ICM TAIPEI, TAIWAN 2014

Satellite Conference

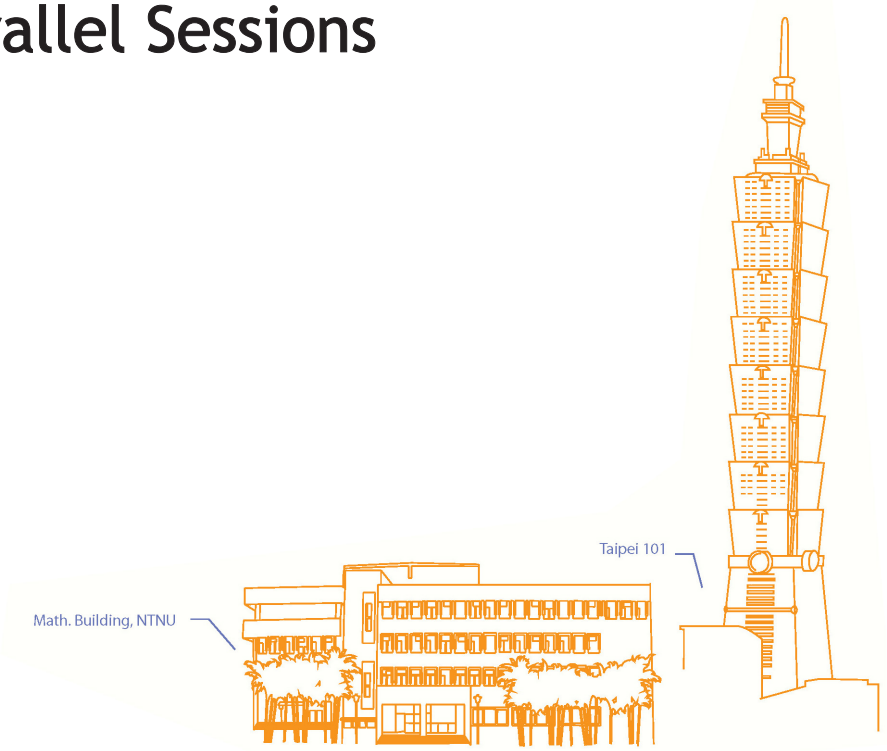
The Fourth Asian Conference on Nonlinear Analysis and Optimization

August 5-9, 2014

Department of Mathematics
National Taiwan Normal University
Taipei, Taiwan

Program Book

CONTENTS



Welcome Message



Dear friends and colleagues:

On behalf of the Organizing Committee, it is our great pleasure and honor to invite you to participate in the ICM Satellite Conference 2014: The Fourth Asian Conference on Nonlinear Analysis and Optimization, which is held at the Department of Mathematics, National Taiwan Normal University, Taipei, Taiwan on August 5-9, 2014.

The Asian Conference on Nonlinear Analysis and Optimization (NAO-Asia) takes place every two years, which aims to provide a forum for researchers and practitioners interested in the topics related to nonlinear analysis and optimization. Building on the success of previous three NAO-Asia conferences, which took place in Japan and Thailand, the 4th conference has a very exciting program with 15 Keynote Speeches and more than 30 parallel sessions. Moreover, it has been approved as a Satellite Conference of ICM 2014. With your important contributions through oral presentations as well as participation in the conference, we believe that the 2014 ICM Satellite Conference: NAO would be more integrated and well-balanced.

In addition to the scientific program, you will benefit from the wonderful time in Taipei by emerging in the beautiful landscape and experiencing the rich cultural background, bringing home an unforgettable memory.

Once again, it is our great pleasure that you come for the 2014 ICM Satellite Conference: NAO. We hope you enjoy the conference and your stay in Taipei.

Yours sincerely,

Jein-Shan Chen
Professor and Chairman
Department of Mathematics
National Taiwan Normal University

Mau-Hsiang Shih
Professor
Department of Mathematics
National Taiwan Normal University

Do Sang Kim
Professor
Department of Applied Mathematics
Pukyong National University

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Prof. Ching-Yu Yang	Department of Mathematics, National Taiwan Normal University

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The Organizing Committee gratefully acknowledges the financial contribution from the following sponsors.

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National Taiwan Normal University

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Taipei City Government

Ministry of Science and Technology, Taiwan

Mathematics Research Promotion Center,
(Ministry of Science and Technology, Taiwan)

National Taiwan Normal University

Naitonal Center for Theoretical Science
Mathematics Division (Taipei Office)

Taiwan Association for Mathematics Education

Yuan Ze University

Conference Information

Conference Venue

GongGuan Campus, National Taiwan Normal University (NTNU)

Address: No. 88 Section 4, Tīng-Chou Rd, Wenshan District, Taipei 11677, Taiwan (R.O.C.)
Tel: +886-2-77346600
Website: http://www.math.ntnu.edu.tw/main.php

Instruction:

A: Jhongjheng Hall

- Registration
- Lunch
- Welcome Reception & Banquet

B: General Hall

- Keynote Speech (Intl. Conference Room, 3F)
- Session A (Intl. Conference Room, 3F)
- Secretariat & Preview Room (2F)
- Coffee Break (2F)
- Luggage Storage (Preview Room and Secretariat Room, 2F)

C: Science Education Building

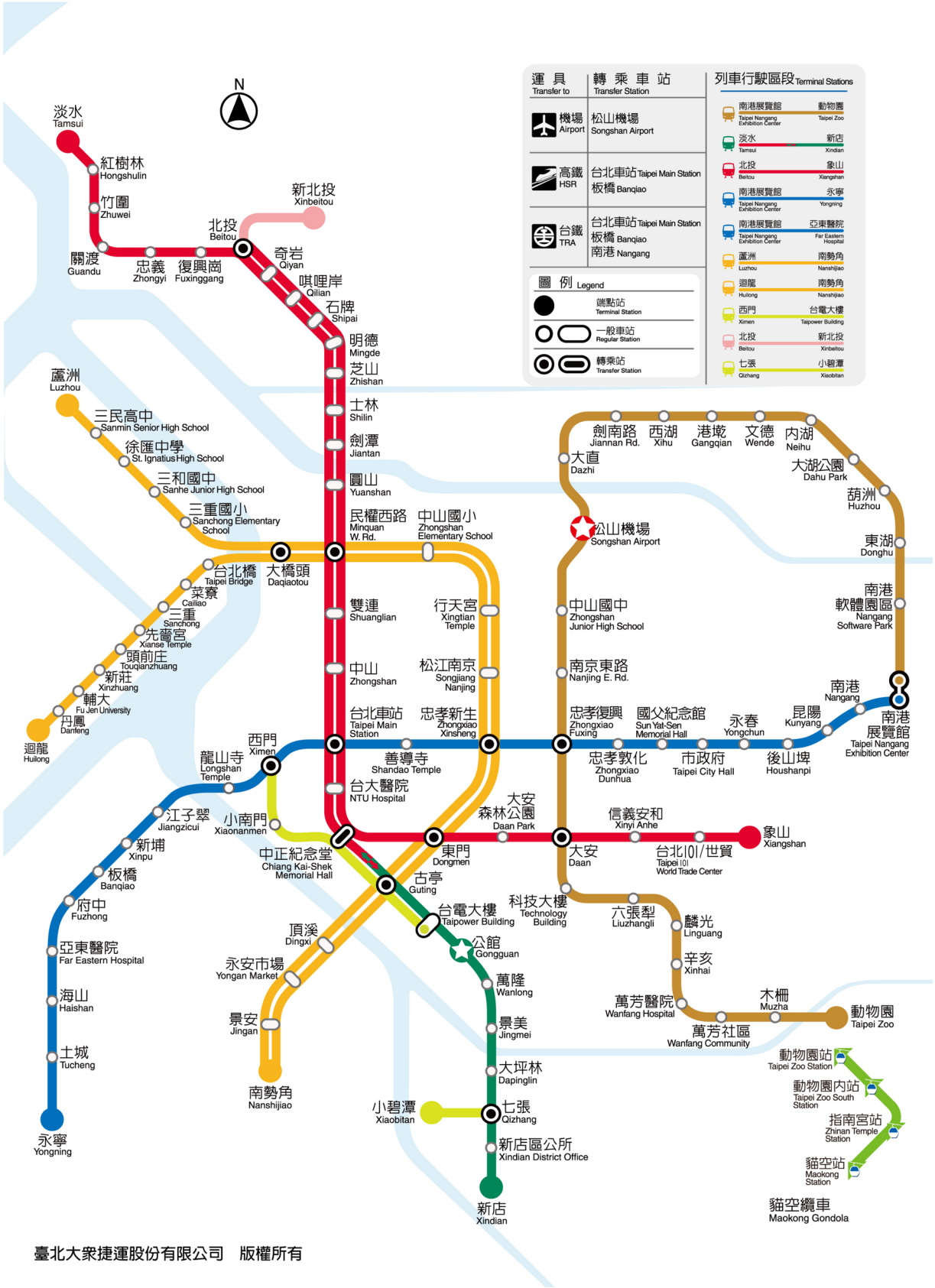
- Session B (Speech Room, 5F)
- Session C (Conference Room, 5F)

D: Mathematics Building

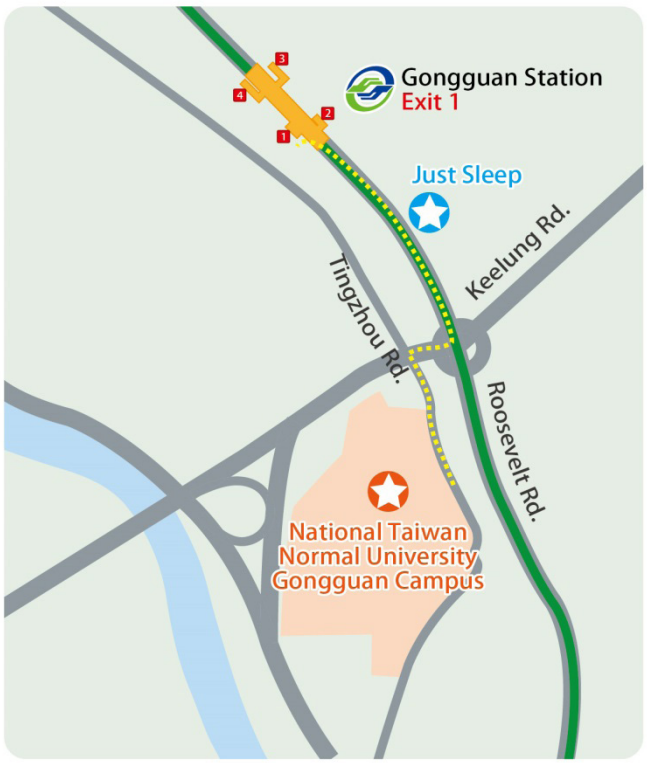
- Session D (M212, 2F)
- Session E, (M210, 2F)

Transportation

MRT Route Map



MRT GongGuan Station to National Taiwan Normal University - GongGuan Campus



Registration

The Registration Desk will be open at the ***Jhongjheng Hall***, open hours are as follows:

Tuesday	August 5, 2014	09:00-17:00
Wednesday	August 6, 2014	08:30-17:00
Thursday	August 7, 2014	08:30-17:00
Friday	August 8, 2014	08:30-15:30

Participant's Badge

All participants will receive the badge upon registration, please wear and clearly display your name badge to attend at all times during the conference. Access to the welcome reception and banquet, a proper name badge is needed.

WIFI

NTNU has free wireless on the entire campus.

SSID: ntnu
Account: math1
Password: 2014icm

Group Photograph

Time: 17:40-18:00, on Thursday, August 7
Location: Entrance of Jhongjheng Hall.

Language

The official language of the conference is **English**.

Conference Policy

- Smoking is prohibited at all times in the conference rooms and on the entire campus.
- Please switch your mobiles off or to vibration mode during all sessions.

Preview Room

Locaiton: 2F, General Hall

Speakers have the responsibility for their presentation functionalities, including the whole data file, the compatibility of data with the conference projection system, the USB flash drive, etc. Please check them prior to your presentation to make sure that they could be displayed correctly.

Open Hours

Tuesday	August 5, 2014	10:00-17:00
Wednesday	August 6, 2014	08:30-17:00
Thursday	August 7, 2014	08:30-17:00
Friday	August 8, 2014	08:30-15:30

Instructions for Oral Presenters

- The computers of the conference are being supplied with Windows 7 and Office 2007. Slide projection will not be available.
- If using a Power Point presentation, please note you need to bring it on a CD or USB storage device and load it on the conference's computer in the conference room or preview room during the break prior to your session. You are also encouraged to bring your own laptop computer as a back-up.
- If combing video films with your presentation, please make sure to check it in the conference room where your lecture is taking place before the start of the session, or during a coffee break prior to your session.
- Macintosh users: Conference doesn't provide Macintosh computer, please note that you need to supply your own and confirm that it has a VGA socket for external device. Please check it in the conference room where your lecture is taking place before the start of the session, or during a coffee break prior to your session.

Social Program

Welcome Reception

Date: 18:00-21:00, Tuesday, August 5, 2014

Venue: Jhongheng Hall, National Taiwan Normal University – GongGuan Campus

Banquet

Date: 18:00-21:00, Thursday, August 7, 2014

Venue: Jhongheng Hall, National Taiwan Normal University – GongGuan Campus

Shuttle bus

Shuttle bus is available between Howard Civil Service International House and National Taiwan Normal University – GongGuan Campus. Bus schedule is as follows:

Date / Time	Departure	Arrival
August 5 09:20	Howard Civil Service International House	National Taiwan Normal University GongGuan Campus
August 5 20:30	National Taiwan Normal University GongGuan Campus	Howard Civil Service International House
August 6 08:20	Howard Civil Service International House	National Taiwan Normal University GongGuan Campus
August 7 08:20	Howard Civil Service International House	National Taiwan Normal University GongGuan Campus
August 7 20:30	National Taiwan Normal University GongGuan Campus	Howard Civil Service International House
August 8 08:20	Howard Civil Service International House	National Taiwan Normal University GongGuan Campus

＊ Shuttle bus service is not available in the afternoon of August 6 and August 8

City Tour

Date: Saturday, August 9, 2014

Time	Location
09:00-9:10	National Taiwan Normal University (NTNU) -- GongGuan Campus
10:10-11:30	Yeh-Liu Geopark
12:00-13:00	Lunch : Pacific Green Bay Hotel
13:30-15:00	Dharma Drum Mountain (World Center for Buddhist Education)
16:00-	Taipei 101 & Xin-Yi Commercial Center (Free Time, no arrangement of return shuttle bus)

＊ **There is a shuttle bus from Howard International House to NTNU -- GongGuan Campus at 8:30.**

Yeh-Liu Geopark

Yeliu is a cape in the town of Wanli, New Taipei City, Taiwan. The cape, known by geologists as the Yeliu Promontory, forms part of the Daliao Miocene Formation. It stretches approximately 1,700 metres into the ocean and was formed as geological forces pushed Datun Mountain out of the sea.

A distinctive feature of the cape is the hoodoo stones that dot its surface. These shapes can be viewed at the Yehliu Geopark operated by the North Coast and Guanyinshan National Scenic Area administration. A number of rock formations have been given imaginative names based on their shapes. The best known is the "Queen's Head", an iconic image in Taiwan and an unofficial emblem for the town of Wanli. Other formations include the "Fairy Shoe," the "Beehive," the "Ginger Rocks" and the "Sea Candles."
http://www.ylgeopark.org.tw/ENG/info/YlIntroduction_en.aspx

Dharma Drum Mountain (World Center for Buddhist Education)

Dharma Drum Mountain (DDM) is an international Buddhist spiritual, cultural, and educational foundation founded by late Ch'an (Zen) Master Sheng-yen. The international headquarters of this organization is located at Jinshan District, New Taipei City, Taiwan (ROC).

Dharma Drum Mountain is one of the most influential Buddhist organizations in Chinese Buddhism. In Taiwan, it is considered one of the "Four Heavenly Kings" or four major Buddhist temples of Taiwanese Buddhism, along with Tzu Chi, Fo Guang Shan, and Chung Tai Shan. Its impact on Buddhist circles and both Eastern and Western societies stems from the vision, charisma, and life experience of Sheng-yen.
http://www.dharmadrum.org/

Taipei 101 & Xin-Yi Commercial Center

Taipei 101 (formerly known as the Taipei World Financial Center, is a landmark skyscraper located in Xinyi District, Taipei, Taiwan. The tower has served as an icon of modern Taiwan ever since its opening. Fireworks launched from Taipei 101 feature prominently in international New Year's Eve broadcasts and the structure appears frequently in travel literature and international media.

Taipei 101 comprises 101 floors above ground and 5 floors underground. The building was architecturally created as a symbol of the evolution of technology and Asian tradition. Its postmodernist approach to style incorporates traditional design elements and gives them modern treatments. The tower is designed to withstand typhoons and earthquakes. A multi-level shopping mall adjoining the tower houses hundreds of stores, restaurants and clubs.
http://www2.taipei-101.com.tw/en/Tower/index_tower.asp

Program at a Glance

	August 5 (TUE)	August 6 (WED)	August 7 (THU)	August 8 (FRI)		August 9 (SAT)
09:00 09:45	Registration	Keynote Speech (5) Prof. W. Takahashi	Keynote Speech (9) Prof. L.-Q. Qi	Keynote Speech (13) Prof. S. Park		City Tour
09:45 10:30		Keynote Speech (6) Prof. A. T.-M. Lau	Keynote Speech (10) Prof. Y.-Y. Ye	Keynote Speech (14) Prof. D. S. Kim		
10:30 10:50		Coffee Break				
10:50 11:00	Opening Ceremony	Parallel Session II-A	Parallel Session IV-A	Parallel Session VI-A		
11:00 11:45	Keynote Speech (1) Prof. T. Rockafellar	Parallel Session II-B	Parallel Session IV-B	Parallel Session VI-B		
		Parallel Session II-C	Parallel Session IV-C	Parallel Session VI-C		
11:45 12:30	Keynote Speech (2) Prof. B. Mordukhovich	Parallel Session II-D	Parallel Session IV-D	Parallel Session VI-D		
		Parallel Session II-E	Parallel Session IV-E	Parallel Session VI-E		
12:30 14:00	Lunch					
14:00 14:45	Keynote Speech (3) Prof. F.-L. Lin	Keynote Speech (7) Prof. K. Goebel	Keynote Speech (11) Prof. F. Bonnans	Keynote Speech (15) Prof. S. Akashi		
14:45 15:30	Keynote Speech (4) Prof. M.-H. Shih	Keynote Speech (8) Prof. B. Ricceri	Keynote Speech (12) Prof. J. E. M- Legaz	14:45 15:10	Coffee Break	
15:30 16:00	Coffee Break			15:10 16:50	Parallel Session VII-A	
16:00 17:40	Parallel Session I-A	Parallel Session III-A	Parallel Session V-A		Parallel Session VII-B	
	Parallel Session I-B	Parallel Session III-B	Parallel Session V-B		Parallel Session VII-C	
	Parallel Session I-C	Parallel Session III-C	Parallel Session V-C		Parallel Session VII-D	
	Parallel Session I-D	Parallel Session III-D	Parallel Session V-D			
	Parallel Session I-E	Parallel Session III-E	Parallel Session V-E			
18:00 21:00	Welcome Reception		Banquet			

Location:

Keynote speech /session A: International Conference Room, 3F, General Hall

Session B: Speech Room, 5F, Science Education Building

Session C: Conference Room, 5F, Science Education Building

Session D: M212, 2F, Mathematics Building

Session E: M210, 2F, Mathematics Building

Program on August 5 (Tuesday Morning and Afternoon)

Keynote Speech (1)-(4)

Location: International Conference Room , 3F, General Hall **Chair: Wataru Takahashi**

11:00-11:45 Full Stability of Local Solutions in Parameterized Optimization
Ralph Tyrrell Rockafellar (University of Washington, U.S.A.)

