Abstracts

Name: Tsuyoshi Ando

Affiliation: Hokkaido University, Japan

Email: ando@es.hokudai.ac.jp

Title: Positive map as difference of two completely positive or super-positive maps

Abstract: Given a positive linear map $\varphi : \mathbb{M}_m \to \mathbb{M}_n$, we construct completely positive linear maps $\varphi^{(j)} : \mathbb{M}_m \to \mathbb{M}_n$ $(j = 1, 2)$ such that

$$\varphi = \varphi^{(1)} - \varphi^{(2)} \quad \text{and} \quad \varphi^{(1)}(I_m) + \varphi^{(2)}(I_m) \ \le \ m \cdot \varphi(I_m).$$

When complete positivity is replaced by super-positivity

$$\varphi^{(1)}(I_m) + \varphi^{(2)}(I_m) \ \le \ (2m-1) \cdot \varphi(I_m).$$

Here a linear map is called super-positive if its Choi matrix is separable.

Name: Changjiang Bu

Affiliation: College of Science, Harbin Engineering University, P.R. China

Email: buchangjiang@hrbeu.edu.cn

Title: Recent results on the generalized inverse and spectral properties of tensors

Abstract: In this talk, we report some recent results on the generalized inverse and spectral properties of tensors, including the Moore-Penrose inverse of tensors, the group inverse of tensors, eigenvalue inclusion sets of tensors, spectral radius of tensors and hypergraphs, and tensor spectra of hypergraphs.

Co-author(s): Lizhu Sun and Jiang Zhou.

Name: Zhen Chao

Affiliation: Department of Mathematics, East China Normal University, P.R. China

Title: On the semi-convergence of regularized HSS iteration methods for singular saddle point problems

Abstract: Recently, Bai and Benzi proposed a class of regularized Hermitian and skew-Hermitian splitting (RHSS) iteration methods for solving the nonsingular saddle point problem. In this paper, we apply this method to solve the singular saddle point problem. In the process of the semi-convergence analysis, we get that the RHSS method and the HSS method are unconditionally semi-convergent, which has weaken the previous results. Then some spectral properties of the corresponding preconditioned matrix and a class of improved

preconditioned matrix are analyzed. Finally, some numerical experiments on linear systems arising from the discretization of the Stokes equations are presented to illustrate the feasibility and effectiveness of this method and preconditioners.

Co-author(s): Guoliang Chen.

Name: Jianlong Chen

Affiliation: School of Mathematics, Southeast University, P.R. China

Email: jlchen@seu.edu.cn

Title: From EP matrices, EP operators to EP elements in rings

Abstract: In this talk, we will give a survey of results concerning EP elements in complex matrices; in operators; in rings (semigroups) with involution and in C^*-algebras.

Name: Man-Duen Choi

Affiliation: Department of Mathematics, University of Toronto, Canada

Email: choi@math.toronto.edu

Title: The non-commutative geometry of two by two matrices

Abstract: The elementary structure of two by two complex matrices shows many deep aspects of NON-COMMUTATIVE geometry (alias, algebra, or probability, or topology), as needed in various applications.

Name: Delin Chu

Affiliation: Department of Mathematics, National University of Singapore, Singapore

Email: matchudl@nus.edu.sg

Title: Least Squares Approach for Regularized Incremental Linear Discriminant Analysis on Large-Scale Data

Abstract: Over the past a few decades, much attention has been drawn to large-scale incremental data analysis, where researchers are faced with huge amount of high-dimensional data acquired incrementally. In such a case, conventional algorithms that compute the result from scratch whenever a new sample comes are highly inefficient. To conquer this problem, we propose a new incremental algorithm IRLS that incrementally computes the solution to the regularized least squares (RLS) problem with multiple columns on the right-hand side. More specifically, for a RLS problem with c ($c > 1$) columns on the right-hand side, we update its unique solution by solving a RLS problem with single column on the right-hand side whenever a new sample arrives, instead of solving a RLS problem with c columns on the

right-hand side from scratch. As a direct application of IRLS, we consider the supervised dimensionality reduction of large-scale data and focus on linear discriminant analysis (LDA). We first propose a new batch LDA model that is closely related to RLS problem, and then apply IRLS to develop a new incremental LDA algorithm. Experimental results on real-world datasets demonstrate the effectiveness and efficiency of our algorithms.

Name: Hongke Du

Affiliation: Department of Mathematics and Information Science, Shaanxi Normal University, P.R. China

Email: hkdu@snnu.edu.cn

Title: Idempotents and regular subspaces in Krein space

Abstract: In this talking, we will show that how to study and uncover closed relationship between Idempotents and regular subspaces in Krein spaces using block-operator matrix technique, spectral theory and two projections theory.

