

2020 **August 13(Thur) - 14(Fri), 2020**

International Conference on Recent Trends in Mathematics



Invited Speakers

Jiweon Ahn (Chungnam National Univ., South Korea)
Nhan Phu Chung (Sungkyunkwan Univ., South Korea)
Tarun Das (Univ. of Delhi, India)
Meihua Dong (Yanbian Univ., China)
Lu Gang (Guangzhou College of Technology and Business, China)
Woochul Jung (Konyang Univ. Hospital, South Korea)
Bowon Kang (Chungnam National Univ., South Korea)
Seunghee Lee (Konyang Univ. Hospital, South Korea)
Carlos Morales (Federal Univ. of Rio, Brazil)
Ngothach Nguyen (Chungnam National Univ., South Korea)
Jumi Oh (Sungkyunkwan Univ., South Korea)
Mohanmmad Reza (Behin Andishan Rayyar Research Group, Iran)
Bomi Shin (Chungnam National Univ., South Korea)
Hwan-Yong Shin (Chungnam National Univ., South Korea)
Khosro Tajbakhsh (Tarbiat Modares Univ., Iran)
Le Huy Tien (Vietnam National Univ. at Hanoi, Vietnam)
Nyamdavaa Tsegmid (Mongolian National Univ. of Education, Mongol)
Xiao Wen (Beihang Univ., China)
Yinong Yang (Beihang Univ., China)
Yoonjeong Yang (Chungnam National Univ., South Korea)

■ Homecoming Conference Schedule

Aug 13 [Thu]		Aug 14 [Fri]	
Time	Speaker	Time	Speaker
09:45-10:00	Opening Remark	10:00-10:20	Nhan-Phu Chung
10:00-10:30	C. A. Morales		
10:30-11:00	Xiao Wen	10:20-10:40	Hwan-Yong Shin
11:00-11:10	Chatting & Break	10:40-11:00	Bowon Kang
11:10-11:30	Woochul Jung	11:00-11:10	Chatting & Break
11:30-11:50	Yinong Yang	11:10-11:30	Yoonjeong Yang
11:50-12:10	Meihua Dong	11:30-11:50	Bomi Shin
12:10-14:00	Lunch	11:50-12:10	Jiweon Ahn
14:00-14:50	Homecoming Ceremony & Photo Time	12:10-14:00	Lunch
14:50-15:00	Chatting & Break	14:00-14:20	Seunghee Lee
15:00-15:30	Tarun Das	14:20-14:40	Ngocthach Nguyen
15:30-16:00	Khosro Tajbakhsh	14:40-15:00	Mohammadreza Bagherzad
16:00-16:10	Chatting & Break	15:00-17:00 (Discussion Time)	Lu Gang, C. A. Morales, Yinong Yang, Meihua Dong, Tarun Das, Khosro Tajbakhsh, Xiao Wen, Le Huy Tien, Nyamdavaa Tsegmid, Mohammadreza Bagherzad
16:10-16:30	Le Huy Tien		
16:30-16:50	Jumi Oh		
16:50-17:10	Nyamdavaa Tsegmid		
18:00-	Dinner		

Day by Day

August 13 [Thursday]

Korea Standard Time

Time	Speaker	Title	Chair
09:45-10:00	Opening Remark		
10:00-10:30	C. A. Morales (Federal Univ. of Rio)	On positively expansive semiflows	Keonhee Lee (Chungnam National Univ.)
10:30-11:00	Xiao Wen (Beihang Univ.)	No-shadowing for singular hyperbolic sets with a singularity	
11:00-11:10	Chatting & Break		
11:10-11:30	Woochul Jung (Konyang Univ. Hospital)	Empirical measures of a dynamical system and its applications	Jaehyun Ahn (Chungnam National Univ.)
11:30-11:50	Yinong Yang (Beihang Univ.)	A study of dynamics on noncompact metrics spaces	
11:50-12:10	Meihua Dong (Yanbian Univ.)	Gromov-Hausdorff stability for group actions	
12:10-14:00	Lunch		
14:00-14:50	Homecoming Ceremony & Photo Time		
14:50-15:00	Chatting & Break		
15:00-15:30	Tarun Das (Univ. of Delhi)	Sightseeing stability in pointwise dynamics	Namjip Koo (Chungnam National Univ.)
15:30-16:00	Khosro Tajbakhsh (Tarbiat Modares Univ.)	On topology of pre-orbits under non-injective endomorphisms	
16:00-16:10	Chatting & Break		
16:10-16:30	Le Huy Tien (Vietnam National Univ. at Hanoi)	A note on mild expansivity	Sang Hoon Lee (Chungnam National Univ.)
16:30-16:50	Jumi Oh (Sungkyunkwan Univ.)	A type of shadowing for non-conservative systems	
16:50-17:10	Nyamdavaa Tsegmid (Mongolian National Univ. of Education)	Dynamics of random dynamical systems	
18:00-	Dinner		