11:45-12:30 Optimal Control of the Sweeping Process Generated by Moving Convex Polyhedra
Boris Mordukhovich (Wayne State University, U.S.A.)

Location: International Conference Room , 3F, General Hall **Chair: Jein-Shan Chen**

14:00-14:45 Developing Prospective Teachers' Competencies to Understand Students' Mathematics Understanding
Fou-Lai Lin (National Taiwan Normal University, Taiwan)

14:45-15:30 Computer Architecture Underlying Mesoscopic Neurocomputing
Mau-Hsiang Shih (National Taiwan Normal University, Taiwan)

Parallel Session I-A (Applications of Mathematical Modeling)

Location: International Conference Room , 3F, General Hall **Chair: Hong-Kun Xu**

16:00-16:25 The ℓ_p Regularization for the Split Feasibility Problem
Hong-Kun Xu (National Sun Yat-Sen University, Taiwan)

16:25-16:50 Effects of Layer Thickness and Edge Conditions to Thermoelastic Characteristics on Thermal Barrier Coatings
Jaegwi Go (Changwon National University, Korea)

16:50-17:15 Critical Numbers in the Theory of Thermal Ignition
Easwaran Balakrishnan (Sultan Qaboos University, Oman)

17:15-17:40 Vehicle Routing Problem for Multi Compartment and Multi Trip with Soft Time Windows
Phannipa Kabcome (Chiang Mai University, Thailand)

Parallel Session I-B (Mathematics of Finance and Engineering)

Location: Speech Room, 5F, Science Education Building **Chair: George Yuan**

16:00-16:25 G-Risk: A New Methodology for Measuring Risk
George Yuan (Tongji University, China)

16:25-16:50 On Absorbing Set of States and Learning Rates in Self-Organizing Maps
Mitsuhiro Hoshino (Akita Prefectural University, Japan)

16:50-17:15 How to Find Jump-times of a Black-Scholes Model with Jumps for Nikkei 225 Stock Index?
Shuya Kanagawa (Tokyo City University, Japan)

Program on August 5 (Tuesday Afternoon)

Parallel Session I-C (Conic Optimization)

Location: Conference Room, 5F, Science Education Building **Chair: Jiyuan Tao**

16:00-16:25 Linear Complementarity Problem with Pseudomonotonicity on Euclidean Jordan Algebras
Jiyuan Tao (Loyola University, U.S.A.)

16:25-16:50 Some Useful Inequalities via Trace Function Method in Euclidean Jordan Algebras
Yu-Lin Chang (Math Dept., National Taiwan Normal University, Taiwan)

Parallel Session I-D (Differential Equations and Applications)

Location: M212, 2F, Mathematics Building **Chair: Tiaza Bem**

16:00-16:25 Multi-Stability of the Network of Relaxation Oscillators Coupled by Gap Junctions
Tiaza Bem (Polish Academy of Sciences, Poland)

16:25-16:50 Application of a Fixed Point Theorem in Partial Ordered Sets to Boundary Value Problems for 3.5 Order Differential Equations
Masashi Toyoda (Tamagawa University, Japan)

16:50-17:15 Existence of Second Order Neutral Integral Differential Equations of Sobolev Type in Banach Spaces
Radhakrishnan Bheeman (PSG College of Technology, India)

17:15-17:40 Neural Network Models for Quadratic Programming with Second-Order Cone Constraint
Xiao-Ren Wu (Department of Mathematics, National Taiwan Normal University, Taiwan)

Parallel Session I-E (Mathematics Education)

Location: M210, 2F, Mathematics Building **Chair: Kimiaki Shinkai**

16:00-16:25 Mathematical Activities Based on Spiral Learning: A Case Study on Japanese Elementary School Students
Kimiaki Shinkai (Tokyo Kasei Gakuin University, Japan)

16:25-16:50 Basic Education for Mathematics in Waseda University
Hiroaki Uesu (Waseda University, Japan)

16:50-17:15 How Future English Teachers Comprehend the Conception of Statistics
Khairiani Idris (National Taiwan Normal University, Taiwan)

Program on August 6 (Wednesday Morning)

Keynote Speech (5)-(6)

Location: International Conference Room , 3F, General Hall **Chair: Mau-Hsiang Shih**

09:00-09:45 Iterative Methods for Generalized Split Feasibility Problems in Nonlinear Analysis
Wataru Takahashi (Tokyo Institute of Technology, Japan)

09:45-10:30 Amenability and Finite Dimensional Invariant Subspace Properties for Semigroups
Anthony To-Ming Lau (University of Alberta, Canada)

Parallel Session II-A (Minimax Problems and Equilibrium Problems)

Location: International Conference Room , 3F, General Hall **Chair: Jong Soo Jung**

10:50-11:15 Iterative Algorithms for Solving Mixed Equilibrium Problems and Constrained Convex Minimization Problems
Jong Soo Jung (Dong-A University, Korea)

11:15-11:40 Semicontinuity of the Solution Set of Lexicographic Vector Equilibrium Problems
Rabian Wangkeeree (Naresuan University, Thailand)

11:40-12:05 Levitin-Polyak Well-Posedness for Lexicographic Vector Equilibrium Problems
Thanatporn Bantaojai (Department of Mathematics, Faculty of Science, Naresuan University, Thailand)

Parallel Session II-B (Nonlinear Optimization and Global Optimization)

Location: Speech Room, 5F, Science Education Building **Chair: Muddappa Gowda**

10:50-11:15 The Lyapunov Rank of a Proper Cone
Muddappa Gowda (University of Maryland, Baltimore County, U.S.A)

11:15-11:40 Weakly Sharp Solutions of Primal and Dual Variational Inequality Problems
Yina Liu (Department of Mathematical Sciences, Xi'an Jiaotong-Liverpool University, China)

11:40-12:05 New Damped-Broyden Methods for Unconstrained Optimization
Mehiddin Al-Baali (Sultan Qaboos University, Oman)

12:05-12:30 Equivalence Conditions for Some Multivalued Iterations in CAT(0) Space
Kyung Soo Kim (Kyungnam University, Korea)

Program on August 6 (Wednesday Morning)

Parallel Session II-C (Variational Inequality and Applications)

Location: Conference Room, 5F, Science Education Building **Chair: Somyot Plubtieng**

10:50-11:15 Existence Theorems for Relaxed η-α Pseudomonotone and Strictly η-Quasimonotone Generalized Variational-Like Inequalities
Somyot Plubtieng (Naresuan University, Thailand)

11:15-11:40 An Indirect Method of Nonconvex Variational Problems in Asplund Spaces: The Case for Saturated Measure Spaces
Nobusumi Sagara (Hosei University, Japan)

11:40-12:05 Critical Point Theory and Variational Methods with Applications to Electronic Structure Models within Quantum Chemistry
Michael Melgaard (University of Sussex, United Kingdom)

12:05-12:30 Strong Convergence Theorem for Widely More Generalized Hybrid Mappings in Hilbert Spaces
Mayumi Hojo (Shibaura institute of technology, Japan)

Parallel Session II-D (Fixed Point Theory and Applications)

Location: M212, 2F, Mathematics Building **Chair: Shue-Chin Huang**

10:50-11:15 Viscosity Approximations for Weak Contractions
Shue-Chin Huang (National Dong Hwa University, Taiwan)

11:15-11:40 Existence and Convergence of Common Fixed Points via an Iterative Projection Technique for Two Strict Pseudo- Contractions in Hilbert Spaces
Narongrit Puturong (Naresuan University, Thailand)

11:40-12:05 Some Mappings Defined on a Bounded Subset of a Uniformly Convex Banach Space
Yukio Takeuchi (Takahashi Institute for Nonlinear Analysis, Japan)

12:05-12:30 The Halpern Iteration Procedure with Two Strongly Quasinonexpansive Mappings in CAT(1) Spaces
Koichi Nakagawa (Toho University, Japan)

Program on August 6 (Wednesday Morning)

Parallel Session II-E (Mathematics Education)

Location: M210, 2F, Mathematics Building **Chair: Yuan-Shun Lee**

10:50-11:15 The Study of Mathematics Learning Opportunities for Fourth Graders in Taiwan
Yuan-Shun Lee (University of Taipei, Taiwan)

11:15-11:40 The Enactment of In-Service Primary Teachers' Knowledge for Teaching Ratio and Proportion in Teaching Practice
Chi-Tai Chu (National Taiwan Normal University, Taiwan)

11:40-12:05 Intern Teachers' Concept Images for Mathematics Teaching Inquiry and Its Application: Through The Aspect of Students' Mathematical Thinking
Chia-Jui Hsieh (National Taiwan Normal University, Taiwan)

12:05-12:30 What Can We See from CTP4 Results? The Predictors of Mathematics Performance
Pei-Chen Wu (National Taiwan Normal University, Taiwan)

Program on August 6 (Wednesday Afternoon)

Keynote Speech (7)-(8)

Location: International Conference Room , 3F, General Hall **Chair: Anthony To-Ming Lau**

14:00-14:45 Selected Examples Connected to Problems in Metric Fixed Point Theory
Kazimierz Goebel (Maria Curie-Sklodowska University, Poland)

14:45-15:30 Some Selected Applications of Certain Minimax Theorems
Biagio Ricceri (Universita di Catania, Italy)

Parallel Session III-A (Geometry of Banach Spaces)

Location: International Conference Room , 3F, General Hall **Chair: Mikio Kato**

16:00-16:25 On the Uniform Non-Squareness of Direct Sums of Banach Spaces
Mikio Kato (Kyushu Institute of Technology, Japan)

16:25-16:50 Multipliers and Invariant Operators in Banach Space Functions on LCA Group
Hang-Chin Lai (National Tsing-Hua University, Taiwan)

16:50-17:15 New Geometrical Notions of Banach Spaces Using ϕ-Direct Sums
Kichi-Suke Saito (Niigata University, Japan)

17:15-17:40 First-Order Sufficient Condition for Minimization of Lower Semicontinuous Functions Using Subdifferentials in Banach Space
Florence Marie Jules (Université des Antilles et de la Guyane, Guadeloupe)

Parallel Session III-B (Nonsmooth Optimization)

Location: Speech Room, 5F, Science Education Building **Chair: Xiao-Qi Yang**

16:00-16:25 Inexact Subgradient Methods for Quasi-Convex Optimization Problems
Xiao-Qi Yang (The Hong Kong Polytechnic University, Hong Kong)

16:25-16:50 S-Lemma with Equality and Its Applications
Ruey-Lin Sheu (National Cheng-Kung University, Taiwan)

Program on August 6 (Wednesday Afternoon)

Parallel Session III-C (Convex Analysis and Set-Valued Analysis)

Location: Conference Room, 5F, Science Education Building **Chair: Kenji Kimura**

16:00-16:25 On a Multicriteria Two-Person Non-Zero-Sum Matrix Game with Set Relations
Kenji Kimura (Niigata Institute of Technology, Japan)

16:25-16:50 Equilibria in Non-Cooperative Games and Cost Allocation for Minimum Cost Spanning Tree Problems
Ming-Hao Ni (Osaka University, Japan)

16:50-17:15 Upper Bound for the 2-Page Linear Crossing Number of Hypercube Graph Q_n via Semidefinite Programming Relaxation
Aroonwan Suebsriwichai (Chiang Mai University, Chiang Mai, Thailand)

Parallel Session III-D (Fixed Point Theory and Applications)

Location: M212, 2F, Mathematics Building **Chair: Lai-Jiu Lin**

16:00-16:25 Variational Inequality Problems over Split Fixed Point Sets of Strict Pseudo-Nonspreading Mappings and Quasi-Nonexpansive Mappings with Applications
Lai-Jiu Lin (National Chang Hua University of Education, Taiwan)

16:25-16:50 Strong Convergence Theorems for Nonlinear Mappings by Halpern's Type Iterations in Banach Spaces
Sachiko Atsushiba (University of Yamanashi, Japan)

16:50-17:15 Some Best Proximity Point Theorems for Some Generalized Proximal Contractions
Pinya Ardsalee (Khon Kaen University, Thailand)

17:15-17:40 Weaker Conditions and Common Fixed Point Theorems in G-Metric Spaces
Deepak Singh (National institute of Technical Teacher Training and Research(NITTTR), Bhopal(M.P.), Ministry of HRD, Govt. of India, India)

Parallel Session III-E (Mathematics Education)

Location: M210, 2F, Mathematics Building **Chair: Jia-Ming Ying**

16:00-16:25 Medical University Students' Change of Belief in a Mathematical Culture Course
Jia-Ming Ying (Taipei Medical University, Taiwan)

16:25-16:50 Conceptualizing Framework of Spatial Literacy : Analyzing, Elaborating, and Synthesizing
Yun-Zu Chen (Department of Mathematics, National Taiwan Normal University, Taiwan)

16:50-17:15 Effects of Segmentation Approach for Middle School Students in Understanding Geometric Proofs
Feng-Lin Lu (Department of Mathematics, National Taiwan Normal University, Taiwan)

Program on August 7 (Thursday Morning)

Keynote Speech (9)-(10)

Location: International Conference Room , 3F, General Hall **Chair: R. T. Rockafellar**

09:00-09:45 Positive Definite and Semi-Definite Tensors

Liqun Qi (The Hong Kong Polytechnic University, China)

09:45-10:30 Data-Driven Optimization

Yinyu Ye (Stanford University, U.S.A.)

Parallel Session IV-A (Applications of Mathematical Modeling)

Location: International Conference Room , 3F, General Hall **Chair: Peng-Wen Chen**

10:50-11:15 A Perfect Match Condition for Point-Set Matching Problems Using the Optimal Mass Transport Approach

Peng-Wen Chen (National Chung Hsing University, Taiwan)

11:15-11:40 A New Linear Relaxation Algorithm for Sum of Linear Ratios Problem with Lower Dimension

Yong-Wen Hu (Muroran Institute of Technology, Japan)

11:40-12:05 Frictional Contact Force Computation of Electrostatically Actuated Microswitch Using Semismooth Newton Method

Chun-Hsu Ko (I-Shou University, Taiwan)

12:05-12:30 Designing Vehicle Suspension and Tire Parameters Using Split and Discard Strategy

Syeda Darakhshan Jabeen (Indian Institute of Technology Kanpur, India)

Parallel Session IV-B (Nonlinear Optimization and Global Optimization)

Location: Speech Room, 5F, Science Education Building **Chair: Gue-Myung Lee**

10:50-11:15 Characterizing Positivity of Difference of SOS-Convex Polynomials and Containment of Semialgebraic Set

Gue-Myung Lee (Department of Applied Mathematics, Pukyong National University, Korea)

11:15-11:40 Superlinearly Convergent Smoothing Newton Continuation Algorithms for Variational Inequalities over Definable Sets

Chek Beng Chua (Nanyang Technological University, Singapore)

11:40-12:05 Interior-Point Algorithms for the Generalized Linear Complementarity Problems

Gyeong-Mi Cho (Dongseo University, Korea)

12:05-12:30 A Global Optimization Method for a Quadratic Reverse Convex Programming Problem

Tamae Akasaka (Niigata University, Japan)

Program on August 7 (Thursday Morning)

Parallel Session IV-C (Game Theory)

Location: Conference Room, 5F, Science Education Building **Chair: Chun-Hsien Yeh**

10:50-11:15 A Strategy Interpretation of the Shapley Value for the Nested Cost Sharing Problem
Chun-Hsien Yeh (Institute of Economics, Academia Sinica, Taiwan)

11:15-11:40 Complement-Associated Games
Yan-An Hwang (Department of Applied Mathematics, National Dong Hwa University, Taiwan)

11:40-12:05 Justifications for the Increasing Serial Cost Sharing Rule
Cheng-Cheng Hu (Department of Economics, National Cheng Kung University, Taiwan)

12:05-12:30 Graphical Analysis on Payoff Functions for Bicriteria Non-Square Matrix Games
Masakazu Higuchi (Graduate School of Science and Engineering, Saitama University, Japan)

Parallel Session IV-D (Fixed Point Theory and Applications)

Location: M212, 2F, Mathematics Building **Chair: Suthep Suantai**

10:50-11:15 Fixed Point Theorems for Nonlinear Mappings and a Semigroup of Some Nonlinear Mappings
Suthep Suantai (Chiang Mai University, Thailand)

11:15-11:40 Variational Inequality with Variational Inequalities and Fixed Point Constraints with Applications
Tsun-Zenn Yu (Nan Kai University of Technology, Taiwan)

11:40-12:05 Viscosity Approximation Process for a Sequence of Quasinonexpansive Mappings
Koji Aoyama (Chiba University, Japan)

12:05-12:30 A New Three Step Iteration and Convergence of Pseudocontractive Mappings
Balwant Singh Thakur (Pt. Ravishankar Shukla University, India)

Parallel Session IV-E (Convex Analysis and Set-Valued Analysis)

Location: M210, 2F, Mathematics Building **Chair: Jong Kyu Kim**

10:50-11:15 Extended Nonlinear Regularized Nonconvex Set-Valued Variational Inequalities
Jong Kyu Kim (Kyungnam University, Korea)

11:15-11:40 On Generalization of Ricceri's Theorem into Set-Valued Maps via Scalarization
Yutaka Saito (Niigata University, Japan)

11:40-12:05 Convexity Properties for Compositions of Set-Valued Map and Monotone Scalarizing Function
Shogo Kobayashi (Niigata University, Japan)

12:05-12:30 Caristi's Random Fixed Point Theorem for Generalized Distance on Polish Space
Areerat Arunchai (Naresuan University, Thailand)

Program on August 7 (Thursday Afternoon)

Keynote Speech (11)-(12)

Location: International Conference Room , 3F, General Hall **Chair: Biagio Ricceri**

14:00-14:45 Second Order Necessary Conditions for Control-Affine Problems with State Constraints
J. Frédéric Bonnans (INRIA/Ecole Polytechnique, Palaiseau, France)

14:45-15:30 On the Monotone Polar and Representable Closures of Monotone Operators
Juan Enrique Martinez-Legaz (Universitat Autonoma de Barcelona , Spain)

Parallel Session V-A (Nonsmooth Optimization)

Location: International Conference Room , 3F, General Hall **Chair: Nguyen Dong Yen**

16:00-16:25 The Mordukhovich Subdifferentials and Directions of Descent
Nguyen Dong Yen (Vietnam Academy of Science and Technology, Vietnam)

16:25-16:50 Numerical Methods for Nonsmooth Optimization Problems with Known Structures
Adil Bagirov (University of Ballarat, Australia)

16:50-17:15 Fractional Programming of Semi-Preinvex Functions
Yi-Chou Chen (Army Academy, Taiwan)

17:15-17:40 Equivalent Statements for Optimality Conditions
Zili Wu (Xi'an Jiaotong-Liverpool University, China)

Parallel Session V-B (Nonlinear Optimization and Global Optimization)

Location: Speech Room, 5F, Science Education Building **Chair: Daishi Kuroiwa**

16:00-16:25 Constraint Qualification for Sufficient Optimality in Minimization Problem with Pseudo-Convex Objective Function
Daishi Kuroiwa (Shimane University, Japan)

16:25-16:50 A Constraint Qualification Characterizing Surrogate Strong and Min-Max Duality
Satoshi Suzuki (Shimane University, Japan)

16:50-17:15 Observation of Convex Optimization Under Locally Lipschitz Constraints
Shunsuke Yamamoto (Shimane University, Japan)

17:15-17:40 A Lagrange-Type Duality Theorem for a DC Programming Problem
Ryohei Harada (Shimane University, Japan)

Program on August 7 (Thursday Afternoon)

Parallel Session V-C (Optimal Control Theory)

Location: Conference Room, 5F, Science Education Building **Chair: Alexander Gornov**