Name: Xue-Feng Duan

Affiliation: College of Mathematics and Computational Science, Guilin University of Electronic Technology, P.R. China

Email: duanxuefeng@guet.edu.cn

Title: Numerical methods for solving a class of matrix feasibility problem

Abstract: In this talk, we design two numerical methods for solving some matrix feasibility problems, which arise in the quantum information science. By making use of the structured properties of linear constraints and the minimization theorem of symmetric matrix on manifold, the projection formulas of a matrix onto the feasible sets are given, and then the relaxed alternating projection algorithm and alternating projection algorithm on manifolds are designed to solve these problems. Numerical examples show that the new methods are feasible and effective.

Name: Hwa-Long Gau

Affiliation: Department of Mathematics, National Central University, Taiwan

Email: hlgau@math.ncu.edu.tw

Title: Lower bounds for the numerical radius

Abstract: We show that if $A = [a_{ij}]_{i,j=1}^n$ is an n-by-n complex matrix and $A' = [a'_{ij}]_{i,j=1}^n$, where

$$a'_{ij} = \begin{cases} a_{ij} & \text{if } (i,j) = (1,2), \ldots, (n-1,n) \text{ or } (n,1), \\ 0 & \text{otherwise,} \end{cases}$$

then $w(A) \geq w(A')$, where $w(\cdot)$ denotes the numerical radius of a matrix. Moreover, if n is odd and $a_{12}, \ldots, a_{n-1,n}, a_{n1}$ are all nonzero, then $w(A) = w(A')$ if and only if $A = A'$. For an even n, under the same nonzero assumption, we have $W(A) = W(A')$ if and only if $A = A'$, where $W(\cdot)$ is the numerical range of a matrix.

Co-author(s): Pei Yuan Wu

Name: Jinchuan Hou

Affiliation: Department of Mathematics, Taiyuan University of Technology, P.R. China

Email: jinchuanhou@aliyun.com

Title: Strong 3-skew commutativity preserving maps on prime rings with involution

Abstract: Let $\mathcal{R}$ be a unital prime $*$-ring of the first kind containing two nontrivial symmetric idempotent P, Q with $PQ = QP = 0$ and $0 < P+Q < 1$ or a unital prime $*$-ring of the second kind containing a nontrivial symmetric idempotent P. For $A, B \in \mathcal{R}$, the 3-skew commutator is defined by ${}_*[A, B]_3 = {}_*[A, {}_*[A, B]_2] = {}_*[A, {}_*[A, {}_*[A, B]]] = A^3B - 3A^2BA^* + 3AB(A^*)^2 - B(A^*)^3$. Let $\Phi : \mathcal{R} \to \mathcal{R}$ be a surjective map. We show that Φ satisfies ${}_*[\Phi(A), \Phi(B)]_3 = {}_*[A, B]_3$ for all $A, B \in \mathcal{R}$ if and only if there exists $\lambda \in \mathcal{C}_S$ with $\lambda^4 = I$ such that $\Phi(A) = \lambda A$ for all $A \in \mathcal{R}$. Where I is the unit of $\mathcal{R}$ and $\mathcal{C}_S$ is the symmetric extend centroid of $\mathcal{R}$. This result then is applied to matrix algebras and operator algebras.

Co-author(s): Xiaofei Qi, Wei Wang.

Name: Li-Ping Huang

Affiliation: School of Mathematics and Statistics, Changsha University of Science and Technology, P.R.China

Email: lipingmath@163.com

Title: Generalized bilinear forms graphs over residue class rings

Abstract: We investigate the generalized bilinear forms graph Γ over a residue class ring modulo p^s (where p is a prime number and s is a positive integer). The generalized bilinear forms graph Γ is a connected vertex transitive graph, and its core is complete. We determine the clique number, the independence number, the chromatic number, and the maximum cliques of Γ, respectively.

Co-author(s): Huadong Su, Gaohua Tang, Jia-Bin Wang.

Name: Dragana Cvetković Ilić

Affiliation: University of Niš, Serbia

Email: dragana@pmf.ni.ac.rs

Title: Completion problems of operator matrices to Fredholm, Weyl and Kato operators

Abstract: We will address some recent results on certain problems of completions of operator matrices. In particular, we will consider the problems of completions of operator matrices to Fredholm, Weyl and Kato operators.

Name: Zhi-Gang Jia

Affiliation: Department of Mathematics and Statistics, Jiangsu Normal University, P.R.China

Email: zhgjia@jsnu.edu.cn

Title: A New TV-Stokes Model for Image Deblurring and Denoising with Fast Algorithms

Abstract: The famous TV-Stokes models, which improve the restored images comfortable, have been very successful in image denoising. In this paper, we propose a new TV-Stokes model for image deblurring with a good geometry explanation. In the tangential field smoothing, the data fidelity term is chosen to measure the distance between the solution and the orthogonal projection of the tangential field of the observation image onto the range of the conjugate of the blurry operator, while the total variation of the solution is chosen as the regularization term. In the image reconstruction, we compute the smoothing part of the image from the smoothed tangential field for the first step, and use an anisotropic TV model to obtain the "texture" part of the deblurred image. The solvability properties for the minimization problems in two steps are established, and fast algorithms are presented. Numerical experiments demonstrate that the new deblurring model can capture the details of images hidden in the blurry and noisy image, and the fast algorithms are efficient and robust.