Korea Standard Time

Time	Speaker	Title	Chair
10:00-10:20	Nhan Phu Chung (Sungkyunkwan Univ.)	Barycenters and optimal transport	Hark-Mahn Kim (Chungnam National Univ.)
10:20-10:40	Hwan-Yong Shin (Chungnam National Univ.)	Ulam type stability of a quadratic equation in fuzzy modular algebras	
10:40-11:00	Bowon Kang (Chungnam National Univ.)	Various types of the chaos for topological dynamics	
11:00-11:10	Chatting & Break		
11:10-11:30	Yoongjeong Yang (Chungnam National Univ.)	Complex surfaces of general type from the viewpoint of Enriques-Kodaira classification	Dongsoo Shin (Chungnam National Univ.)
11:30-11:50	Bomi Shin (Chungnam National Univ.)	Recent topics in topological dynamics	
11:50-12:10	Jiweon Ahn (Chungnam National Univ.)	Various definitions of shadowable measures	
12:10-14:00	Lunch		
14:00-14:20	Seunghee Lee (Konyang Univ. Hospital)	Stability theory and its applications	Tarun Das (Univ. of Delhi)
14:20-14:40	Ngocthach Nguyen (Chungnam National Univ.)	From finite to infinite dimensional dynamical systems	
14:40-15:00	Mohanmmadreza Bagherzad (Behin Andishan Rayyar Research Group)	From Modeling and simulation to data analysis: applications of mathematics in humanities and policymaking	
15:00-17:00	<div>Discussion Time</div> <div>Tarun Das (Univ. of Delhi)</div> <div>Khosro Tajbakhsh (Tarbiat Modares Univ.)</div> <div>Le Huy Tien (Vietnam National Univ. at Hanoi)</div> <div>Nyamdavaa Tsegmid (Mongolian National Univ. of Education)</div> <div>Mohanmmadreza Bagherzad (Behin Andishan Rayyar Research Group)</div> <div>Xiao Wen (Beihang Univ.)</div> <div>Yinong Yang (Beihang Univ.)</div> <div>Meihua Dong (Yanbian Univ.)</div> <div>Lu Gang (Guangzhou College of Technology and Business)</div> <div>C. A. Morales (Federal Univ. of Rio)</div>		Keonhee Lee (Chungnam National Univ.)

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Day 1

1-1 C. A. Morales*(Federal University of Rio de Janeiro) : On positively expansive semiflows

We show that if a semiflow of a compact metric space satisfies the kind of positive expansiveness defined in [1], then the space is a finite union of closed orbits of the semiflow. Afterwards, we discuss alternative notions of positive expansivity for semiflows.

REFERENCES

- [1] J. F. Alves, M. Carvalho and J. Siqueira, Equilibrium states for impulsive semiflows, *J. Math. Anal. Appl.*, **451**(2017), 839-857.

1-2 Xiao Wen*(Beihang University), Lan Wen(Peking University) : No-shadowing for singular hyperbolic sets with a singularity

We prove that every singular hyperbolic chain transitive set with a singularity does not admit the shadowing property. Using this result we show that if a star flow has the shadowing property on its chain recurrent set then it satisfies Axiom A and the no-cycle conditions; and that if a multisingular hyperbolic set has the shadowing property then it is hyperbolic. This is joint work with Lan Wen.

1-3 Woochul Jung*(Konyang University Hospital) : Empirical measures of a dynamical system and its applications

A dynamical systems is a pair (X, f) consisting of a compact metric space (X, d) and a continuous map $f : X \rightarrow X$. Define *empirical measure* of $x \in X$ as

$$\varepsilon_n(x) = \frac{1}{n} \sum_{j=0}^{n-1} \delta_{f^j(x)},$$

where δ_y is the Dirac measures at $y \in X$. We first study concepts of empirical measures, physical measures and physical-like measures as previous results. In this talk, we introduce properties of applications of such measures.

1-4 Yinong Yang*(Beihang University) : A study of dynamics on noncompact metrics spaces

In this talk, we present some results of dynamics on noncompact metric spaces. In particular, introduce the notions of expansiveness, shadowing property and topological stability for group actions on noncompact metric spaces and give a version of Walters's stability theorem for group actions on locally compact metric spaces. Moreover, we show that if G is a finitely generated virtually nilpotent group and there exists $g \in G$ such that T_g is expansive and has the shadowing property then T is topologically stable.