16:00-16:25 Stochastic Algorithms for Global Optimization
Alexander Gornov (Institute for System Dynamics and Control Theory of SB RAS, Russian Federation)

16:25-16:50 Numerical Solution of the Stochastic and Deterministic LQR Problem
Hermann Mena (University of Innsbruck, Austria)

16:50-17:15 Existence Theorems for Monotone Multi-Valued Mappings in Partially Ordered Metric Spaces
Jukrapong Tiammee (Ching Mai University, Thailand)

17:15-17:40 Approximation Methods for Common Solutions of Split Variational Inclusion and Fixed Point Problems in Hilbert Spaces
Narin Petrot (Naresuan University, Thailand)

Parallel Session V-D (Fixed Point Theory and Applications)

Location: M212, 2F, Mathematics Building **Chair:** ***Wei-Shih Du***

16:00-16:25 Some Generalizations of Mizoguchi-Takahashi's Fixed Point Theorem with New Local Constraints
Wei-Shih Du (Department of Mathematics, National Kaohsiung Normal University, Taiwan)

16:25-16:50 Coincidence Points of Weaker Contractions in Partially Ordered Metric Spaces
Ing-Jer Lin (Department of Mathematics, National Kaohsiung Normal University, Taiwan)

16:50-17:15 Best Proximity Points for a New Proximal Contraction
Amitabh Banerjee (Govt. D.B. Girls' P.G. College, Raipur, India)

Parallel Session V-E (Partial Differential Equations and Applications)

Location: M210, 2F, Mathematics Building **Chair: Young-Ho Kim**

16:00-16:25 A Note on the Moment Exponential Stability for Stochastic Functional Differential Equations
Young-Ho Kim (Changwon National University, Korea)

16:25-16:50 Cayley Digraphs of Brandt Semigroups Relative to Green's Equivalence Classes
John Meksawang (Chiang Mai University, Thailand)

16:50-17:15 Unbounded Sets of Solutions of Non-Cooperative Elliptic Systems on Spheres
Piotr Stefaniak (Nicolaus Copernicus University, Faculty of Mathematics and Computer Science, Poland)

Program on August 8 (Friday Morning)

Keynote Speech (13)-(14)

Location: International Conference Room , 3F, General Hall **Chair: Kazimierz Goebel**

09:00-09:45 A Unification of Generalized Fan-Browder Type Alternatives
Sehie Park (National Academy of Sciences, Korea)

09:45-10:30 Optimality Conditions and Duality for Nonconvex Semi-Infinite Multiobjective Optimization Problems
Do Sang Kim (Pukyong National University, Korea)

Parallel Session VI-A (Applications of Mathematical Modeling)

Location: International Conference Room , 3F, General Hall **Chair: Mabel C. Chou**

10:50-11:15 Analysis of a Cross-Hospital Network of Emergency Department Patient Flow
Mabel C. Chou (National University of Singapore, Singapore)

11:15-11:40 On the Mathematical Models Describing the Generation of DNA Damages by Radiation
Yasumasa Saisho (Hiroshima University, Japan)

11:40-12:05 Optimal Path Planning for Watering System
Shu-Ling Cheng (Far East University, Taiwan)

Parallel Session VI-B (Vector Optimization and Set Optimization)

Location: Speech Room, 5F, Science Education Building **Chair: Tamaki Tanaka**

10:50-11:15 Scalarization Technique for Set-Valued Maps
Tamaki Tanaka (Niigata University, Japan)

11:15-11:40 Recoverings a Function from a Subdifferential
Marc Lassonde (Antilles-Guyane University, France)

11:40-12:05 Optimality and Duality in Multiobjective Fractional Programming Problems Involving Generalized Type I Functions
Shun-Chin Ho (Chung-Jen Junior College of Nursing, Health Sciences and Management, Taiwan)

12:05-12:30 Optimality Conditions and an Algorithm for a Cone-DC Vector Optimization Problem
Syuuji Yamada (Faculty of Science, Niigata University, Japan)

Program on August 8 (Friday Morning)

Parallel Session VI-C (Nonlinear Analysis)

Location: Conference Room, 5F, Science Education Building **Chair: Sangho Kum**

10:50-11:15 Moving Averages on Convex Metric Spaces
Sangho Kum (Chungbuk National University, Korea)

11:15-11:40 An Atomic Decomposition for Generalized Orlicz-Morrey Spaces
Denny Ivanal Hakim (Faculty of Mathematics and Natural Sciences, Institut Teknologi Bandung, Indonesia)

11:40-12:05 Generalizations of the Ekeland Variational Principle in Asymmetric Locally Convex Spaces
Thidaporn Seangwattana (Naresuan University, Thailand)

12:05-12:30 Fixed Point Theorems for Chatterjea's Mappings in Metric Spaces with a Directed Graph
Narongsuk Boonsri (Khon Kaen University, Thailand)

Parallel Session VI-D (Fixed Point Theory and Applications)

Location: M212, 2F, Mathematics Building **Chair: Kiattisak Rattanaseeha**

10:50-11:15 The General Iterative Methods for Split Variational Inclusion Problem and Fixed Point Problem in Hilbert Spaces
Kiattisak Rattanaseeha (Loei Rajabhat University, Thailand)

11:15-11:40 On Existence and Uniqueness of Common Fixed Point and Continuity of Maps
Anita Tomar (V. S. K. C. Government Degree College Dakpathar, India)

11:40-12:05 One Step Iteration Scheme for Two Multivalued Nonexpansive Mappings in Banach Spaces
Izhar Uddin (Department of Mathematics Aligarh Muslim University, Aligarh, India)

Parallel Session VI-E (Mathematics Physics)

Location: M210, 2F, Mathematics Building **Chair: Kiyoko Furuya**

10:50-11:15 Vector Valued Measure for Path Integral Representation of a Solution for Dirac Equation
Kiyoko Furuya (Graduate School of Humanities and Science Ochanomizu University, Japan)

11:15-11:40 Non-Hermitian Extension of the Heisenberg and Schrödinger Uncertainty Relations
Kohei Sekikawa (Yamaguchi University, Japan)

11:40-12:05 Generalized Schrödinger Uncertainty Relation Associated with a Monotone or Anti-Monotone Pair Skew Information
Minato Tomonari (Yamaguchi University, Japan)

Program on August 8 (Friday Afternoon)

Keynote Speech (15)

Location: International Conference Room , 3F, General Hall **Chair: Do Sang Kim**

14:00-14:45 Application of Fixed Point Theory and Dynamical System Theory to Collatz Conjecture
Shigeo Akashi (Tokyo University of Science, Japan)

Parallel Session VII-A (Optimization Algorithms)

Location: International Conference Room , 3F, General Hall **Chair: Mohamed Tawhid**

15:10-15:35 Inexact Newton and Quasi-Newton Methods for the Output Feedback Pole Assignment Problem
Mohamed Tawhid (Thompson Rivers University, Canada)

15:35-16:00 Algorithms for the Split Variational Inclusion Problem in Hilbert Spaces
Chih-Sheng Chuang (National Sun Yat-sen University, Taiwan)

16:00-16:25 Some Extensions of Fixed Point and Mean Convergence Theorems for Non-Self Mappings in Hilbert Spaces
Toshiharu Kawasaki (Nihon University, Japan)

Parallel Session VII-B (Lattice Dynamic Systems)

Location: Speech Room, 5F, Science Education Building **Chair: Koichiro Naito**

15:10-15:35 Entropy and Recurrent Dimensions of Discrete Quasi-Periodic Dynamical Systems Given by p-Adic Expansions
Koichiro Naito (Department of Applied Mathematics, Kumamoto University, Japan)

15:35-16:00 The Shortest Vector Problems in p-Adic Lattices and Simultaneous Approximation Problems of p-Adic Numbers
Koichiro Naito (Department of Applied Mathematics, Kumamoto University, Japan)

16:00-16:25 Transference Principle of Simultaneous Approximation Problems and Lll Algorithm of Multidimensional p-Adic Approximation Lattices
Schoichi Kamada (Graduated School of Science and Technology, Kumamoto university, Japan)

16:25-16:50 Inhomogeneous Simultaneous Approximations of p-Adic Numbers and Their Applications to Cryptography
Hirohito Inoue (Graduate School of Science and Technology, Kumamoto University, Japan)

Program on August 8 (Friday Afternoon)

Parallel Session VII-C (Fixed Point Theory and Applications)

Location: Conference Room, 5F, Science Education Building **Chair: Shawn Xianfu Wang**

15:10-15:35 Subgradient Projectors: Characterizations, Examples and Convergences
Shawn Xianfu Wang (University of British Columbia, Canada)

15:35-16:00 On a Shrinking Projection Method for a Family of Mappings on a Geodesic Space
Yasunori Kimura (Toho University, Japan)

16:00-16:25 Well-Posedness for the Bilevel New Genearalized Mixed Equilibrium Problems in Banach Spaces
Panu Yimmuang (Department of Mathematics, Faculty of Science, Naresuan University, Thailand)

16:25-16:50 A New Class of Mappings of Nonexpansive Type with respect to the Bregman Distance
Yukino Tomizawa (Kaohsiung Medical University, Taiwan)

Parallel Session VII-D (Fixed Point Theory and Applications)

Location: M212, 2F, Mathematics Building **Chair: Hidefumi Kawasaki**

15:10-15:35 Sperner's Lemma and Related Topics
Hidefumi Kawasaki (Kyushu University, Japan)

15:35-16:00 On the Fixed Points of Nonexpansive Mappings in Modular Metric Spaces
Afrah Abdou (King Abdolaziz University, Saudi Arabia)

16:00-16:25 Fixed Point Theorem for Set-Valued Kannan Mappings
Toshikazu Watanabe (Nihon University, Japan)

16:25-16:50 Weak Convergence Theorems for Nonlinear Mappings of Generalized Nonexpansive Type in a Banach Space
Takanori Ibaraki (Yokohama National University, Japan)

Keynote Speeches

Taipei City Bird

Application of Fixed Point Theory and Dynamical System Theory to Collatz Conjecture

Shigeo Akashi* and Satoshi Kodama
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Abstract

Let $\mathcal{N}$ be the set of all positive integers. Then, the mapping $C(\cdot)$ on $\mathcal{N}$ with values in $\mathcal{N}$ is called Collatz mapping, if this mapping is defined as the following:

$$C(n) = \begin{cases} \frac{n}{2}, & \text{if } n \text{ is even,} \\ 3n+1, & \text{if } n \text{ is odd,} \end{cases}$$

where n means any positive integer, and, for any nonnegative integer k, k-time nested superposition of $C(\cdot)$, which is denoted by $C^k(\cdot)$, is defined as the following:

$$C^k(\cdot) = \begin{cases} I(\cdot), & \text{if } k \text{ is equal to } 0, \\ C(C^{k-1}(\cdot)), & \text{if } k \text{ is positive,} \end{cases}$$

where $I(\cdot)$ means the identity mapping.

In 1937, Collatz proposed the problem asking if, for any positive integer n, there exists a positive integer k_n satisfying $C^{(kn)}(n) = 1$. Nowadays, this conjecture is called Collatz conjecture, and there exist several mathematical approaches to this problem, which are based on various kinds of research areas such as number theory, probability theory and computation theory.

As is often the case with famous conjectures, this conjecture has also produced various conjectures which have been closely related to the original one. For example, we refer to the problem asking if there exists a positive integer n satisfying $\sup_{k\geq 0} C^k(n) = 1$, and moreover, the problem asking if there exists such an initial value m that $C^k(m) \neq 1$ holds for any $k \in \mathcal{N}$.

By the way, mathematical researches on the mappings which resemble the original Collatz mapping have been also promoted. For example, it is known that the freak Collatz

mapping $D(\cdot)$ on $\mathcal{N}$ with values in $\mathcal{N}$, which is defined as the following:

$$D(n) = \begin{cases} \frac{n}{2}, & \text{if } n \text{ is even,} \\ 3n-1, & \text{if } n \text{ is odd,} \end{cases}$$

has at lease two periodic orbits which are different from each other. More concretely speaking, one periodic orbit $D(\cdot)$ runs through $\{1, 2\}$ and another one runs through $\{7, 20, 10, 5, 14\}$.

In this talk, we apply both the fixed point theory and the dynamical system theory to these conjectures which remain to be solved. Finally, all the presenters would like to express our hearty thanks to Professor Wataru Takahashi who has proposed the fixed-point-theoretic approach to this problem.

Second Order Necessary Conditions for Control-Affine Problems with State Constraints

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Abstract

We establish new second order necessary conditions for control-affine problems (i.e. with a Hamiltonian that is an affine function of the control) with a scalar control and a scalar state constraint. These optimality conditions extend to the constrained state framework the Goh transform, which is the classical tool for obtaining an extension of the Legendre condition. Then we show how to design a shooting algorithm in order to solve such problems, extending [2]. The presentation is based on the joint work [1] with S. Aronna and B.S. Goh.

References

[1] Aronna S., Bonnans J.F., Goh B.S., *Second order necessary conditions for control-affine problems with state constraints*, Research report, to appear.

[2] Aronna S., Bonnans J.F., Martinon P., *A well-posed shooting algorithm for optimal control problems with singular arcs*, Journal of Optimization Theory and Applications, **158** (2): 419-459, 2013.

Selected Examples Connected to Problems in Metric Fixed Point Theory

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Abstract

There are several problems in metric fixed point theory, which are not popular among researchers. In spite of elementary settings and simple formulation they are not solved for many years.

We can list here, minimal displacement problem, optimal retraction problem, fixed point estimates for rotative mappings, estimates for commuting mappings, and many others. On the basis of some examples we provide an overlook on such cases and stress on difficulties in the field.

The talk is addressed to general audience, not only to specialists in fixed point theory.

Optimality Conditions and Duality for Nonconvex Semi-Infinite Multiobjective Optimization Problems

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Abstract

In this talk, we establish optimality conditions for a nonconvex semi-infinite multiobjective optimization problem by using the scalarization method due to Chankong-Haimes. Based on this method, duality theorems are presented via a pair of primal-dual scalar problems. In addition, these results are applied to approximate solutions for the nonconvex semi-infinite multiobjective optimization problems.

Keywords and phrases: KKT condition, weakly Pareto solution, duality theorem, approximate solution.

Amenability and Finite Dimensional Invariant Subspace Properties for Semigroups

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Abstract

Let S be a semigroup and $m(S)$ be the Banach space of bounded real-valued functions on S. S is called left amenable if there is a non-zero left translation invariant linear functional on $m(S)$. Examples of amenable semigroups include commutative semigroups and solvable groups.

In this talk I shall discuss some recent results concerning of amenability and Ky Fan's finite dimensional invariant subspace property as well as their generalizations to Banach algebras.

Developing Prospective Teachers' Competencies to Understand Students' Mathematics Understanding

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Abstract

Student-centered teaching is the core rationale of current mathematics teaching; the sensitivity to students' mathematics understanding, especially their cognitive process and thinking, becomes the first priority in learning mathematics teaching. Therefore, Psychology of Mathematical Learning is the first course for our prospective teachers to learn mathematics teaching. This course is running developmentally by the two authors during the past two years. This lecture is going to elaborate the design, teaching, reflection, and revision of the yearly developmental course.

As for the teaching content, school students' mathematics learning activities are divided into five major topics in this course: 1) intuitive theory with respect to mathematics; 2) conceptual understanding; 3) procedural skill; 4) problem solving; and 5) reasoning and argumentation. In accord with the above five topics, the prospective teachers are supposed to ideally execute 5-time research in the academic year to recognize students' cognitive behaviors, analyze their underlying reasons, and predict any possible learning difficulty. These content materials mainly derive from: 1) national surveys; 2) international literature reviews; and 3) corresponding learning theories.

Each year, two teacher educators would simultaneously lead two classes using the same teaching content and method, and one post doc serves as the participant observer in each class. The teaching method of this course, an investigative learning cycle for prospective teachers, includes three stages: 1) sense making; 2) research; and 3) reflection. In the first stage, the educators would ask the prospective teachers to make intuitive analyses as well as analyze the underlying reasons, and then proceed with the dialectics between their analyses and literature, with exemplary mathematical items chosen from literature. In the second stage, the prospective teachers divide into small groups by themselves; each group needs to design their own research question as well as tool, and then conduct a survey or interview with students. In the final stage, these prospective teachers need to compare their research results with literature for validation and then come up with their

claims. It's noticeable that these claims might be somehow biased because the sample data are all in small size. Furthermore, this course would evaluate these prospective teachers' achievements through 2-3 times of group research reports, 1 learning report, 1 midterm and final exam in each semester.

This developmental course is continually revised through the processes of design, teaching experiments, and prospective teachers' feedback. For example, the sequence of five topics is adjusted as above after our first-year teaching experiment; the frequency of group research is reduced and the discussion of theoretical literature is additionally included based on the prospective teachers' feedback every half a semester. Even though the sequence and content are changed, the investigative learning cycle for prospective teachers remains the same. This lecture emphasizes on when, why, and how we design the mathematics teachers' educational materials and revise our teaching during our 2-year teaching experiments. Moreover, the preliminary learning effects brought to the prospective teachers are evaluated by their reports, test results and their own perceived effects.

On the Monotone Polar and Representable Closures of Monotone Operators

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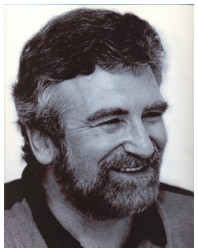
Abstract

Fitzpatrick proved that maximal monotone operators in topological vector spaces are representable by lower semi-continuous convex functions. A monotone operator is representable if it can be represented by a lower-semicontinuous convex function. The smallest representable extension of a monotone operator is its representable closure. The intersection of all maximal monotone extensions of a monotone operator, its monotone polar closure, is also representable. A natural question is whether these two closures coincide. In finite dimensional spaces they do coincide. The aim of this talk is to analyze such a question in the context of topological vector spaces. In particular, we prove in this context that if the convex hull of a monotone operator is not monotone, then the representable closure and the monotone polar closure of such operator do coincide.

Keywords: Monotone operator, representable operator, monotone polar, closure, topological vector space.



Optimal Control of the Sweeping Process Generated by Moving Convex Polyhedra

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Abstract

We study a new class of optimal control problems of the sweeping (Moreau) process governed by differential inclusions, which are described by the normal cone mapping to moving polyhedral convex sets in finite-dimensional spaces. The main attention is paid to deriving necessary optimality conditions for such unbounded discontinuous differential inclusions with intrinsic state constraints. This is done by developing the method of discrete approximations and employing appropriate tools of second-order variational analysis and generalized differentiation.

Based on the joint work with G. Colombo, R. Henrion, and N. D. Hoang.

A Unification of Generalized Fan-Browder Type Alternatives

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Abstract

In our previous works, we obtained some characterizations of (partial) KKM spaces. In the present paper, we begin with a modification of a such characterization using a general Fan-Browder type fixed point property and show that this characterization implies an alternative theorem. This theorem unifies and contains a number of historically well-known important fixed point or maximal element theorems. We list some of them chronologically and gave simple proofs. Finally, we introduce some recent works related to the generalized Fan-Browder type alternatives.

Keywords and phrases: Abstract convex space; (Partial) KKM space; Fixed point; Coincidence point; Maximal element.

Positive Definite and Semi-Definite Tensors

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Abstract

Positive definite matrices and positive semi-definite matrices are very important concepts of matrix analysis in both theory and applications. In the recent decade, these two concepts have been extended to tensors. Research on positive definite tensors and positive semi-definite tensors has made significant progresses. In this talk, I will review these progresses. The main contents are as follows.

