a code of some GPA - homeomorphisms with respect to some its band partition. The computer program realized this algorithm produced a lot of examples of GPA - homeomorphisms of both orientable and non-orintable surfaces with prescribed structures of invariant foliations.

What is more, the algorithm of testing formal codes to be realizable may be used in principle for solving the problem of enumeration of GPA - homeomorphism in the following sense. Requires a list of all GPA - homeomorphisms (i.e. of their codes) with fixed structure of invariant foliations and the topological entropy not exceeding a given value. But practical realization of this procedure requires too much time. The reason is that it requires the enumeration of formal codes (in contrast with the main algorithm above which do not include enumeration procedures). Main ideas above as well as combinatorial technique where used previously for solving similar problems for diffeomorphisms of surfaces with one-dimensional hyperbolic attractors [1].

References

1. A. Yu. Zhirov. Combinatorics of one-dimensional hyperbolic attractors of diffeomorphisms of surfaces. Proceedings of the Steklov Institute of Mathematics 244, 132-200 (2004); translation from Tr. Mat. Inst. Steklova 244, 143-215 (2004).

Acknowledgement

.

The Department of Mathematics, Faculty of Science, The Maharaja Sayajirao University of Baroda, sincerely acknowledges financial support received from

Gujarat Council on Science and Technology (GUJCOST)
Government of Gujarat, Gandhinagar

Gujarat Council on Science and Technology (GUJCOST) was established in 1986 under Education Department, Gujarat State. Gujarat Council on Science & Technology is functioning as an autonomous society from Date 1-2-2000 under department of Science & Technology having one of its objectives to promote popularization of science and the spread of scientific temper, attitude among the people of the State.

Department of Science and Technology, Delhi

Department of Science & Technology (DST), Ministry of science and Technology, Government of India, was established in May 1971, with the objective of promoting new areas of Science & Technology and to play the role of a nodal department for organizing, coordinating and promoting Science & Technology activities in the country.

National Board for Higher Mathematics (NBHM)
Department of Atomic Energy, Mumbai

The National Board for Higher Mathematics (NBHM) was set up by the Government of India under the Department of Atomic Energy (DAE), in the year 1983, to foster the development of higher Mathematics in the country, to formulate policies for the development of mathematics, help in the establishment and development of mathematical centers and give financial assistance to research projects and to doctoral and postdoctoral scholars. The objectives of the board are: to promote the growth of higher Mathematics in the country; and to coordinate activities for the development of Mathematics.

We also sincerely thank all who have helped us in one or the other way in organizing the ICM2010 Satellite Conference on Dynamical System including Bank of Baroda, Sayajigunj, Vadodara for their financial support.