1-5 Meihua Dong*(Yanbian University) : Gromov-Hausdorff stability for group actions

In this talk, I will introduce some results about Gromov-Hausdorff stability for group actions and moreover I will introduce Yanbian University and the math department of Yanbian University.

1-6 Tarun Das*(University of Delhi) : Sightseeing stability in pointwise dynamics

We shall undertake a journey starting from stability theorem due to Walters, on way shall discuss some recent results by researchers in the related direction and shall conclude giving glimpses of some of our findings.

1-7 Khosro Tajbakhsh*(Tarbiat Modares University), Saeed Azimi(Tarbiat Modares University), Nikita Begun(Tarbiat Modares University) : On topology of pre-orbits under non-injective endomorphisms

It is well known for non-injective endomorphisms that if for every point the pre-orbit is dense in the manifold then the endomorphism is transitive (i.e. there exists a point that its orbit is dense in the manifold). But it has not yet been completely investigated that what are the necessary conditions that make the pre-orbits of each and every point dense in the whole manifold? A more conclusive question is about the relation between the topology of pre-images of a point, the α -limit set of that point and the properties of the endomorphism. An important class of endomorphisms are Anosov maps and the mentioned question relate to the important investigation about the transitivity of Anosov maps. There are several works regarding the transitivity and robust transitivity. Almost all of the researches on this matter build up on the known dynamical and topological theorems, but in this work, we take a novel straight-forward constructional approach; we study the pre-images of a point and then their relation with each other, the pre-orbit, and the α -limit set. We answer the question about the density of pre-orbits of points under the linear toral endomorphisms, and also investigate the situation under endomorphisms of on a 2-dimensional manifold. In the linear case we make a great use of the integral lattice properties of the points of \mathbb{T}^m in the universal cover \mathbb{R}^m . Then we show that *Absolutely Hyperbolicity* is the enough condition for a linear toral endomorphism to make the pre-orbits of each and every point dense in \mathbb{T}^m . In the general case since we cannot use integral lattice properties as well as the linear case, we introduce new concepts to address the topology of pre-images and the relation between them. As our first step we investigate the situation on the 2-dimensional manifold and show that under certain conditions the pre-images of the points under Anosov endomorphisms are dense.

The concept of *mild expansivity* is introduced and studied in [2]. A homeomorphism f on a compact metric space X is said to be *mild expansive* if there is $\delta > 0$ such that

$$(1) \quad \lim_{n \rightarrow \pm\infty} \text{diam } \Gamma_\delta(f^n(x)) = 0, \quad \forall x \in X,$$

where $\text{diam} A = \sup\{d(x, y) : x, y \in A\}$ and

$$\Gamma_\delta(x) = \{y \in X : d(f^n(x), f^n(y)) \leq \delta \text{ for all } n \in \mathbb{Z}\}.$$

Mild expansivity seems to be a natural and effective generalization of expansivity. In combining with shadowing property, mild expansivity gives rich implications including a mild version of the Walters's theorem on topological stability, and the Spectral Decomposition Theorem.

In this talk, we propose a concept of *weakly mild expansive* as an improvement of mild expansivity, using \liminf instead of \lim . This is motivated from the idea about Lyapunov exponents in classical theory of dynamical systems.

Definition. A homeomorphism f on a compact metric space X is said to be *weakly mild expansive* if there is $\delta > 0$ such that

$$(2) \quad \liminf_{n \rightarrow \pm\infty} \text{diam } \Gamma_\delta(f^n(x)) = 0, \quad \forall x \in X.$$

As (1) implies (2), mild expansivity is stronger than weakly mild expansivity. We will discuss about weakly mild version of the Walters's theorem on topological stability, and the Spectral Decomposition Theorem.

REFERENCES

- [1] N. Aoki, K. Hiraide, *Topological Theory of Dynamical Systems: Recent Advances*, North-Holland Mathematical Library (Volume 52), 1994.
- [2] Huy-Tien Le, Keonhee Lee, Ngoc-Thach Nguyen, *Spectral decomposition and stability of mild expansive systems*, Topological Methods in Nonlinear Analysis, 2020 (accepted).

- 1-9** Jumi Oh*(Sungkyunkwan University), Manseob Lee(Mokwon University), Xiao Wen(Beihang University) : A type of shadowing for non-conservative systems
-

The shadowing property is fundamental to observe the dynamical systems having the hyperbolic structure. In the last few years, many dynamists have studied various shadowing properties, and its relationship with structural stability and hyperbolicity. In this talk, we introduce the new notion of shadowing property which is the generalized shadowing property, for diffeomorphisms on a compact smooth manifold. And we study the structural stability of a system having the generalized shadowing property.