Except the zero tensor, there are no odd order positive semi-definite tensors. An even order symmetric tensor is positive semi-definite (definite) if and only if its smallest H-eigenvalue or Z-eigenvalue is nonnegative (positive). Even order diagonally dominated symmetric tensors, even order symmetric B_0 tensors, and even order Cauchy tensors with positive generating vectors are positive semi-definite tensors. They are easily checkable. Even order symmetric M tensors, even order completely positive tensors, even order Laplacian tensors, even order signless Laplacian tensors, even order strong Hankel tensors, even order complete Hankel tensors, even order Hilbert tensors, even order symmetric P_0 tensors, even order diagonally dominated circulant tensors, even order circulant B_0 tensors, the Motzkin tensor are all positive semi-definite tensors. We now have a rich theory on positive definite and semi-definite tensors.

Some Selected Applications of Certain Minimax Theorems

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Abstract

In this lecture, I intend to present a selection of the various applications of certain minimax theorems. In particular, I will consider operators $T : X \to X$ of the type $T = \mathrm{id} + J'$ where X is an infinite-dimensional real Hilbert space and J' is the Gâteaux derivative of a C^1 functional $J : X \to \mathbf{R}$. For such operators the following properties will be highlighted. If J is sequentially weakly lower semicontinuous and J' is non-expansive, then there exists a closed ball B in X such that $T(B)$ intersects every convex and dense subset of X. If J' is compact, $\liminf_{\|x\|\to+\infty} \|x\|^{-2} J(x) > -2^{-1}$, T is non-monotone and $\lim_{\|x\|\to+\infty} \|T(x)\| = +\infty$, then the set of all singular points of T is not σ-compact.

Full Stability of Local Solutions in Parameterized Optimization

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Abstract

Stability of solutions, with respect to possible shifts in the parameters on which an optimization problem depends, is a very important issue. It not only influences the credibility of results but also affects the design of solution algorithms. Full stability of a particular locally optimal solution, associated with a particular vector of parameters, refers to a localization with respect to which parameter vectors yield unique solution vectors and this dependence is Lipschitz continuous.

It has been known for some time that full stability can be characterized in very general circumstances in terms of coderivative conditions on certain set-valued mapping. Recently there has been further progress on calculus rules which allow the conditions to be confirmed in specific situations.

Keywords: Variational analysis, parameterized optimization, locally optimal solutions, full stability.

Computer Architecture Underlying Mesoscopic Neurocomputing

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Abstract

Research on brain-machine interfaces reveals that when large populations of broadly tuned neurons are working together, precise computations can be achieved. This leads us to create a new computing model, a design of an interneural computing machine (ICM) that can resolve network computation from a microscopic level (single neurons) to a mesoscopic level (neuromorphic ensembles). ICM mathematically models a machine that mechanically operates on an evolutionary neural network. Operation of ICM is fully determined by a finite set of learning algorithms that constantly change the coupling strength between neuromorphic nodes. Three algorithms, called the seed growth algorithm, the coupling-isometric cliquishness algorithm, and the regenerative prototype algorithm, are proposed to determine a primordial neuromorphic ensembles from the evolutionary neural network. A population dynamics simulation shows that information is well-represented by those neuromorphic ensembles, which defines the concept of mesoscopic neurobits of interneural computing machines.

Iterative Methods for Generalized Split Feasibility Problems in Nonlinear Analysis

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Abstract

In this talk, motivated by the idea of the split feasibility problem and results for solving the problem, we consider generalized split feasibility problems. Then, using nonlinear analysis, we establish weak and strong convergence theorems which are related to the problems. As applications, we get well-known and new weak and strong convergence theorems which are connected with fixed point problem, split feasibility problem and equilibrium problem.

Keywords and phrases: Generalized hybrid mapping, maximal monotone operator, inverse strongly monotone mapping, fixed point, split feasibility problem, equilibrium problem, iteration procedure.

Data-Driven Optimization

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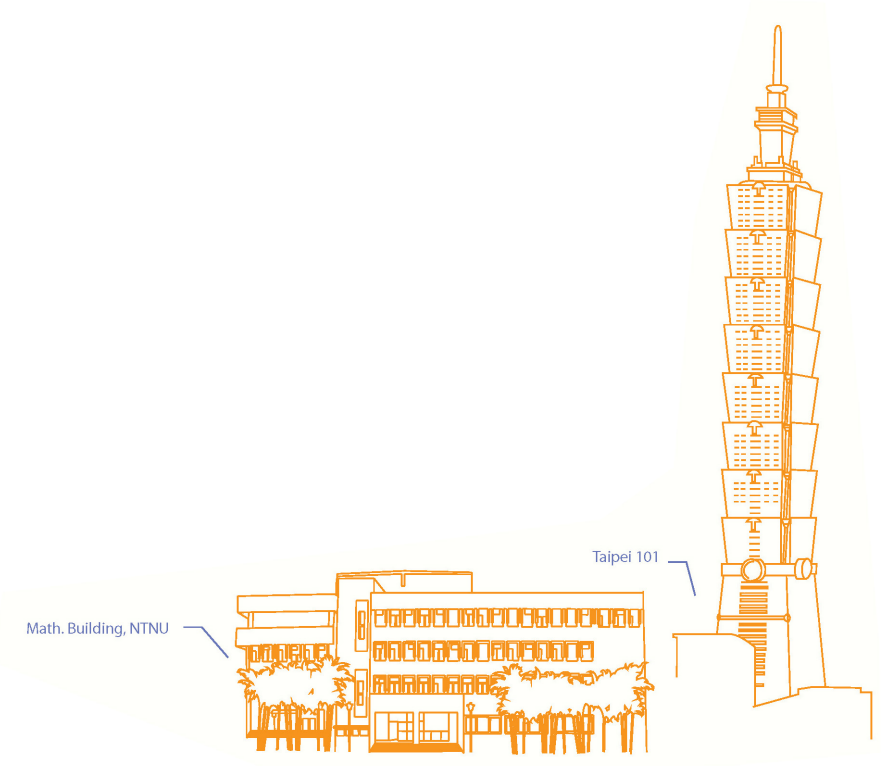
Abstract

We present several optimization models and algorithms dealing with uncertain, dynamic, structured and/or massive data. Specifically, we discuss • Distributionally Robust Optimization Models, where many problems can be efficiently solved when the associated uncertain data possess no priori distributions; • Near-Optimal Online Linear Programming Algorithms, where the constraint matrix is revealed column by column along with the objective function and a decision has to be made as soon as a variable arrives; • Least-squares with Nonconvex Regularization, where a sparse or low-rank solution is sought; • Alternating Direction Method of Multipliers (ADMM), where an example is given to show that the direct extension of ADMM for three-block convex minimization problems is not necessarily convergent, and possible convergent variants are proposed.

Parallel Sessions



On the Fixed Points of Nonexpansive Mappings in Modular Metric Spaces

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Abstract

The notion of a modular metric on an arbitrary set and the corresponding modular spaces, generalizing classical modulars over linear spaces like Orlicz spaces, have been recently introduced. In this paper we investigate the existence of fixed points of modular nonexpansive mappings. We also discuss some compactness properties of the family of admissible sets in modular metric spaces with uniform normal structure property.

Keywords: Nonexpansive mapping condition, Fixed point, Modular function space, Modular metric spaces, Orlicz spaces.

A Global Optimization Method for A Quadratic Reverse Convex Programming Problem

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Abstract

In this talk, we propose a global optimization method for a quadratic reverse convex programming problem (QRC, for short). The feasible set of a QRC is expressed as an area obtained by excluding the interior of a convex set from another convex set. One of difficulties in solving a QRC is that the feasible set is not always connected. In order to overcome this drawback, we introduce a procedure for listing the KKT points of a quadratic programming problem. By utilizing such a procedure, we can obtain at least one feasible solution in each maximal connected subset of the feasible set. Furthermore, we propose an algorithm for finding a globally optimal solution of a QRC by combining

such a procedure with classical nonlinear optimization methods.

Keywords and phrases: Global optimization, Quadratic reverse convex programming, KKT points.

New Damped-Broyden Methods for Unconstrained Optimization

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Abstract

Recently, we have extended the damped-technique in the modified BFGS method of Powell for constrained optimization to the Broyden family of quasi-Newton methods for unconstrained optimization. Appropriate choices for the damped-parameter which maintains the convergence property of these methods will be proposed. Numerical results will be described to show that these choices improve the performance of quasi-Newton methods substantially in several cases.

Viscosity Approximation Process for a Sequence of Quasinonexpansive Mappings

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Abstract

We study the viscosity approximation method due to Moudafi for a fixed point problem of quasinonexpansive mappings in a Hilbert space. First, we establish a strong convergence theorem for a sequence of quasinonexpansive mappings. Then we employ our result to approximate a solution of the variational inequality problem over the common fixed point set of the sequence of quasinonexpansive mappings.

Some Best Proximity Point Theorems for Some Generalized Proximal Contractions

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Abstract

We prove some best proximity point theorems by using the concept of contractive conditions introduced by Geraghty.

Caristi's Random Fixed Point Theorem for Generalized Distance on Polish Space

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Abstract

In this paper, we present the random version of generalized Caristi's fixed point theorem for generalized distance on Polish spaces. Moreover, we prove some Caristi's random fixed point theorems for multi-valued mappings on Polish spaces. Our results in this paper extend and improve some known results in the literature.

Keywords: Caristi's random fixed point theorem, generalized distance, Polish space.

Strong Convergence Theorems for Nonlinear Mappings by Halpern's Type Iterations in Banach Spaces

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Abstract

In this talk, we study Halpern's type iterations and some iterations for nonlinear mappings. And we prove strong convergence theorems for nonlinear mappings. Furthermore, we also give some convergence theorems for nonlinear mappings.

Keywords and phrases: Fixed point, iteration, nonexpansive mapping, nonexpansive semigroup, strong convergence.

Numerical Methods for Solving Nonsmooth Optimization Problems with Known Structures

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Abstract

In this talk, we discuss numerical methods for solving nonsmooth nonconvex optimization problems with known structures. These problems include the minimization of difference of (nonsmooth) convex functions and problems where the objective function is represented as a smooth composition of nonsmooth functions. We discuss application of such problems. Numerical algorithms use different generalizations of a subdifferential. Computational results using well-known nonsmooth optimization test problems are reported.

Keywords: Nonsmooth optimization, Nonconvex optimization, Numerical optimization, Subdifferential.

Critical Numbers in the Theory of Thermal Ignition

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Abstract

Many problems in spontaneous ignition theory requires the determination of either the critical ambient temperature or the critical initial temperature. The classical problem deals with the former and the well established approach is to express the heat balance equation in terms of dimensionless variables introduced by Frank-Kamenetskii. Assuming Arrhenius kinetics, the dimensionless form of the steady state heat balance equation for material undergoing an exothermic reaction over some closed region Ω is $\bigtriangledown^2 u + \lambda \exp(u) = 0$. For Ω the N-dimensional symmetrical sphere, this equation has the form $u''(r) + (N-1)r^{-1}u'(r) + \lambda \exp(u) = 0$. Analytical results in this approach are well established and studied by many authors.

Burnell et al introduced a new formulation in which the ambient temperature was considered as the bifurcation parameter. In this formulation the equation takes the form $u''(r)+(N-1)r^{-1}u'(r)+\lambda \exp(-1/u) = 0$. In this talk we look at the numerical solutions in the new formulation for both class A geometries (infinite slab, infinite circular cylinder and sphere) and some non-class A geometries. Multiplicity of limit points will be also discussed.

Keywords: Nonlinear systems, Boundary value problems, Limit points.

Best Proximity Points for a New Proximal Contraction

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Abstract

In this paper, we define a new proximal contraction and prove best proximity point theorems. We also provide an example to illustrate the theorem.

Levitin-Polyak Well-Posedness for Lexicographic Vector Equilibrium Problems

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Abstract

In this paper, we introduce the notions of Levitin-Polyak(LP) well-posedness and LP well-posedness in the generalized sense for the Lexicographic vector equilibrium problems. Then, we establish some sufficient conditions for Lexicographic vector equilibrium problems to be LP well-posedness at the reference point. Numerous examples are provided to explain that all the assumptions we impose are very relaxed and cannot be dropped. The results in this paper unify, generalize and extend some known results in the literature.

Multi-Stability of the Network of Relaxation Oscillators Coupled by Gap Junctions

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Abstract

We study a large-scale neural model network comprised of electrically coupled relaxation oscillators with short duty cycle, which can be considered either as models of pacemaker cells, spiking cells with fast regenerative and slow recovery variables or firing rate models of excitatory cells with synaptic depression or cellular adaptation. We show that different spatiotemporal patterns of activity can emerge in the network as a result of switching from synchrony, produced by short external signals of different spatial profiles. The variety of stable patterns increases with decreasing rate of neuronal firing and with decreasing strength of electrical coupling. The ring topology promotes anti-phase behavior as compared to all-to-all coupling and gives rise to a hierarchical organization of activity: during each of the main phases of a given pattern cells fire in a particular sequence determined by the local connectivity.

Our results show that complex stable spatiotemporal activity patterns can be produced by stochastic or sensory stimuli in neural networks without chemical synapses, where each cell is equally coupled to others via gap junctions. This suggests that in developing nervous systems where only electrical coupling is present such a mechanism can lead to the establishment of proto-networks generating premature multiphase oscillations. Another implication concerns working memory: since switching between patterns may only occur in a specific phase of the cycle incoming information, arriving in a proper time window may be stored in an oscillatory network in the form of a specific spatiotemporal activity pattern which is expressed until new pertinent information arrives.

Keywords: neural network, spatiotemporal activity patterns, electrical coupling, multiphase activity, network connectivity.

Existence of Second Order Neutral Integral Differential Equations of Sobolev Type in Banach Spaces

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Abstract

In this paper, we established the existence of mild solution for second order nonlinear impulsive integrodifferential equation of Sobolev type with nonlocal initial conditions. The results are obtained by using strongly continuous cosine families of operators and the fixed point approach. An example is provided to illustrate the theory.

Fixed Point Theorems for Chatterjea's Mappings in Metric Spaces with a Directed Graph

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Abstract

Let (X, d) be a complete metric space with a directed graph G where $V(G) = X$ and $E(G) \subset X \times X$. In this talk, we we introduce a new contractive type condition between a pair of mappings $S, T : X \to X$ with respect to G. In particular, if $S = T$ and $E(G) = X \times X$, we obtain fixed point theorem of Chatterjea.

Some Useful Inequalities via Trace Function Method in Euclidean Jordan Algebras

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Abstract

In this talk, we establish convexity of some functions associated with symmetric cones, called SC trace functions. As illustrated in the paper, these functions play a key role in the development of penalty and barrier function methods for symmetric cone programs. With trace function method we offer much simpler proofs to these useful inequalities.

A Perfect Match Condition for Point-Set Matching Problems Using the Optimal Mass Transport Approach

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Abstract

In this paper, we demonstrate one application of the optimal mass transport problem to point-set matching problems. The present study, which is based on the L2 mass transport cost, states that perfect matches always occur when the product of the point-set cardinality and the norm of the curl of the non-rigid deformation field does not exceed some constant. This analytic result is justified by a numerical study of matching two sets of pulmonary vascular tree branch points whose displacement is caused by the lung volume changes in the same human subject. The nearly perfect match performance verifies the effectiveness of this mass transport-based approach.

Fractional Programming of Semi-Preinvex Functions

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Abstract

We establish necessary and sufficient optimality conditions for nondifferentiable fractional variational programming under semi-preinvex functions. Employing the necessary and sufficient optimality conditions, dual models are formulated. The weak duality, strong duality and strict converse duality theorems are proved in the framework of semi-preinvex.

Conceptualizing Framework of Spatial Literacy : Analyzing, Elaborating, and Synthesizing

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Abstract

Though spatial literacy was needed in studying natural and social sciences, it was never the focus in any discipline. This could also be seen in mathematics; space and shape were concerned but restricted for the use of geometric domain only. In order to design curriculum about space and shape across different disciplines, we need to assess students' spatial literacy. The goal of this study is to conceptualize framework of spatial literacy in 3 stages of building and testing.

In the first stage, we adapted Yores literacy framework for science and mathematics (2011), and proposed a framework of spatial literacy in both fundamental and derived senses. The framework was used to analyze spatial curriculum in different countries.

In the second stage, we interviewed 7 high school teachers in different disciplines to validate our framework. By considering spatial ideas and concepts required in different disciplines, we elaborated the derived sense of spatial literacy. As learning difficulties and teaching strategies were concerned, the fundamental sense of spatial literacy was thus elaborated.

In the third stage, we synthesized the results in the previous stages, and concluded that the framework of spatial literacy contributed to both future assessments in spatial literacy and curriculum designs in related disciplines as geography and natural science.

Keywords: Spatial literacy, spatial visualization, spatial communication, spatial reasoning.

Optimal Path Planning for Watering System

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Abstract

Optimal path planning is an important question in watering plants. Especially for large-scale garden with varying plants and limited workers, watering robots become very helpful. However, due to the varying amount of water each plant needs and water capacity constraint of the container, developing watering system poses severe challenges. In this paper, we propose an integrated system, in which minimized cost function measured by minimum watering distance and multiple constraints (i.e., water-demanding variance of the plants and water-fulfilled level of the plants) are considered to obtain optimal watering path planning based on shortest path algorithm. And, experiments have been performed to validate the proposed system. The results show the effectiveness of the proposed system.

Keywords and phrases: Optimal trajectory planning, Integrated system, Minimized cost function, Shortest path algorithm.

Interior-Point Algorithms for the Generalized Linear Complementarity Problems

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Abstract

In this paper, we consider the generalized linear complementarity problems which have applications in structural engineering problems, electrical engineering problems, economic equilibrium problems, noncooperative problems, traffic assignment problems and optimization problems. We review interior-point algorithms for the generalized linear complementarity problems and propose new interior-point algorithms based on new barrier functions.

Analysis of a Cross-Hospital Network of Emergency Department Patient Flow

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Abstract

We study a network of multiple hospitals and its emergency department patient flow. We analyze the attendance pattern at individual hospitals in terms of day, time, triage, age, gender, race, and location which provide insights for hospital administrators for operational purposes. We also study the general attendance pattern on an aggregate level to aid policymakers and planners in veering the strategic direction of healthcare development. We build an integrated forecasting model which can be used to predict patient flows for various population characteristics. Finally, we present an resource optimization model which can be applied to the network to improve the network efficiency.

Keywords: Network design, Demand forecasting.

The Enactment of In-Service Primary Teachers' Knowledge for Teaching Ratio and Proportion in Teaching Practice: A Case Study of Two Indonesian Teachers

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Abstract

This study draws upon an ongoing research in investigating whether in-service primary teacher's Mathematics Content Knowledge (MCK) and Mathematics Pedagogical Content Knowledge (MPCK) have always enacted in their teaching practice. We use both qualitative and quantitative approach to investigate two in-service primary teachers MCK and MPCK understanding categories on ratio and proportion and analysed teaching practice in the same content with revise coding component framework, developed by learning

mathematics for teaching (LMT) project, to adapt to Indonesian primary teaching practice. The result indicated that some teachers' respond on written assessment could be observed in practice. However, the students misconception on ratio and proportion which were explored in written assessment were seldom appear in teaching practice since they did not provide task for students to reveal misconception.

Keywords: MCK, MPCK, ratio and proportion, Indonesia.

Superlinearly Convergent Smoothing Newton Continuation Algorithms for Variational Inequalities over Definable Sets

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Abstract

We use the concept of barrier-based smoothing approximation, introduced by Chua and Li, to extend various smoothing Newton continuation algorithms to variational inequalities over general closed convex sets X. We prove that when the underlying barrier has a gradient map that is definable in some o-minimal structure, the iterates generated converge superlinearly to a solution of the variational inequality. We further prove that if X is proper and definable in the o-minimal expansion of globally analytic sets by power functions with real algebraic exponents, then the gradient map of its universal barrier is definable in the o-minimal expansion by the exponential function.

Algorithms for the Split Variational Inclusion Problem in Hilbert Spaces

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Abstract

Split variational inclusion problem is an important problem, and it is a generalization of the split feasibility problem. In this talk, we present several algorithms for the split variational inclusion problems in Hilbert spaces. As applications, we give strong convergence theorems for the split feasibility problem in Hilbert spaces. Final, we give numerical results for split variational inclusion problems to demonstrate the efficiency of the proposed algorithm.

Some Generalizations of Mizoguchi-Takahashi's Fixed Point Theorem with New Local Constraints

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Abstract

In this talk, motivated by Kikkawa-Suzuki's fixed point theorem, we establish some new generalizations of Mizoguchi-Takahashi's fixed point theorem with new local constraints on discussion maps.

Vector Valued Measure for Path Integral Representation of a Solution for Dirac Equation

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Abstract

Dirac equation is the basic equation of relativistic quantum mechanics to the fermions. For the case of space-dimension = 1, Ichinose [4] proved the path integral for Dirac equations are represented by a scalar measure. For the case of radial Dirac equation Ichinose [5] constructed a countably additive path space measure. The main idea is to combine his method of constructing a path space measure developed for the one-dimensional Dirac equation.

But in general, for the case of space-dimension ≥ 2, Feynman path integrals for Dirac equations are not represented by (scalar-valued) measures.(See Zastwinak [8,9]).

In this talk, we shall introduce that the path integral for Dirac equations are represented by our vector-valued measure.

Keywords: Path Integrals, Dirac Equations, L^2-valued measure.

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Effects of Layer Thickness and Edge Conditions to Thermoelastic Characteristics on Thermal Barrier Coatings

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Abstract

The thermoelastic behaviors of such as temperature distribution, displacements, and stresses in thermal barrier coatings (TBC) are seriously influenced by top coat thickness and edge conditions. The top coat of TBC specimens prepared with TriplexProTM-200 system was controlled by changing the processing parameter and feedstock, showing the various thicknesses and microstructures. A couple of governing partial differential equations was derived based on the thermoelastic theory. Since the governing equations are too involved to solve analytically, a finite volume method was developed to obtain approximations. The thermoelastic behaviors of TBC specimens with the various thicknesses and microstructures were estimated through mathematical approaches with different edge conditions. The results demonstrated that the microstructure and thickness of the top coat, and the edge condition in theoretical analysis are crucial factors to be considered in controlling the thermoelastic characteristics of plasma-sprayed TBCs.

Stochastic Algorithms for Global Optimization

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Abstract

We consider stochastic algorithms and computing techniques for solving noncovex nonlinear optimal control problems. It is proposed series of tests and application problems from different areas: nano-physics, medicine and technical ecology, composite materials construction, energetics, geography and others.

The Lyapunov Rank of a Proper Cone

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Abstract

In various strategies for solving primal-dual conic linear problems or cone complementarity problems, one tries to write the optimality/complementarity conditions in the form of a square system by replacing the complementarity constraints by linearly independent bilinear relations (which come from the so-called Lyapunov-like transformations). In order to identify proper cones where this can be achieved, we define the *Lyapunov rank* (also called the bilinearity rank) of a proper cone as the maximal number of linearly independent Lyapunov-like transformations on the cone, or equivalently, as the dimension of the Lie algebra of the automorphism group of that cone. In this talk, we present some rank results for polyhedral cones, symmetric cones, completely positive cones, and Bishop-Phelps cones. We show, for example, that proper irreducible polyhedral cones (such as the l_1-cone in an Euclidean space of dimension more than 2) have rank one and symmetric cones admit square complementarity systems.

Keywords: Proper cone, Complementarity problem, Lyapunov rank, Symmetric cone, Completely positive cone, Special Bishop-Phelps cone.

An Atomic Decomposition for Generalized Orlicz-Morrey Spaces

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Abstract

In this talk, we discuss an atomic decomposition for generalized Orlicz-Morrey spaces which consists of the decomposition and the synthesis result. The decomposition result states that any functions in generalized Orlicz-Morrey spaces can be decomposed into more elementary functions that satisfy certain size and cancellation condition. Meanwhile, the synthesis result tells that the sum of functions that supported on a cube with the size condition, converges to some function in generalized Orlicz-Morrey spaces. Our proof uses the predual space of generalized Orlicz-Morrey spaces and the vector valued inequality for Hardy-Littlewood maximal operator. This result can be viewed as a generalization of the decomposition for Morrey spaces.

Keywords: generalized Orlicz-Morrey spaces, atomic decomposition, Hardy-Littlewood maximal operator.

A Lagrange-Type Duality Theorem for a DC Programming Problem and Its Applications

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Abstract

In the field of non-convex optimization, DC programming is interesting and important because it has wide range of applications, see [1]. In this talk, we give a Lagrange-type duality theorem for a DC programming problem in [4], which is a generalization of previous results by J.-E. Martinez-Legaz, M. Volle [2] and Y. Fujiwara, D. Kuroiwa [3] when all constraint functions are real-valued. Also we study a Lagrange-type duality theorem for a reverse-convex programming problem as its application.

Keywords: DC programming problem, reverse-convex programming problem, Lagrange duality theorem.

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Graphical Analysis on Payoff Functions for Bicriteria Non-Square Matrix Games

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Abstract

When we draw the image of the pair of strategy sets under payoff functions of a specific two-person zero-sum game with two or three evaluation criteria, the images has various and interesting graphical shapes. So far we have studied features of that graphical images in several mathematical settings. In this paper, we first consider a bicriteria two-person zero-sum game with a vector-valued payoff function. One player chooses a mixed strategy in two-dimensional Euclidean spaces, the other player chooses a mixed strategy in three-dimensional Euclidean spaces, respectively. The payoff function can be represented by a pair of two non-square matrices. Therefore, the value of a strategy pair under the payoff function is a two-dimensional vector. We visualize the image of each payoff function under some conditions in the two-dimensional objective space. Next, we classify the images by its graphical information.

Keywords: multicriteria matrix game, minimax theorem, graphical image.

Optimality and Duality in Multiobjective Fractional Programming Problems Involving Generalized Type I Functions

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Abstract

In this paper, we establish sufficient optimality conditions for the (weakly) efficiency to multiobjective fractional programming problems involving generalized (F, α, ρ, d)-V-type I functions. Using the optimality conditions, we also investigate a parametric type duality for multiobjective fractional programming problems concerning generalized (F, α, ρ, d)-V-type I function. Then some duality theorems are proved for such problems in the framework of generalized (F, α, ρ, d)-V-type I functions.

Keywords and phrases: Multiobjective fractional programming, weakly efficient solution, efficient solution, generalized type I function, duality.

Strong Convergence Theorem for Widely More Generalized Hybrid Mappings in Hilbert spaces

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Abstract

In this talk, using the concept of attractive points of a nonlinear mapping, we obtain a strong convergence theorem of Halpern's type [1] for a wide class of nonlinear mappings which contains nonexpansive mappings, nonspreading mappings and hybrid mappings in a Hilbert space. Using this result, we obtain new strong convergence theorems of Halpern's type in a Hilbert space. In particular, we obtain an extension of Suzuki's theorem [3] and also solve a problem posed by Kurokawa and Takahashi [2].

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Keywords: Fixed Point Theory and Ergodic Theory

On Absorbing Set of States and Learning Rates in Self-Organizing Maps

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Abstract

We deal with mathematical models and their theoretical analysis for self-organizing maps referred to as Kohonen type algorithm. In self-organizing map models, by repeating learning, some model functions have important properties such as ordering which appears in the relation between the array of nodes and the values of nodes. These models and these properties apply to many practical problems and are very useful. We investigate behavior of ordering in self-organizing maps with a one dimensional array of nodes and treat some closed classes of states with absorbing property. We give some numerical examples in self-organizing map with an extended learning process.

Keywords and phrases: self-organizing maps, absorbing property.

Intern Teachers' Concept Images For Mathematics Teaching Inquiry and Its Application: Through The Aspect of Students' Mathematical Thinking

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Abstract

Based on the idea "concept image for mathematics teaching (CIMT)", the study investigated the concept image of secondary school mathematics intern teachers in Taiwan. This study focuses on the concept of students' mathematics thinking in mathematics teaching. We found that, about the roles of students' thinking in mathematics class, the intern teachers usually evoked three main categories of concept images in the aspect of students' mathematics thinking. We also found that even intern teachers did know how important "student thinking" was for mathematics learning, they do not usually evoke the image of "make students think" when facing teaching situations. The study also found that most of the intern teachers who evoked the image of "student thinking" also evoked the image of students' cognition at the same time. In addition, this research applied the result of this study to mathematics teacher education program and obtained a lot of exciting results.

Justifications for the Increasing Serial Cost Sharing Rule

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Abstract

I studies the increasing serial cost sharing rule by providing two axiomatic characterizations. I characterize the increasing serial cost sharing rule by Efficiency, Additivity, Cost Monotonicity, Fixed Cost and Free Lunch. I also show that Efficiency, Equal treatment of Equals, Increasing Demand, Cost Monotonicity, Fixed Cost and Smallest Demand Consistency determine uniquely the increasing serial cost sharing rule.

A New Linear Relaxation Algorithm for Sum of Linear Ratios Problem with Lower Dimension

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Abstract

Carlsson and Shi (2013) developed a linear relaxation for solving the sum-of-linear-ratios (SOLR) problem with lower dimension. They casted the SOLR problem into an equivalent problem with linear objective and a set of linear and nonconvex quadratic constraints. They proposed a linear relaxation by dropping out the nonconvex quadratic constraints for the SOLR problem and designed a branch-and-bound algorithm to solve the SOLR problem.

In this research we present a new linear relaxation algorithm for globally solving the SOLR problem with lower dimension. Instead of dropping out the nonconvex quadratic constraints, we make a linear relaxation of the SOLR problem with some extra variables. Therefore, this linear relaxation is generally tighter than the previous one. With the help of the new relaxation, we propose an algorithm for solving the SOLR problem and prove the convergence of the algorithm. The numerical experiments results indicate that our method is much more efficient than the previous.

Viscosity Approximations for Weak Contractions

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Abstract

The purpose of this talk is to study Moudafi's approximations with weak contractions. We plan to show that Browder's and Halpern's type convergence theorems imply Moudafi's viscosity approximations with weak contractions. We will use these convergence theorems to derive Browder's type convergence theorems with a weak contraction for families of nonexpansive mappings.

Keywords and Phrases: Weak contraction; Moudafi's viscosity approximation; Browder's iteration; Halpern's iteration; uniformly asymptotically regular; CAT(0) space.

Complement-Associated Games

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Abstract

In this work, an alternative definition of the associated game is constructed, we name the **E-complement-associated game**. We define a sequence of games; the term of order m, in this sequence, is the E-complement-associated game of the term of order $(m-1)$. We show that the sequence converges and that the limit game is the sum of an **inessential game** and a **constant game**. Based on the E-complement-associated game, the **equal allocation of nonseparable costs (EANSC)** is characterized by **associated consistency(AC)** and other four axioms, **Pareto optimality(PO), translation covariance (TC), symmetry (SYM), continuity(CONT)**. Additionally, we also introduce a corresponding complement-associated game of the Shapley value, we name the **Sh-complement-associated game**. Based on the Sh-complement-associated game, the corresponding sequence also converges but its limit game is a **constant-sum game**.

Weak Convergence Theorems for Nonlinear Mappings of Generalized Nonexpansive Type in a Banach Space

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Abstract

In this paper, we study some properties of Bregman generalized nonexpansive mappings which was introduced by Naraghirad, Takahashi and Yao [J. Nonlinear Convex Anal. 13:141–156] in a Banach space. Further, we prove weak convergence theorems for finding a fixed point of a Bregman generalized nonexpansive mapping in a Banach space.

How Future English Teachers Comprehend the Conception of Statistics

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Abstract

As English Learners with language limitation, future English teachers often encounter specific challenges in learning statistics. While as future teachers and citizens, they need to be aware of the important of statistics in promoting their learning ability and statistical literacy to be lifelong learners and good citizens. This article reports an empirical study on future English teachers' views of the importance of statistics course for their life and future professions. This study applied phenomenographic method to analyze interview transcripts and written responses data of 44 future English teachers taking introductory statistics course. A range of views of the importance of statistics from limited to more integrated ones were found. Considering how they value the statistics provides an opportunity for teachers to develop more proper statistics teaching that could lead students towards more integrated views of the significance of statistics for them as future teachers and citizens.

Keywords: conceptions of statistics, future English teachers, phenomenography.

Inhomogeneous Simultaneous Approximations of p-adic Numbers and Their Applications to Cryptography

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Abstract

Lattice based cryptography, the security of which depends on the hardness of the shortest vector problems (SVP), is considered as one of the most secure systems against quantum computers. In the usual real numbers case the inhomogeneous simultaneous approximation problems (ISAP), which are NP complete, are used to construct cryptographic systems. In our previous papers we have combined these problems, SVP and SAP or ISAP, by using p-adic analysis. In this talk, showing the relations between the shortest vectors in the p-adic approximation lattices and the integer solutions of p-adic ISAP, we propose a new cryptosystem given by using ISAP and we investigate its security by applying the LLL algorithm.

Keywords and phrases: Simultaneous homogeneous approximation, p-adic theory, LLL algorithm, Cryptography.

First-Order Sufficient Condition for Minimization of Lower Semicontinuous Functions Using Subdifferentials in Banach Spaces

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Abstract

We provide an inequality relating the lower Dini directional derivative and the subdifferential of a proper lower semicontinuous function in Banach spaces, which extends the known formula for convex functions [1, 7]. We show that this property is equivalent to other subdifferential properties of Banach spaces, such as mean value inequality and separation principles. As an application, we obtain a first-order sufficient condition for optimality of lower semicontinuous functions using subdifferentials, which extends known conditions in terms of derivatives [2] or directional derivatives [3], and which amounts to the maximal monotonicity of the subdifferential for convex lower semicontinuous functions [6]. This talk is based on our recent works [4, 5].

Keywords: Subdifferential, lower Dini subderivative, integration of subdifferentials.

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Iterative Algorithms for Solving Mixed Equilibrium Problems and Constrained Convex Minimization Problems

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Abstract

In this talk, we introduce new implicit and explicit iterative algorithms for finding a common element of the set of solutions of a mixed equilibrium problem and the set of solutions of a constrained convex minimization problem in Hilbert spaces. Under suitable control conditions, we prove that the sequences generated by the proposed algorithms converge strongly to a common element of two sets, which is a solution of a certain variational inequality.

Keywords: Mixed equilibrium problem, Gradient-projection algorithm, Constrained convex minimization problem, Nonexpansive mapping, Fixed points, κ-Lipschitzian and η-strongly monotone operator, Variational inequality.

Vehicle Routing Problem for Multi Compartment and Multi Trip with Soft Time Windows

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Abstract

This research presents the new mathematical model approach to solve the vehicle routing problem with soft time windows (VRPSTW) with distribution of products with multiple categories. In addition, we include multiple compartments and trips. Each compartment is dedicated to a single type of product. Each vehicle will be allowed to have more than one trip, as long as it corresponds to the maximum distance allowed in the work day. Numerical results show the effectiveness of our model.

Transference Principle of Simultaneous Rational Approximation Problems of p-adic Numbers and LLL Reduction Algorithm of Multidimensional p-adic Approximation Lattices

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Abstract

In the theory of lattices the shortest vector problem (SVP) is the most famous NP hard problem and the lattice-based cryptography is believed to be secure for quantum computers. On the other hand simultaneous rational approximation problem (SAP) is also well known for their computational complexity. In this talk we show the relations between the shortest vectors in the p-adic approximation lattices and the integer solutions of p-adic SAP. We investigate the two types, the 1st and the 2nd type, of simultaneous approximation problems. By using the LLL reduction algorithm we construct the algorithm, which gives the solutions of the 2nd type simultaneous approximation problems from the solutions of the 1st type approximation problems. Furthermore, we numerically compare the minimum norms of the vectors given by the LLL reduction algorithm and the norms of the shortest vectors theoretically given by the simultaneous approximations.

Keywords and phrases: Simultaneous homogeneous approximation, p-adic theory, LLL algorithm, Cryptography.

How to Find Jump-Times of a Black-Scholes Model with Jumps for Nikkei 225 Stock Index?

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Abstract

We investigate a Black-Scholes SDE with jumps for the modeling of Nikkei 225 stock index. The stock price data of Nikkei 225 stock index are observed at discrete times, for example by the minute. Since the stock price data include lots of jumps, it is difficult to find real jump-times from the data. In this paper we consider how to separate jump-times from the observed times.

On the Uniform Non-Squareness of Direct Sums of Banach Spaces

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Abstract

As is well known, the uniform non-squareness has been playing important roles in the Banach space theory especially in connection with the fixed point property and various norm inequalities among geometric constants, etc. On the other hand, as a natural extension of the notion of ℓ_p-sum of Banach spaces the ψ-direct sum was introduced in [3] (cf. Y. Takahashi et al., J. Inequal. Appl. 7, 2001, for the two Banach spaces case).

In [4] it was shown that *the ψ-direct sum $X \oplus_\psi Y$ is uniformly non-square if and only if X and Y are uniformly non-square and $\psi \neq \psi_1, \psi_\infty$, where ψ_1 and ψ_∞ are the corresponding convex functions to the ℓ_1- and ℓ_∞-norms on $\mathbb{C}^2$, respectively.*

In this talk we shall discuss the uniform non-squareness for ψ-direct sums of an arbitrary finite number of Banach spaces, which was raised as a problem in [4] and by now partial answers have been presented in [1], [2], and [6, 7] etc.

This is a joint work with Prof. Takayuki Tamura, Chiba University, Chiba, Japan.

Keywords and phrases: direct sums of Banach spaces, uniform non-squareness.

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Sperner's Lemma and Related Topics

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Abstract

An elementary way to prove Brouwer's fixed point theorem is to use Sperner's lemma, which claims that any proper labeling of any simplicial subdivision of n-simplex has an odd number of completely labeled subsimplices. In 2-dimensional case, every vertex of the subsimplices is labeled a number of $\{1, 2, 3\}$. We prove that if a mapping f from the set of vertices of the subsimplices, say V^2, into itself satisfies the direction preserving condition, then each completely labeled subsimplex has a fixed point.

On the other hand, Gale proved Hex theorem by Brouwer's fixed point theorem. Hex is a strategy board game of two players. Hex theorem asserts that if the vertices of the Hex board is labeled "1" or "2", then there exists a "1"-path joining W abd E or "2"-path joining N and S. We prove Hex theorem by Sperner's lemma.

Keywords: Sperner's lemma, Brouwer's fixed point theorem, Hex, Discrete fixed point theorem.

Some Extensions of Fixed Point and Mean Convergence Theorems for Non-Self Mappings in Hilbert Spaces

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Abstract

Let H be a real Hilbert space and let C be a non-empty subset of H. Kocourek, Takahashi and Yao [9] defined a class of nonlinear mappings in a Hilbert space. A mapping T from C into H is said to be generalized hybrid if there exist real numbers α and β such that

$$\alpha\|Tx - Ty\|^2 + (1-\alpha)\|x - Ty\|^2 \leq \beta\|Tx - y\|^2 + (1-\beta)\|x - y\|^2$$

for any $x, y \in C$. Hojo, Takahashi and Yao [3] defined a broad class of nonlinear mappings than the class of generalized hybrid mappings. A mapping T from C into H is said to be extended hybrid if there exist real numbers α, β and γ such that

$$\begin{aligned}\alpha(1+\gamma)\|Tx - Ty\|^2 + (1-\alpha(1+\gamma))\|x - Ty\|^2 \\ \leq (\beta+\alpha\gamma)\|Tx - y\|^2 + (1-(\beta+\alpha\gamma))\|x - y\|^2 \\ -(\alpha-\beta)\gamma\|x - Tx\|^2 - \gamma\|y - Ty\|^2\end{aligned}$$

for any $x, y \in C$. Furthermore they proved a fixed point theorem for generalized hybrid non-self mappings by using the extended hybrid mapping.