- 1-10** Nyamdavaa Tsegmid*(Mongolian National University of Education), Zorigt Choinhor(Mongolian National University of Education), Azjargal Enkhbayar(Mongolian National University of Education) : Dynamics of random dynamical systems
-

In this talk, we introduce the concept of ω -expansive of random map on compact metric spaces \mathcal{P} . Also we introduce the definitions of positively, negatively shadowing and shadowing property in RDS.

Day 2

2-1 Nhan Phu Chung*(Sungkyunkwan University) : Barycenters and optimal transport

Recently unbalanced optimal transport problems and various generalized Wasserstein distances on the space of finite measures have been introduced and studied by various authors. In this talk, we will present the existence, uniqueness of barycenters in Hellinger-Kantorovich spaces and generalized Wasserstein spaces. We also characterize Hellinger-Kantorovich barycenters via homogeneous multimarginal problems. These are joint works with Minh-Nhat Phung and Thanh-Son Trinh.

2-2 Hwan-Yong Shin*(Chungnam National University), Hark-Mahn Kim(Chungnam National University) : Ulam type stability of a quadratic equation in fuzzy modular algebras

In this talk, we find the solution of the following quadratic functional equation

$$n \sum_{1 \leq i < j \leq n} Q(x_i - x_j) = \sum_{i=1}^n Q\left(\sum_{j \neq i} x_j - (n-1)x_i\right)$$

which is derived from the gravity of the n distinct vectors x_1, \dots, x_n in an inner product space, and prove that the stability results of the \mathcal{A} -quadratic mappings in μ -complete convex fuzzy modular $*$ -algebras without using lower semicontinuity and β -homogeneous property.

- 2-3 Bowon Kang*(Chungnam National University) : Various types of the chaos for topological dynamics
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In this talk, we discuss various types of the chaos for topological dynamics and their relationship.

- 2-4 Yoonjeong Yang*(Chungnam National University) : Complex surfaces of general type from the viewpoint of Enriques-Kodaira classification
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In this talk I will introduce the Enriques-Kodaira classification for n -dimensional compact connected complex manifolds, and briefly mention the classification of surfaces (complex dimension 2) using this. And also I'll introduce that what the Euler characteristic χ and the canonical line bundle \mathcal{K} used here mean geometrically.

- 2-5 Bomi Shin*(Chungnam National University) : Recent topics in topological dynamics
-

In this talk, we introduce concepts of topological dynamics. We show recent interests and results in two respects. One is genericity of dynamical measures, and the other is continuous dynamical systems with non-isolated singularities.

2-6 Jiweon Ahn*(Chungnam National University) : Stability of measure expansivity on C^2 -topology

Many studies on the stability of a given dynamical systems have been studied primarily on C^1 -topology. However, it is very important to study on C^2 -topology to study dynamics with properties that are slightly more similar to given dynamics. In this talk, we prove the following;

Let Λ be a compact invariant set for a C^2 diffeomorphism f with a dominated splitting. If f is C^2 -robustly measure expansive, then Λ is hyperbolic.

2-7 Seunghee Lee*(Konyang University Hospital) : Stability theory and its applications

While training error of most deep neural networks degrades as the depth of the network increases, residual networks appear to be an exception. We introduce that the main reason for this is the Lyapunov stability of the gradient descent algorithm and discuss whether it makes sense to extend it to other stability theories.

2-8 Keonhee Lee(Chungnam National University), Ngothach Nguyen*(Chungnam National University) : From finite to infinite dimensional dynamical systems

In this talk, we discuss some recent topics on finite dimensional dynamical systems and its applications to infinite dimensional dynamical systems induced by partial differential equations.

- 2-9 Mohammadreza Bagherzad*(Behin Andishan Rayyar Research Group) : From Modeling and simulation to data analysis: applications of mathematics in humanities and policymaking
-

Mathematical approaches are widely used by researchers in the field of humanities to have a better interpretation of real-world events, and to predict future trends of a social or political problem. More important these methods help policy-makers to perform scenario analysis. In this talk, I am going to present examples of applications of modeling and simulation in political and social sciences. Also, I am going to show how we can apply these methods to predict the future of the spread of COVID-19 in the world.

- 2-10 Tarun Das(University of Delhi),
 Khosro Tajbakhsh(Tarbiat Modares University),
 Le Huy Tien(Hanoi University of Science, Vietnam National University),
 Nyamdavaa Tsegmid(Mongolian National University of Education),
 Mohammadreza Bagherzad(Behin Andishan Rayyar Research Group),
 Xiao Wen(Beihang University),
 Yinong Yang(Beihang University),
 Meihua Dong(Yanbian University),
 Lu Gang(Guangzhou College of Technology and Business),
 C. A. Morales(Federal University of Rio de Janeiro) : Discussion Time
-

Discussion Time

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