On the other hand, the author [8] defined a more broad class of nonlinear mappings in a Hilbert space which covers the class of generalized hybrid mappings and the class of extended hybrid mappings. A mapping T from C into H is said to be widely more generalized hybrid if there exist real numbers $\alpha, \beta, \gamma, \delta, \varepsilon, \zeta$ and η such that

$$\begin{aligned}\alpha\|Tx - Ty\|^2 + \beta\|x - Ty\|^2 + \gamma\|Tx - y\|^2 + \delta\|x - y\|^2 \\ +\varepsilon\|x - Tx\|^2 + \zeta\|y - Ty\|^2 + \eta\|(x - Tx) - (y - Ty)\|^2 \leq 0\end{aligned}$$

for any $x, y \in C$.

In this talk, we show some fixed point theorems and mean convergence theorems of Baillon's type for widely more generalized hybrid non-self mappings in a Hilbert space; see

also [6].

Keywords and Phrases: Fixed point theorem, mean convergence theorem, Hilbert space, non-self mapping, widely more generalized mapping.

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Extended Nonlinear Regularized Nonconvex Set-Valued Variational Inequalities

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Abstract

In this talk, we suggest a new system of extended nonlinear regularized nonconvex set-valued variational inequalities and establish an equivalence between this system and fixed point problems. By using the equivalence formulation, we define perturbed projection iterative algorithms with mixed errors for finding a solution of the system of extended nonlinear regularized nonconvex set-valued variational inequalities. Also, we prove the convergence theorems of the iterative sequences generated by the algorithms.

Keywords: System of extended nonlinear regularized nonconvex set-valued variational inequalities, uniformly r-prox regular sets, iterative sequences, convergence analysis, mixed errors.

Equivalence Conditions for Some Multivalued Iterations in CAT(0) Space

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Abstract

In this talk, we obtain some equivalence conditions for the convergence of multivalued iterative sequences generated by set-valued contraction mapping in $CAT(0)$ spaces.

A Note on the Moment Exponential Stability for Stochastic Functional Differential Equations

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Abstract

This talk deals with moment estimate and moment exponential stability of a stochastic functional differential equation of Itô-type. Under a monotone condition, we shall establish the asymptotic estimate for the solution of stochastic functional differential equations.

On a Multicriteria Two-Person Non-Zero-Sum Matrix Game with Set Relations

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Abstract

In this paper, we introduce a set-valued game, which is formulated by making use of a concept of set comparison. For the set-valued game, we define an optimal response strategy based on two set comparisons. Also we define minimax and maximin value and strategies for the set-valued game. As an application of the set-valued game, we reformulate multicriteria two-person non-zero-sum matrix game as a set-valued game and consider optimal response and minimax [maximin] value of the game.

On a Shrinking Projection Method for a Family of Mappings on a Geodesic Space

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Abstract

In this talk, we deal with an iterative sequence generated by a modified version of the shrinking projection method for a finite family of nonexpansive mappings defined on a complete geodesic space. We consider an error when calculating the value of a metric projection and show that the generated sequence still has a nice property for approximating a common fixed point of the mappings.

Keywords and phrases: CAT(κ) space, nonexpansive mapping, fixed point, approximation, shrinking projection method.

Frictional Contact Force Computation of Electrostatically Actuated Microswitch Using Semismooth Newton Method

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Abstract

This paper presents an effective approach for frictional contact force computation of electrostatically actuated microswitch. It requires the electrostatic-structural coupled analysis in designing the microswitch. To find the solution, the electrostatic force and structure displacement are obtained by performing the electrostatic and structure analysis, respectively. Furthermore, the frictional contact conditions are formulated with the second-order cone (SOC) complementarity problems. The Fischer?Burmeister (FB) function is used to transform the SOC complementarity problems into a set of nonlinear equations. Since the FB function is semismooth, the generalized Jacobian of FB function is used to deal with the nonlinear equations. The self-consistent solution of the electrostatic filed, structure, and friction contact equations is then found by using the semismooth Newton method. The simulations of microswitch actuation are performed to demonstrate the effectiveness of the proposed approach.

Keywords and phrases: Microswitch, Frictional contact force, Second-order cone complementarity problem, Semismooth Newton method.

Convexity Properties for Compositions of Set-Valued Map and Monotone Scalarizing Function

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Abstract

In this paper, we consider several convexity properties on composite functions of a set-valued map with its image in a vector space and a monotone scalarizing function for sets. The monotonicity means to preserve set-relations, for example, $I^{(j)}_{k,V}$ and $S^{(j)}_{k,V}$ introduced in [2] are monotone in the following sense: $I^{(j)}_{k,V}(A) \leq I^{(j)}_{k,V}(B)$ and $S^{(j)}_{k,V}(A) \leq S^{(j)}_{k,V}(B)$ for any nonempty subsets A and B in a vector space which have some set-relation $A \leq^{(j)}_K B$ in [1], where K is a convex cone, k is an interior point of K, and V is a subset of the vector space. These functions have certain inherited properties from a parent set-valued map: if set-valued map F has some kind of convexity, then $I^{(j)}_{k,V} \circ F$ and $S^{(j)}_{k,V} \circ F$ have also similar properties; see [3]. In this talk, we report some universal properties on convexity of composite functions.

Keywords and phrases: Composition, Monotonicity, Convexity.

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Moving Averages on Convex Metric Spaces

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Abstract

Recently, Bauschke et al. studied the homogeneous linear difference equation in a Banach space called the moving average in connection with a Gauss-Seidel iteration scheme. Moreover, they considered simple but powerful moving Kolmogorov means including arithmetic, harmonic and resolvent means of positive definite matrices as special cases. Motivated by their work, in this paper, we provided a convergence scheme of nonlinear moving averages which is not recovered in the framework of moving Kolmogorov means in general metric spaces admitting contractive means. Then we apply the convergence result to investigate properties of the limit of the moving geometric average of positive definite operators on a Hilbert space.

A Constraint Qualification in Minimization Programming with Pseudo-Convex Objective Function and Its Applications

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Abstract

In mathematical programming, constraint qualifications play essential and important roles to derive much of theoretical results. In this talk, we give a constraint qualification for sufficient optimality conditions in a minimization programming problem whose objective function is pseudo-convex, and we introduce a result that the constraint qualification is necessary and sufficient to validate the KKT condition for any pseudo-convex objective functions. Also we study its applications.

Keywords: constraint qualification, sufficient optimality condition, pseudo-convex function.

Multipliers and Invariant Operators in Banach Space Functions on LCA Group

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Abstract

Let G be a locally compact abelian (LCA) group with Haar measure dt and with dual group Γ. Let A be a commutative Banach algebra, X and Y be Banach spaces with A-module. Denote by $L^1(G,A)$ the space of all Bochner integrable A-valued functions defined on G. It is a commutative Banach algebra under convolution. $L^p(G,X)$ is the Banach space of all X-valued measurable functions defined on G whose X-norms are in usual L^p space. It is a Banach space for each p, $1 \leq p \leq \infty$.

In this paper, we characterize the multiplier operators and the invariant operators of various Banach-valued functions defined on G, and prove that the space A-module homomorphism of X to Y^* ($\cong$ A-module multiplier of X to Y^*) is isometrically isomorphic to the dual functional of A-module tensor product space: $(X \otimes_A Y)^*$. Furthermore, we have the restriction and extension forms: A replaced by $L^1(G,A)$, X by $L^1(G,X)$, Y by $L^p(G,Y)$, and Y^* by $L^q(G,Y^*)$ with $(1/p)+(1/q)=1$ and $1<p,q<\infty$. Finally, a relation between invariant operators and multiplier operators is established. It explores a necessary and sufficient condition for each invariant operator to be a multiplier.

Keywords and phrases: Banach module, homomorphism, multiplier operator, invariant operator, Bochner integral, Radon-Nikodyn property, module tensor product.

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Recovering a Function from a Subdifferential

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Abstract

We describe a class of extended real-valued lower semicontinuous functions for which the lower Dini subderivative of the function at a given point of its domain can be expressed in terms of an appropriate subdifferential of the function at neighbouring points. This class includes the directionally approximately convex functions, the uniformly prox-regular functions, the semi-smooth functions, etc. For such functions, the lower Dini subderivative can therefore be recovered from a subdifferential, and consequently the function itself, up to a constant, can be recovered from a subdifferential. The issue of recovering a function from one of its Dini derivatives is an old central question since Lebesgue's seminal work (see, e.g. [1]), while the issue of recovering a function from a subdifferential is the subject of intensive researches in recent years, since Moreau and Rockafellar's seminal works on convex functions to the many successive works by Thibault and his co-authors on increasingly large classes of functions (see [2] and the references therein). Our approach is different because we have divided the latter problem in two parts: recovering a Dini subderivative from a subdifferential on the one hand, recovering a function from a Dini subderivative on the other.

Keywords: Subdifferential, lower Dini subderivative, approximately convex function, semi-smooth property, integration of subdifferentials.

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Characterizing Positivity of Difference of SOS-Convex Polynomials and Containment of Semialgebraic Set

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Abstract

In this talk, we first present sums of squares characterizations of positivity and non-negativity of the difference of SOS-convex polynomials over a convex semialgebraic set. Consequently, we establish numerically checkable sums of squares characterizations of containment of a convex semialgebraic set either in another convex semialgebraic set or in another reverse convex semialgebraic set, described by SOS-convex polynomials. Finally, we obtain robust set containment characterizations for convex semialgebraic sets in the face of data uncertainty of the SOS-convex polynomials that define the convex semialgebraic sets.

Keywords: Set containment, SOS-convex polynomials, sums of squares polynomials, convex semialgebraic sets.

The Study of Mathematics Learning Opportunities for Fourth Graders in Taiwan

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Abstract

The result of Trends in International Mathematics and Science Study (TIMSS) (Mullis et. al., 2008) showed that 4th graders and 8th graders in East Asia were with excellent perfornances in Mathematics; therefore, many scholars tried to analyze the factors which would inflence students' perfornances. Lin (2010) considered these factors could be represented as $aX + bY + cZ$; X represented school lessons, Y represented out-of-school lessons, Z represented others such as societal factor or cultural factor, etc., and a, b, c, represented the weights to these factors.

This study aimed at discussing Taiwanese 4th graders' mathematics learning opportunities (MLO) through documentary analysis. It began with analyzing literatures on general learning opportunities and MLO, then followed by defining the major levels, categories, and sub-categories of MLO based on the literatures and the opinions from a panel of four mathematics educators and three in-service elementary school teachers as well as postgraduates in mathematics education. The data of students' MLO research report mainly originated from TIMSS 2007, one of the authors' video study in 2007, educational statistics in 2007, TEDS-M 2008, and PIRLS 2006.

The research results defined students' MLO as available resources and favorable conditions for students' mathematics learning and were classified into five levels: country, school, family, teacher, and student.

For country-level, the yearly decrease of average number of students and student-teacher ratio in class, equal MLO for every student, and remedial teaching were conducive to increase students' MLO. Nevertheless, Chinese Language Policy, less mathematics lesson hours and lower educational expenses in Taiwan than the U.S., Japan, Korea, and Singapore indicated these factors would reduce students' MLO. As for the effects of students' MLO regarding consistent mathematics curriculum guideline and students' usable fields still waited for further investigation.

For school-level, school climate and student behavior in Taiwan were both favorable and unfavorable for students' MLO. The administration-oriented assignments of school principals and the lack of learning resources weakened students' MLO. The effects of students' MLO regarding most schools centered on crowded areas and parent involvement still needed to be explored further; the data with respect to school-based support in teacher continual professional development were not yet found.

For family-level, fewer poor families and most parents with our nationality seemed to benefit to students' MLO. The learning resources and books at home were advantageous and disadvantageous for students' MLO. The effects of students' MLO regarding parental expectations and supports needed to be studied further; the effects regarding parental educational backgrounds were incomplete.

For teacher-level, teachers with good educational backgrounds and experiences, high self-efficacy in mathematics teaching and attitudes, long teaching hours, teaching with new contents and teacher-student interaction were beneficial for students' MLO. However, for mathematics, pre-service and in-service teacher education, interaction among colleagues, the dependence of mathematics learning resources on textbooks and blackboards rather than multimedia, and teaching preparations seemed to weakened students' MLO. The effects of students' MLO regarding teachers' mathematics competencies and the ratio of

mathematics powerful teaching classifications needed to be studied further. There were no data to support if teacher beliefs towards mathematics essence, teaching, and learning would influence students' MLO.

For student-level, the use of students' common language and mathematics homework were both advantageous for students' MLO, but students' language literacy and emotional expression seemed to be disadvantageous for their MLO. The influence of students' MLO about the ration between their attention to the lectures, do-it-themselves, group collaborative learning, and communication required for further exploration. There were no data discussing the effects of students' MLO with regard to their intelligence, after-school learning, and the use of reference books, test papers as well as extracurricular reading in mathematics.

Keywords: documentary analysis, mathematics learning opportunities.

Coincidence Points of Weaker Contractions in Partially Ordered Metric Spaces

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Abstract

In this talk, we prove new coincidence point theorems for the $(\varphi, \psi, \phi, \xi)$-contractions and generalized Meir-Keeler-type α-ψ-contractions in partially ordered metric spaces. Our results generalize many recent coincidence point theorems in the literature.

Variational Inequality Problems over Split Fixed Point Sets of Strict Pseudo-Nonspreading Mappings and Quasi-Nonexpansive Mappings with Applications

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Abstract

In this paper, we first establish strong convergence theorem for a variational inequality problem over split fixed point sets of strict pseudo-nonspreading mappings and quasi-nonexpansive mappings. As applications, we study variational inequality problems over various types of split common solutions for fixed point of finite family of strict pseud-nonspreading mappings and solution of countable family of nonlinear operators. We study the strong convergence of the problem more general than the problem studied by Chang *et al.*[1] without semicompact assumption. We also study the problem which contains common solution of fixed point of hemicontinuous pseudo-contractive mappings and zeros of sum of monotone mappings. Our result improve the results of the problems by studied by Zegeye *et al.* [2] and Yao *et al.*[3]. In this paper, we only assume that hemicontinuity on the pseudo-contractive mappings we consider, we don't need Lipschitz continuous assumption. We study fixed point of a countable family of pseudo-contractive mappings with hemicontinuity assumption, neither Lipschitz or closedness assumptions on pseudo-contractive mappings is need in our fixed point results. Our results in this paper improve and generalize Theorems 3.1, 4.1 of Takahashi *et al.* in [7]; Theorem 3.1 of Takahashi *et al.* in [8]; Theorem 3.1 of Cheng *et al.* in [4]; Theorem 3.1 of Deng [5]; Theorem 3.1 of Zegeye *et al.* in [6] and [2]; Theorem 3.1 of Yao *et al.* in [3]; Theorem 3.1 of Tang in [9]; Theorem 3.1 [10]; Theorem 3.3 [13]; Theorem 3.1 [14]; Theorem 10 [12]; Theorem 3.1 [15]; Theorem 15 [12]; Theorem 3.1 [11] and Theorem 3.2 [16]. Our results

will have many applications in nonlinear analysis and fixed point theory.

Keywords and phrases: monotone mapping, pseudo-contractive mapping, fixed point, multiple sets split feasibility problem, split system variational inequality problem, split monotone variational inclusion problem.

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Weakly Sharp Solutions of Primal and Dual Variational Inequality Problems

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Abstract

The aim of this work is to characterize weakly sharp solutions of a variational inequality and a dual variational inequality in terms of two gap functions. We discuss relations between the Gâteaux differentiabilities of these two gap functions and present sufficient conditions for their locally Lipschitz property as well. Based on these results, we propose sufficient conditions for the weak sharpness of a variational inequality problem and its dual problem.

Keywords: variational inequality, gap functions, Gâteaux differentiability, locally Lipschitz property, weakly sharp solution, error bound.

Effects of Segmentation Approach for Middle School Students in Understanding Geometric Proofs

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Abstract

Learning geometric proofs is a complicated process which needs high cognitive demand for middle school students. As such, teaching geometry is more complex and often less successful than teaching numerical operations or elementary algebra (Duval, 1998). Using segmentation approach to reduce the intrinsic cognitive load of geometric proofs and promote students reading motivation as well as their understanding are the research issues in mathematics education. Tso and Lu (2011) indicated using segmentation to present geometric proofs can lower experts or novices difficulty experienced and effort expended in the reading process. But Tso and Lu did not analyze in depth for students with different learning achievements. Therefore, this study aims to investigate the effects of a segmentation approach for presenting geometric proofs on the learning performance of eighth graders and their perceived cognitive load. The subjects comprised 207 Taiwanese eighth graders who were divided into three groups based on their usual grades in mathematics, before being randomly assigned to read either segmented or non-segmented texts on geometric proofs. The results show that the segmentation approach led to significant results for theses novices in terms of the degree of difficulty experienced, amount of effort

expended, and confidence. However, only students with a good level of mathematical achievement displayed actual comprehension. Overall, the segmentation approach did not significantly improve the learning outcomes of students. The study thus explored relevant teaching suggestions to address this finding and proposed directions for future research.

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Cayley Digraphs of Brandt Semigroups Relative to Green's Equivalence Classes

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Abstract

This paper we describe Cayley digraph of Brandt semigroups relative to Green's equivalence classes. Moreover, we investigate isomorphic conditions for those Cayley digraphs.

Critical Point Theory and Variational Methods with Applications to Electronic Structure Models within Quantum Chemistry

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Abstract

We report on a series of rigorous results on the existence of ground states and excited states for various weakly coupled, semilinear nonlinear elliptic PDEs arising in electronic structure models of molecular systems in quantum chemistry.

For wave function methods, we give results for Hartree-Fock type models taking into account relativistic effects and magnetic fields by using the Lions-Fang-Ghoussoub critical point approach to multiple solutions on a noncompact Riemannian manifold.

Within Density Functional Theory (DFT), we give rigorous results on the open-shell, spin-polarized Kohn-Sham models for non-relativistic and quasi-relativistic N-electron Coulomb systems, that is, systems where the kinetic energy of the electrons is given by either the non-relativistic operator $-\Delta_{x_n}$ or the quasi-relativistic operator (nonlocal, pseudodifferential operator of order one) $\sqrt{-\alpha^{-2}\Delta_{x_n}+\alpha^{-4}}-\alpha^{-2}$; here α is Sommerfeld's fine structure constant. For standard and extended Kohn-Sham models in the local density approximation, we prove existence of a ground state (or minimizer) provided that the total charge Z_{tot} of K nuclei is greater than $N-1$. For the quasi-relativistic setting we also need that Z_{tot} is smaller than a critical charge $Z_{\text{c}}=2\alpha^{-1}\pi^{-1}$.

This is joint work with C. Argaez (Dublin Institute of Technology, Ireland), E. Chiumiento (IAM CONICET, Argentina) and M. Enstedt (Uppsala University, Sweden).

Keywords: Critical point theory, Riemannian manifolds, concentration-compactness, minimizer, excited states.

Numerical Solution of the Stochastic and Deterministic LQR Problem

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Abstract

The numerical treatment of the stochastic and deterministic linear quadratic optimal control problem requires solving Riccati equations. In the finite time horizon case, the Riccati differential equation (RDE) arises. We review efficient numerical methods for solving deterministic and stochastic RDEs. We focus on problems govern by parabolic partial differential equations and the corresponding large-scale Riccati equations arising from the discretization. We discuss several variants of the available methods which exploit the structure on the problem (e.g. sparsity, symmetry or low-rank). The performance of each of these methods is tested in numerical experiments.

Keywords: RDE, SRDE, LQR, Stochastic LQR, numerical methods.

Entropy and Recurrent Dimensions of Discrete Quasi-Periodic Dynamical Systems Given by p-adic Expansions

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Abstract

In this paper we treat symbolic dynamical systems given by the shift mapping on the coefficient sequence of expansions of p-adic numbers. We give some inequality relations between the recurrent dimensions and the topological entropies of these discrete dynamical systems. Applying these relations to the quasi-periodic discrete orbits, given by Sturmian sequences, we estimate the gap values of recurrent dimensions, which indicate the unpredictability level of the orbits.

Keywords and phrases: Symbolic dynamics, Topological entropy, p-adic theory, Continued fractions, Quasi-periodic orbits.

The Shortest Vector Problems in p-adic Lattices and Simultaneous Approximation Problems of p-adic Numbers

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Abstract

We construct multi-dimensional p-adic approximation lattices by simultaneous rational approximations of p-adic numbers. In the infinitely many p-adic lattices we can show that the search problems for the shortest vectors in these lattices are NP-complete. For analyzing these p-adic lattices we apply the LLL reduction algorithm. Using the open source software SAGE, we compare the minimum norms of the vectors given by the LLL algorithm and the norms of vectors estimated by the simultaneous approximation theory.

Keywords and phrases: p-adic theory, Continued fractions, Diophantine approximation, LLL algorithm.

The Halpern Iteration Procedure with Two Strongly Quasinonexpansive Mappings in CAT(1) Spaces

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Abstract

In 2013, Kimura and Satô [1] proved a convergence theorem in a complete CAT(1) space with a strongly quasinonexpansive mapping. In this talk, we show an analogous result dealing with a convergent sequence in a complete CAT(1) space with two strongly quasinonexpansive mappings.

Keywords and phrases: CAT(1) space, Halpern type, fixed point, strongly quasinonexpansive.

References

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Equilibria in Non-Cooperative Games and Cost Allocation for Minimum Cost Spanning Tree Problems

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Abstract

A spanning tree is a tree in which each agent is connected with a common source by a path, and the cost of the spanning tree is the sum of the costs of all edges in the tree. In a minimum cost spanning tree (msct) problem, we usually want to find a spanning tree of minimum cost. To determine how to allocate the cost associated with the mcst among agents, a cooperative game and some cost allocation rules have been proposed.

In this study, we formulate a non-cooperative game for an mcst problem, and discuss several necessary conditions and sufficient conditions for cost sharing strategies being Nash equilibria or strong equilibria. We provide a cost allocation rule that ensures its allocation results to be Nash equilibria or strong equilibria. Moreover, we discuss some relationships between Nash equilibria or strong equilibria of the non-cooperative game

and cost allocation vectors in the core of the corresponding cooperative game.

Keywords: Minimum cost spanning tree problem, Non-cooperative game, Equilibria, Cost allocation.

Approximation Methods for Common Solutions of Split Variational Inclusion and Fixed Point Problems in Hilbert Spaces

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Abstract

In this work, the iterative algorithms which combine Moudafi's viscosity approximation method with some fixed point technically proving methods are utilized for finding a common solution of split variational inclusion problem and fixed point problem of infinite family of nonexpansive operators in a setting of real Hilbert spaces. We prove that the iterative schemes with some suitable control conditions converge strongly to a common solution of the considered problem.

Existence Theorems for Relaxed η-α Pseudomonotone and Strictly η-Quasimonotone Generalized Variational-Like Inequalities

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Abstract

In this paper, we prove the existence of solutions for variational-like inequality and generalized variational-like inequality with relaxed η-α pseudomonotone and strictly η-quasimonotone in Banach spaces by using KKM technique. The results presented in this paper improve and extend some corresponding results of several authors.

Keywords: Variational-like inequality, Generalized variational-like inequality, Relaxed η-α pseudomonotone operator, Strictly η-quasimonotone operator, Solution existence.

Existence and Convergence of Common Fixed Points via an Iterative Projection Technique for Two Strict Pseudo-Contractions in Hilbert Spaces

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Abstract

The purposes of this paper are to study some existence and convergence theorems of common fixed points for two strict pseudo-contractions by using an iterative projection technique with some suitable conditions. The method permits us to obtain a strong convergence Iteration for finding some common fixed points of two strict pseudo-contractions in the framework of real Hilbert spaces. Further, some related applications are discussed in real Hilbert spaces.

Keywords and phrases: Strict pseudo-contraction, Common fixed points, Iterative projection technique.

The General Iterative Methods for Split Variational Inclusion Problem and Fixed Point Problem in Hilbert Spaces

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Abstract

In this paper, the autor introduces the general iterative method for finding a common element of the solution set of a split variational inclusion and fixed point problem in a real Hilbert space. Under appropriate conditions imposed on the parameters, the strong convergence theorems are obtained.

Keywords: Split variational inclusion problem, Fixed point problem, Inverse strongly monotone; Projection.

An Indirect Method of Nonconvex Variational Problems in Asplund Spaces: The Case for Saturated Measure Spaces

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Abstract

The purpose of this paper is to establish an existence result for nonconvex variational problems with Bochner integral constraints in separable Asplund spaces via the Euler–Lagrange inclusion, under the saturation hypothesis on measure spaces, which makes the Lyapunov convexity theorem valid in Banach spaces. The approach is based on the indirect method of the calculus of variations.

Keywords: Indirect method, Nonconvex variational problem, Saturated measure space, Lyapunov convexity theorem, Asplund space, Euler–Lagrange inclusion.

On the Mathematical Models Describing the Generation of DNA Damages by Radiation

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Abstract

It is well known that the double-strand break (*dsb*) of DNA is one of the most serious lesions leading to many radiobiological effects and various mathematical models of *dsb* generation were devised. However we often find some mathematical incompleteness in those arguments. In this talk, we give new stochastic models describing the generation of *dsb*s and derive the dependence of the generation of *dsb*s on dose of radiation under the assumption of randomness in the *dsb* location and in the number of *dsb*s ([1]).

Keywords: Mathematical model, DNA, dsb.

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New Geometrical Notions of Banach Spaces using ψ-Direct Sums

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Abstract

In this talk, we present new geomerical notions of Banach spaces as generalizations of p-uniform smoothness and q-uniform convexity. Further, we characterize the notions in terms of norm inequalities and consider the duality relations.

This talk is a joint work with Ryotaro Tanaka.

Keywords and phrases: absolute norm, Beckner's inequality, ψ-direct sum.

On Generalization of Ricceri's Theorem into Set-Valued Maps via Scalarization

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Abstract

In this paper, we consider several Ricceri's theorems ([3]) on Fan-Takahashi minimax inequality ([4]) for set-valued maps by some scalarization method. In 2010, Kuwano, Tanaka and Yamada propose Fan-Takahashi minimax inequality for set-valued maps by using certain scalarizing functions ([2]) for sets based on set-relations $\leq_C^{(j)}$ $(j = 1, \ldots, 6)$ introduced by [1], where C is a convex cone in a vector space. In 2012, we propose a certain Ricceri's theorem on Fan-Takahashi minimax inequality for set-valued maps with respect to "$\leq_C^{(5)}$". In this talk, we discuss such kind of Ricceri's theorem with respect to other set-relations.

Keywords and phrases: Fan-Takahashi minimax inequality, Set-relations, Set-valued map.

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Generalizations of the Ekeland Variational Principle in Asymmetric Locally Convex Spaces

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Abstract

The aim of the present paper is to prove the extensions of the Ekeland variational principle in asymmetric locally convex spaces. We give a property which is used in the proof of the results and establish the results from some generalizations of the Ekeland-type variational principle for $Q-$function on quasi-metric space to asymmetric locally convex spaces. Moreover, we prove the equivalence among the result, Caristi-Kirk fixed point theorem, Takahashi's minimization theorem and Equilibrium version of the Ekeland variational principle.

Non-Hermitian Extension of the Heisenberg and Schrödinger Uncertainty Relations

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Abstract

In quantum mechanics a physical state is represented by density operator ρ and an observable is represented by hermitian operator A. Then the expectation $E_\rho(A)$ is given by $Tr[\rho A]$ and the variance $V_\rho(A)$ is given by $Tr[\rho A^2] - (Tr[\rho A])^2$. The uncertainty relation is obtained by Heisenberg as follows:

$$V_\rho(A) \cdot V_\rho(B) \geq \frac{1}{4}|Tr[\rho[A,B]]|^2$$

for self-adjoint operators A, B and density operator ρ, where $[A,B] = AB - BA$. The refined uncertainty relation is obtained by Schrödinger as follows:

$$V_\rho(A) \cdot V_\rho(B) - |\mathrm{Re}\{Cov_\rho(A,B)\}|^2 \geq \frac{1}{4}|Tr[\rho[A,B]]|^2$$

for self-adjoint operators A, B abd density operator ρ, where $Cov_\rho(A,B) = Tr[\rho A_0 B_0]$. Here $A_0 = A - Tr[\rho A]I$ and $B_0 = B - Tr[\rho B]I$.

Recently Dou and Du proposed to release the restriction on operators which are observables. And they defined the corresponding Wigner-Yanase-Dyson skew information and studied some properties of them in [1], [2]. Also they obtained non-hermitian extensions of Heisenberg or Schrödinger uncertainty relations which is a generalization of Luo's theorem given in [3]. In this paper we generalize further extension of results in [1].

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S-Lemma with Equality and Its Applications

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Abstract

Let $f(x) = x^T Ax + 2a^T x + c$ and $h(x) = x^T Bx + 2b^T x + d$ be two quadratics having symmetric matrices A and B. The S-lemma with equality asks when the unsolvability of the system $f(x) < 0, h(x) = 0$ implies the existence of a real number μ such that $f(x) + \mu h(x) \geq 0,\ \forall x \in \mathbb{R}^n$. The problem is much harder than the inequality version which asserts that, under Slater condition, $f(x) < 0, h(x) \leq 0$ is unsolvable if and only if $f(x) + \mu h(x) \geq 0,\ \forall x \in \mathbb{R}^n$ for some $\mu \geq 0$. In this paper, we overcome the difficulty that the equality $h(x) = 0$ does not possess any Slater point and that both f and h may not be homogeneous. We show that the S-lemma with equality is always true unless the matrix A has exactly one negative eigenvalue; $h(x)$ is a non-constant linear function ($B = 0, b \neq 0$); and one natural relation between A and b is met. As an application, we can globally solve $\inf\{f(x)|h(x) = 0\}$ as well as the two-sided generalized trust region subproblem $\inf\{f(x)|l \leq h(x) \leq u\}$ without any assumption. Moreover, the convexity of the joint numerical range $(f(x), h(x))$ for f being nonhomogeneous and h linear can be characterized using the newly developed S-lemma with equality.

Mathematical Activities Based on Spiral Learning: A Case Study on Japanese Elementary School Students

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Abstract

Starting in April 2011, the Japanese government has introduced new course guidelines for elementary schools, which states "In order to connect the contents of instruction between grades smoothly, educational guidance must be advanced repeatedly". Based on this teaching method (known as "spiral learning"), the author's department hosted a one-day lectures on "geometrical figures" and "numbers and calculations" for elementary school students so that they could understand how mathematics is applied to our daily life. This article reports the substance and result of the lecture, and considers the

effectiveness of spiral learning.

Keywords: Course guidelines, Ellipse, Geometry, Spiral learning.

Weaker Conditions and Common Fixed Point Theorems in G-metric Spaces

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Abstract

In an interesting article, Bouhadjera and Godet-Thobie *[2009 arXiv :0906.3159 VI (Math. F.A.)]* introduced new concept of sub- compatibility and sub-sequential continuity which are respectively weaker than occasionally weak compatibility and reciprocal continuity. M. Imdad et al. [Applied Mathematical letters *24(2011),1165-1169]* improved aforementioned article of Bouhadjera and Godet-Thobie with the comment that flaws in the article can be recovered by replacing sub-compatible pairs with compatible pairs or replacing sub-sequential continuous pairs with reciprocal continuous pairs.

In this note, acknowledging the concept of M. Imdad et al. *[Applied Mathematical letters 24(2011),1165-1169]*, some common fixed point theorems are proved for four mappings under two different combination of mapping conditions e.g. sub-compatible mappings with reciprocal continuity and sub-sequential continuity with compatible mappings in the frame work of G-metric spaces.

Suitable examples substantiate the genuineness of our investigations in this note.

Keywords and Phrases: G-metric spaces, sub-compatible maps, sub-sequential continuity and reciprocal continuity, compatible mappings.

Unbounded Sets of Solutions of Non-Cooperative Elliptic Systems on Spheres

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Abstract

The aim of this talk is to consider the following non-cooperative system of elliptic equations

$$\begin{cases} \alpha_1 \Delta_{S^{n-1}} u_1(x) &= \nabla_{u_1} F(u(x), \lambda) \\ \alpha_2 \Delta_{S^{n-1}} u_2(x) &= \nabla_{u_2} F(u(x), \lambda) \\ \vdots & \vdots \\ \alpha_p \Delta_{S^{n-1}} u_p(x) &= \nabla_{u_p} F(u(x), \lambda) \end{cases} \quad \text{on} \quad S^{n-1}, \tag{1}$$

where $\Delta_{S^{n-1}}$ is the Laplace-Beltrami operator on the sphere $S^{n-1} = \{x \in \mathbb{R}^n \colon ||x|| = 1\}$, $\alpha_i \in \{-1, 1\}$, $F \in C^2(\mathbb{R}^p \times \mathbb{R}, \mathbb{R})$ is such that $\nabla_u F(u, \lambda) = \lambda u + \nabla_u g(u, \lambda)$, where $g \in C^2(\mathbb{R}^p \times \mathbb{R}, \mathbb{R})$, $\nabla_u g(0, \lambda) = 0$ and $\nabla_u^2 g(0, \lambda) = 0$ for every $\lambda \in \mathbb{R}$. More precisely, we study connected sets of weak solutions of system (1).

As the main topological tool we use the degree for G-invariant strongly indefinite functionals, see [2]. We show that any continuum of nontrivial solutions of system (1), bifurcating from the set of trivial solutions, is unbounded. This is a generalization of the result due to S. Rybicki, see [3]. Moreover, we characterize bifurcation points of this system at which the global symmetry-breaking phenomenon occurs.

Keywords and phrases: global bifurcations, symmetry breaking, non-cooperative elliptic system, equivariant degree.

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Fixed Point Theorems for Nonlinear Mappings and A Semigroup of Some Nonlinear Mappings

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Abstract

In this talk, we first discuss some fixed point theorems of certain types of nonlinear mappings and then we prove existence and convergence theorems of common fixed point for reversible semitopological semigroups of some nonlinear mappings in uniformly convex Banach spaces and uniformly convex metric spaces.

Upper Bound for the 2-Page Linear Crossing Number of Hypercube Graph Q_n via Semidefinite Programming Relaxation

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Abstract

The crossing number of a hypercube graph Q_n is the minimum number of edge crossings when then graph representation is drawn on a plane. In this paper, we describe a method for drawing the associate conflict graph Q'_n and finding the bound of 2-page fixed linear crossing number of Q_n. We consider a 2-page drawing of Q_n and maximize the weight of a cut of Q'_n instead of minimizing the crossing number of the 2-page drawing by formulating original problem into the MAXCUT problem. We consider a semidefinite relaxation of the MAXCUT problem. The numerical results confirm with the known result for complete graph K_n shows the effectiveness of the approximation.

A Constraint Qualification Characterizing Surrogate Strong and Min-Max Duality

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Abstract

In mathematical programming, constraint qualifications are essential elements for duality theory. Recently, necessary and sufficient constraint qualifications for Lagrange strong and min-max duality via convex programming have been investigated. In general, necessary and sufficient constraint qualifications for strong duality are not equivalent to necessary and sufficient constraint qualifications for min-max duality. Actually, Farkas Minkowski, which is a necessary and sufficient constraint qualification for Lagrange strong duality, is not equivalent to locally Farkas Minkowski, which is a necessary and sufficient constraint qualification for Lagrange min-max duality.

In this talk, we investigate a constraint qualification which completely characterizes surrogate strong and min-max duality for quasiconvex programming. We show that the closed cone constraint qualification for surrogate duality is a necessary and sufficient constraint qualification for both of surrogate strong and min-max duality via quasiconvex programming.

Keywords: quasiconvex programming, constraint qualification, surrogate duality.

Designing Vehicle Suspension and Tire Parameters Using Split and Discard Strategy

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Abstract

In this paper, we present a mathematical model of a half car with two passengers. The model under study has important features such as; non-linearity of suspension spring and damper, tire damping with non-linear spring stiffness. These features validate the model to real application. The response of the dynamical system running over a road with series of irregular shaped bumps has been studied by simulation. These bumps have been mathematically expressed. The suspension and tire parameters have been determined optimally using a new hybrid algorithm in time domain. The developed algorithm is based on Split and Discard Strategy (SDS) and advanced real coded genetic algorithm (ARCGA). To find these parameters we have formulated a constrained non-linear optimization problem to minimize the vibration experienced by the passenger as well as to enhance road holding performance during riding. For this purpose the weighted sum of sprung mass jerk and tire deflections are minimized under technological constraints. Moreover, the results obtained from simulations of model with original and optimized suspension parameters are compared.

Keywords: Suspension, half car, optimization, genetic algorithm

Some Mappings Defined on a Bounded Subset of a Uniformly Convex Banach Space

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Abstract

Browder and Petryshyn [1] initiated the study of fixed points of strictly pseudo-contractions in the Hilbert space setting. Ishikawa's research [2] made an impact on this study area. After these works, many articles were appeared. Some researchers claim that strictly pseudo–contractions have more powerful applications than non-expansive mappings. However, in 2008, Zhou [4] presented a lemma. The proof of the lemma is trivial but his lemma is so interesting. Zhou's lemma says that, for any strictly pseudo–contraction T, we can easily find a nonexpansive mapping S such that $F(S) = F(T)$. In Zhou's lemma, we do not claim $F(T) \neq \emptyset$. In the context of [4], may be, he assumed that C is closed and convex. However, these conditions are unnecessary.

Zhou's lemma. *Let $k \in [0, 1)$. Let C be a subset of a Hilbert space H and T be a k–strictly pseudo–contraction of C into H. Let $c \in [k, 1)$ and S be a mapping defined by $Sx = cx + (1 - c)Tx$ for $x \in C$. Then, S is nonexpansive with $F(T) = F(S)$.*

In this talk, motivated by these works, we introduce a class of mappings defined on a bounded subset C of a uniformly convex Banach space E. We call the class Class (p). Then, we study the relation between a mapping T of Class (p) and $S = kI + (1 - k)T$, where $k \in [0, 1)$ and I is the identity mapping on E. Our direction is different from the way that we consider strictly pseudo–contractions in Banach spaces. In our way, we have some results and apply these to have some convergence theorems.

Keywords and phrases: Modulus of convexity, Zhou's lemma, nonexpansive mapping, strictly pseudo–contraction, fixed point.

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Scalarization Technique for Set-Valued Maps

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Abstract

Fan-Takahashi minimax inequality in [1, 6] is one of the important results in convex analysis as well as nonlinear analysis. In 2010, Kuwano, Tanaka and Yamada extend classical Fan-Takahashi minimax inequality into set-valued versions by using the following scalarizing functions ([3]) for sets based on set-relations $\leq_C^{(j)}$ $(j = 1, \ldots, 6)$ introduced by [2] where C is a convex cone in a vector space:

$$(\mathrm{I}_{k,V'}^{(j)} \circ F)(x) := \inf \left\{ t \in \mathbb{R} \;\middle|\; F(x) \leq_C^{(j)} (tk + V') \right\} \tag{2}$$

$$(\mathrm{S}_{k,V'}^{(j)} \circ F)(x) := \sup \left\{ t \in \mathbb{R} \;\middle|\; (tk + V') \leq_C^{(j)} F(x) \right\} \tag{3}$$

where $V' \in 2^Y \setminus \{\emptyset\}$, direction $k \in \operatorname{int} C$ and the set-relations $\leq_C^{(j)}$ $(j = 1, \ldots, 6)$ are defined in [2]. In NAO2012, Saito, Tanaka and Yamada propose a certain Ricceri's theorem ([5]) on Fan-Takahashi minimax inequality for set-valued maps with respect to "$\leq_C^{(5)}$".

These scalarizing functions have some kinds of montonicity and convexity, and certain inherited properties from a parent set-valued map: if set-valued map F has some kind of convexity, then $\mathrm{I}_{k,V}^{(j)} \circ F$ and $\mathrm{S}_{k,V}^{(j)} \circ F$ have also similar properies; see [4].

In this talk, we take an overview of this kind of scalarization technique. Detail properties of the scalarizing functions will be reported by Kobayashi and its application by Saito in this conference.

Keywords and phrases: Fan-Takahashi minimax inequality, set optimization, sublinear scalarization, set-valued map, set-relation.

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Linear Complementarity Problem with Pseudomonotonicity on Euclidean Jordan Algebras

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Abstract

In this talk, we present interconnections between pseudomonotonicity, the column sufficiency property, and the globally uniquely solvable property in the setting of Euclidean Jordan algebras.

Keywords: Euclidean Jordan algebra, Pseudomonotone, Positive subdefinite, Copositive, Column sufficiency property, Complementarity problem, Globally uniquely solvable property.

Inexact Newton and Quasi–Newton Methods for the Output Feedback Pole Assignment Problem

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Abstract

The pole assignment problem is a special algebraic inverse eigenvalue problem. In this paper, we present two types of algorithms, namely a quasi-Newton method with line search and some variants of the inexact Newton methods to tackle that problem. For a nonmonotone version of inexact Newton–Krylov method, we give local convergence under the assumptions of semismoothness and BD-regularity at the solution and global convergence under a nonmonotonic backtracking strategy. For a quasi-Newton method with line search, under suitable assumptions, we show local Q-superlinear convergence.

The methods are also modified to tackle problem where the corresponding control system is with time delay. Numerical results illustrate the applicability and the performance of the proposed methods are given.

A New Three Step Iteration and Convergence of Pseudocontractive Mappings

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Abstract

In this paper, we study a new three step iteration process for pseudocontractive mappings and prove convergence result for a countable family of pseudocontractive mappings. Our results improve and generalize most of the results that have been proved for this important class of nonlinear mappings. We also compare the performance of iteration by an example.

Existence Theorems for Monotone Multi-Valued Mappings in Partially Ordered Metric Spaces

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Abstract

In this paper, we introduce two new types of monotone multi-valued mappings in partially ordered metric spaces and prove some existence theorems of those two types of mappings under some contraction conditions. Our main results extend many known results in the literature. Moreover, we also give an example which satisfies our main theorem but Nadler's theorem cannot be applied.

On Existence and Uniqueness of Common Fixed Point and Continuity of Maps

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Abstract

This paper is devoted to investigate the existence and uniqueness of common fixed point via variants of continuity. Our results generalize and improve several known results existing in literature. Finally, we present an example to demonstrate the validity of the hypotheses and degree of generality of our results over comparable ones from the existing literature.

Keywords: Continuity, common fixed point, weak compatibility.

A New Class of Mappings of Nonexpansive Type with respect to the Bregman Distance

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Abstract

We introduce a new class of nonlinear mappings of nonexpansive type with respect to the Bregman distance. We design a new hybrid iterative scheme for finding fixed points of the mappings.

Many authors have studied iterative methods for approximating fixed points of nonexpansive mappings since many problems in nonlinear functional analysis are related to finding fixed points of nonexpansive mappings. However, many of the useful examples of nonexpansive mappings in Hilbert spaces are no longer nonexpansive in Banach spaces. From this background, we try to extend existing theories in Hilbert spaces to Banach spaces. In order to overcome these difficulties, we use the Bregman distance instead of the norm. In 1967, Bregman has discovered an elegant and effective technique for the using of the so-called Bregman distance in the process of designing and analyzing feasibility and optimization algorithms. Our main purpose is to study convergences for finding fixed points of nonlinear mappings which are more general than nonexpansive mappings with respect to the Bregman distance in Banach spaces.

We introduce a new class of nonlinear mappings of nonexpansive type in reflexive Banach spaces. This is extension of asymptotically quasi-nonexpansive mappings with respect to the Bregman distance in the intermediate sense. The new mappings are not Lipschitz continuous in general. In certain conditions, the set of fixed points of the mapping is closed and convex. Moreover, we establish a new strong convergence theorem of the shrinking projection method for finding a fixed point of the mapping. Our results are generalization of results in Hilbert spaces by Takahashi-Takeuchi-Kubota in 2008.

Keywords: asymptotically quasi-nonexpansive in the intermediate sense, Bregman distance, Bregman projection, Legendre function, totally convex function.

Generalized Schrödinger Uncertainty Relation Associated with a Monotone or Anti-Monotone Pair Skew Information

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Abstract

In quantum mechanics a physical state is represented by density operator ρ and an observable is represented by hermitian operator H. Then the expectation $E_\rho(H)$ is given by $Tr[\rho H]$ and the variance $V_\rho(H)$ is given by $Tr[\rho H^2] - (Tr[\rho H])^2$. The uncertainty relation is obtained by Schrödinger as follows:

$$V_\rho(A) \cdot V_\rho(B) - |\mathrm{Re}\{Cov_\rho(A,B)\}|^2 \geq \frac{1}{4}|Tr[\rho[A,B]]|^2$$

for self-adjoint operators A, B abd density operator ρ, where $Cov_\rho(A,B) = Tr[\rho A_0 B_0]$. Here $A_0 = A - Tr[\rho A]I$ and $B_0 = B - Tr[\rho B]I$.

In [1] monotone pair skew information was defined and several uncertainty relations were given. And we generalized these results in [3]. On the other hand they gave the Schrödinger type uncertainty relations for monotone pair skew information under some conditions in [2]. In this paper we also obtain further extensions of Schrödinger type uncertainty relations corresponding to the results given in [3].

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Application of a Fixed Point Theorem in Partial Ordered Sets to Boundary Value Problems for 3.5 Order Differential Equations

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Abstract

The Riemann-Liouville fractional derivative of order $\alpha > 0$ of a function f of $(0, \infty)$ into R is given by

$$D_{0+}^{\alpha} f(t) = \frac{1}{\Gamma(n-\alpha)} \frac{d^n}{dt^n} \int_0^t \frac{f(s)}{(t-s)^{\alpha-n+1}} ds,$$

where $n = [\alpha] + 1$ and $[\alpha]$ denotes the integer part of α and $\Gamma(\alpha)$ denotes the gamma function.

In this talk, we apply a fixed point theorem in partial ordered sets to boundary value problems for a fractional order differential equation

$$D_{0+}^{\alpha} u(t) + f(t, u(t)) = 0, \ u(0) = u(1) = u''(0) = u''(1) = 0,$$

where $3 < \alpha \leq 4$ and f is a continuous function of $[0, 1] \times R$ into R.

One Step Iteration Scheme for Two Multivalued Nonexpansive Mappings in Banach Spaces

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Abstract

In this paper, we study the one step iteration scheme for two multivalued nonexpansive mappigs and utilize the same to prove weak as well as strong convergence theorems. Thus, our results generalize and improve many relevant results contained in Abbas et al. (Appl. Math. Lett. 24 (2011), no. 2, 97-102), Khan (Bull. Belg. Math. Soc. Simon Stevin 17 (2010) 127-140), Khan (Nonlinear Anal. 8 (2005) 1295-1301) and Fukhar-ud-din (J. Math. Anal. Appl. 328 (2007) 821-829) and references cite therein.

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Abstract

Waseda University celebrated its 125 anniversary in 2007 and has been promoting “WASEDA-style academic literacy” from that time. “WASEDA-style academic literacy” is composed of “English communication”, “Text creating” and ”Mathematical thinking”. Then, we set up a mathematical subjects “Mathematical Basics Plus” series. In this paper, we describe a brief overview of ”Mathematical Basics Plus” series, an implementation status of these subjects and future prospects.

Keywords: Mathematics education, e-learning, On-demand Lessons.

Subgradient Projectors: Characterizations, Examples and Convergences

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Abstract

We study calculus, characterizations and finite convergence of subgradient projectors of convex and nonconvex functions. Connections with respect to cutters and firmly nonexpansive mappings are discussed.

Semicontinuity of the Solution Set of Lexicographic Vector Equilibrium Problems

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Abstract

In this paper we establish sufficient conditions for the solution set of Lexicographic Vector Equilibrium Problems to be semicontinuous. All kinds of semicontinuity are considered: lower semicontinuity, upper semicontinuity, Hausdorff upper semicontinuity and closedness.

Fixed Point Theorem for Set-Valued Kannan Mappings

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Abstract

For the single mappings, relations between contractive mappings and Kannan mappings are studied detail [1, 2, 3]. For the set-valued mappings, in [4], Suzuki and Takahashi consider fixed point theorems for contractive set-valued mappings using w-distances.

In this talk, we consider fixed point theorems for set-valued Kannan mappings using w-distances. Moreover we consider relations between contractive mappings and Kannan mappings.

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What Can We See from CTP4 Results? The Predictors of Mathematics Performance

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Abstract

In mathematics education, researchers are interested in the abilities that are related to mathematics performance. Some studies revealed that reading comprehension and quantitative reasoning are related to mathematics performance. The curriculum, language experience and culture background in international schools are very different from local schools in each country. We wondered whether the relationships among reading comprehension, quantitative reasoning and mathematics performance exist or not in such schools. In this study, we employed Comprehensive Testing Program 4 (CTP4) data of all Gr.10 students from an international school in Taiwan. Structural Equation Modeling (SEM) was applied in this study. We established three SEM models (M1 M3). In M1, we probed into the relationship between reading comprehension and mathematics performance. We found that reading comprehension is a good predictor of mathematic performance since the loading is large. In M2, the loading of quantitative reasoning is large as well, which indicated that quantitative reasoning is also a good predictor of mathematics performance. However M3, in which reading comprehension and quantitative reasoning are both considered, showed that the direct influence of reading comprehension declined. This indicated that reading comprehension is an indirect predictor of mathematics performance. The covariance of reading comprehension and quantitative reasoning is high.

Neural Network Models for Quadratic Programming with Second-Order Cone Constraints

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Abstract

Neural network methods for constrained optimization have been developed and received considerable attention. In this paper, we propose some neural network models for quadratic programming with second-order cone constraints and the global convergence, the stability of neural network models will be analyzed.

Equivalent Statements for Optimality Conditions

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Abstract

For a nonsmooth programming problem with inequality constraints, we present equivalent conditions for a feasible point to be a minimizer. These conditions are allowed to be further developed if a feasible point is KKT and not KKT respectively.

Keywords: Feasible point, minimizer, KKT point, necessary condition.

The ℓ_p Regularization for the Split Feasibility Problem

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Abstract

The ℓ_p regularization for the split feasibility problem (SFP) is the minimization problem

$$\min_{x\in C} \frac{1}{2}\|Ax - P_Q Ax\|^2 + \lambda \|x\|_p^p, \qquad (*)$$

where C and Q are closed convex subsets of $\mathbb{R}^n$ and $\mathbb{R}^m$, respectively, A is an $m \times n$ matrix, P_Q is the nearest point projection from $\mathbb{R}^m$ onto Q, $\lambda > 0$ is a regularization parameter, and $p \in [0, \infty]$ (in the case of $p = 0, \infty$, $\|x\|_0^0$ and $\|x\|_\infty^\infty$ are understood the ℓ_0 and ℓ_∞ norm of x, respectively).

The SFP, containing the extensively studied linear inverse problem $Ax = b$ as a special case, models several inverse problems arising from signal/image processing, compressed sensing and so on. Due to the sparsity requirement, the ℓ_1 regularized SFP has been received a considerable attention in the recent years. In this talk, we present certain properties of the ℓ_p regularized SFP (*) with different values of p which correspond to essentially distinct nature as for $p \in [0, 1)$, (*) is a nondifferentiable, nonconvex, and intractable problem. We will also present a splitting algorithm for solving the ℓ_1 regularized SFP (*). Numerical experiments on an image deblurring problem will be included to verify the efficiency of our algorithm.

Optimality Conditions and an Algorithm for a Cone-DC Vector Optimization Problem

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Abstract

A vector-valued function defined as the difference of two vector-valued cone-convex functions is called a vector-valued cone-dc function. The concept of vector-valued cone-dc function has been proposed by Hojo, Tanaka and Yamada (2012). Moreover, several properties of vector-valued cone-dc function have been analyzed by Yamada, Tanaka and Tanino (2013). From their results, we notice that many vector optimization problems can be transformed into cone-DC vector optimization problems.

The aim of this talk is to propose an algorithm for finding an efficient solution of a constrained cone-dc vector optimization problem (CVP) minimizing a vector-valued cone-dc function with respect to a closed convex ordering cone over a compact convex set. First, we propose several optimality conditions for an unconstrained cone-dc vector optimization problem. Second, we present a method for constructing a sequence of unconstrained vector optimization problems approximating (CVP). Moreover, we prove that every accumulation point of the sequence of efficient solutions of such approximation problems is an efficient solution of (CVP). Third, based on the above results, we propose an algo-

rithm for finding an efficient solution of (CVP).

Keywords and Phrases: Vector optimization, efficient solution, vector-valued cone-DC function.

Observation of Convex Optimization under Locally Lipschitz Constraints

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Abstract

The convex optimization problem is to minimize a convex objective function over a convex set which is usually described by convex constraint functions. Constraint qualifications for the optimality condition are essential to solve a convex optimization problem. Recently, a convex optimization under not necessarily convex constraints was studied. In this talk, we study constraint qualifications for optimality conditions in convex optimization under locally Lipschitz constraints.

Keywords: convex optimization problem, constraint qualification, optimality condition, locally Lipschitz constraints.

Inexact Subgradient Methods for Quasi-Convex Optimization Problems

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Abstract

In this paper, we consider a generic inexact subgradient algorithm to solve a nondifferentiable quasi-convex constrained optimization problem. The inexactness stems from computation errors and noise, which come from practical considerations and applications. Assuming that the computational errors and noise are deterministic and bounded, we study the effect of the inexactness on the subgradient method when the constraint set is compact or the objective function has a set of generalized weak sharp minima. In both cases, using the constant and diminishing stepsize rules, we describe convergence results in both objective values and iterates, and finite convergence to approximate optimality. We also investigate efficiency estimates of iterates and apply the inexact subgradient algorithm to solve the Cobb-Douglas production efficiency problem. The numerical results verify our theoretical analysis and show the high efficiency of our proposed algorithm, especially for the large-scale problems.

A Strategic Interpretation of the Shapley Value for the Nested Cost Sharing Problem

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Abstract

The nested cost sharing problem is concerned with sharing the cost of a public facility among agents who have different needs for it, but serving a given agent allows serving all agents with smaller needs than his at no extra cost. We provide a strategic interpretation of the Shapley value for the problem. We introduce a 3-stage extensive form game that respects individual rationality and show that there is one and only one subgame perfect equilibrium outcome of the game. Moreover, it is the allocation assigned by the Shapley value. *Journal of Economic Literature* Classification Numbers: C71; C72; C78.

Keywords: Subgame perfect equilibrium, Strategic interpretation, Shapley value, Nested cost sharing problem.

The Mordukhovich Subdifferentials and Directions of Descent

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Abstract

The problem of finding minima of weakly sequentially lower semicontinuous functions on reflexive Banach spaces is studied by means of convex and nonconvex subdifferentials. Finding a descent direction for a non-stationary point is a question of importance for many optimization algorithms. The existence or non-existence of such a direction is clarified through several theorems and a series of selective examples. For the general problem, a notion called radius of descent is proposed and shown to be useful for the analysis related to decent directions.

Keywords and Phrases: Weakly sequentially lower semicontinuous function, minimization, subdifferential, descent direction, radius of descent.

Well-Posedness for the Bilevel New Genearalized Mixed Equilibrium Problems in Banach Spaces

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Abstract

In this paper, the well-posedness and generalized well-posedness for the problem (BNGMEP) are introduced by an ϵ-bilevel mixed equilibrium problem. Also, we explore the sufficient and necessary conditions for (generalized) well-posedness of the problem (BNGMEP) and show that, under some suitable conditions, the well-posedness and generalized well-posedness of (BNGMEP) are equivalent to the uniqueness and existence of its solutions, respectively. These results are new and improve some recent results in this field.

Medical University Students' Change of Beliefs in a Mathematical Culture Course

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Abstract

In this study, we propose a liberal-arts course about the culture and history of mathematics, and examine its influences on the mathematics beliefs of medical university students in Taiwan. This study used a single-group pretest-posttest design. Research tools of this study include: (1) a liberal-arts mathematics course with an emphasis on history and culture, and (2) a 20-question Likert-scale questionnaire used in the pre-test and the post-test. The questions were separated into two dimensions, aiming to investigate students' beliefs about the *nature* and the *values* of mathematics. A total of 100 students took the pre-test, participated in the teaching experiment, and finally took the post-test. In the teaching experiment course, named "Mathematical Thinking in the Multicultural Contexts", students were exposed to mathematical topics presented in their historical contexts. There were also examples of distinct approaches to similar problems by scholars in different civilisations, such as comparing Liu Hui's work and Euclid's *Elements*. Students were also required to make artistic creations related to mathematics. The results showed that part of the students' beliefs did change. In the dimension of the nature of mathematics, after taking the course, the students were more prone to believe that

"generalisation" was a method of thinking in mathematics; however, the results also revealed that the course did not clarify for students the difference between the "context of justification" and the "context of discovery". As for the values of mathematics, students were more prone to believe that "sensibility to beauty" and "creativity" were important values of mathematics.

Variational Inequality with Variational Inequalities and Fixed Point Constraints with Applications

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Abstract

In this paper, we study variational inequality over the common solution of variational inequalities of hemicontinuous monotone mappings and fixed point of generalized hybrid mapping. This problem contains variational inequality with fixed point over fixed point set, simultaneous solution of a triple hierarchical problem and a variational inequality with variational inequalities and fixed point constraint, triple hierarchical problem, optimization programming over the solution set of mathematical programming with equilibrium constraints, multiple level programming, mathematical programming with equilibrium constraint. Our results improve Theorem 4.1 of Iiduka,Theorem 3.1 of Iemeto *et al.*(Iemoto-Hishinuma-Iiduka) and Theorem 3.2 of Iiduka(Iiduka-NA-2009), Theorems 3.1 and 4.1(Ceng-Ansari-Yao). Our proofs of Theorem (thm-CP5-1) and Corollary 3.2 are much simple and elegant than Theorems 3.1 and 4.1 of Ceng *et al.*(Ceng-Ansari-Yao), Theorems 3.1 and 4.1 of Takahashi *et al.*(Takahashi-Toyoda-2003-417-428-JOTA), Theorem 2.9 of Mondafi *et al.* (Mondafi-Mainge-2006-FPTA), Theorems 3.1 and 4.1 of Yao *et al.* (Yao-Chen-Xu) and Theorems 3.3 and 4.1 of Lu *et al.*Lu-Xu-Yinand Yamada (Yamada-SCM-2001).

G-Risk: A New Methodology for Measuring Risk

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Abstract

In this talk, based on the concept of G-Risk concept from the nonlinear expectation theory, combining with the case study for the gold markets, we will show how to use G-risk concept to develop a new methodology in measuring Risk in financial markets. This new methodology will not only overcome the shortage of the traditional Value at Risk (VaR) such as the coherence, sub-additional properties, but also show how the G-risk method allows for adaptivity due to the sensitivity of financial markets in the practice.

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