Co-author(s): Musheng Wei (SHNU).

Name: Tong-song Jiang

Affiliation:
Department of Mathematics, Heze University, P. R. China,
Department of Mathematics, Linyi University, P. R. China.

Email: jiangtongsong@sina.com

Title: On eigenvalues and eigenvectors of split quaternion matrices

Abstract: This paper, by means of a real representation of a split quaternion matrix, introduces definitions of right eigenvalue, right full-eigenvalue and right semi-eigenvalue of a

split quaternion matrix, and studies the problems of the right eigenvalue, right full-eigenvalue and right semi-eigenvalue of split quaternion matrices. This paper not only gives necessary and sufficient conditions for a split quaternion matrix to have a right eigenvalue, right full-eigenvalue and right semi-eigenvalue respectively, but also derives algebraic techniques for finding them and their corresponding eigenvectors of a split quaternion matrix.

Co-author(s): Zhaozhong Zhang, Ziwu Jiang.

Name: Olga Y. Kushel

Affiliation: Department of Mathematics, Shanghai University, P.R. China

Email: kushel@mail.ru

Title: Positive pairs matrix perturbations

Abstract: We present a highly applicable method for studying spectral properties of structured matrices and their submatrices. The method is based on the theory of transversal and positive rank-one perturbations, developed by Y. Barkovsky.

Co-author(s): Mikhail Tyaglov

Name: Seung-Hyeok Kye

Affiliation: Seoul National University, Korea

Email: kye@snu.ac.kr

Title: Separability criterion for three-qubit states with a four dimensional norm

Abstract: We give a separability criterion for three qubit states in terms of diagonal and anti-diagonal entries. This gives us a complete characterization of separability when all the entries are zero except for diagonal and anti-diagonals. The criterion is expressed in terms of a norm arising from anti-diagonal entries. We compute this norm in several cases, so that we get criteria with which we can decide the separability by routine computations.

Co-author(s): Lin Chen and Kyung Hoon Han

Name: Chi-Kwong Li

Affiliation: Department of Mathematics, College of William and Mary, USA

Email: ckli@math.wm.edu

Title: Numerical range and dilation

Abstract: We survey some results concerning the use of numerical ranges to study dilation theory of operators. Connections to problems arising in quantum information science will be mentioned.

Name: Lei Li

Affiliation: School of Mathematical Sciences, Nankai University, P.R.China

Email: leilee@nankai.edu.cn

Title: weak 2-local isometries on function algebras

Abstract: We establish spherical variants of the Gleason-Kahane-Zelazko and Kowalski-Slodkowski theorems and we prove that every weak-2-local isometry between two uniform algebras is a linear map. Moreover, we apply our method to Lipschitz algebras.

Co-author(s): A.M. Peralta, Liguang Wang and Ya-Shu Wang.

Name: Qiting Li

Affiliation: Department of Mathematical Science, Tsinghua University, P.R.China

Email: liqt13@mails.tsinghua.edu.cn

Title: Entanglement monogamy in three qutrit systems

Abstract: Quantum information, as a rising interdisciplinary field which combines quantum mechanics, informatics and mathematics, becomes a new frontier science for information processing. The key concept of quantum information is the quantum entanglement and one of the most fundamental parts of quantum entanglement is the entanglement measure. Quantum entanglement, differing from classical correlation, is not shareable at liberty when distributed among three or more parties. There is constraint on distributed entanglement among many parties: if two bodies are maximally entangled, they can not share any entanglement with other subsystems. This property is called entanglement monogamy, which is of paramount importance in many protocols of quantum information and quantum communication. By introducing an arbitrary-dimensional multipartite entanglement measure, which is defined in terms of the reduced density matrices corresponding to all possible two partitions of the entire system, we prove that multipartite entanglement cannot be freely shared among the parties in both n-qubit systems and three-qutrit systems. Furthermore, our result implies that the satisfaction of the entanglement monogamy is related to the number of particles in the quantum system. As an application of three-qutrit monogamy inequality, we give a condition for the separability of a class of two-qutrit mixed states in a $3 \otimes 3$ system.

Co-author(s): Jianlian Cui, jcui@math.tsinghua.edu.cn

Name: Tingting Li

Affiliation: School of Mathematics, Southeast University, P.R.China

Email: littnanjing@163.com

Title: Core and Dual Core Inverses of a Sum of Morphisms

Abstract: Let $\mathscr{C}$ be an additive category with an involution $*$. Suppose that $\varphi : X \to X$ is a morphism of $\mathscr{C}$ with core inverse $\varphi^{\oplus} : X \to X$ and $\eta : X \to X$ is a morphism of $\mathscr{C}$ such that $1_X + \varphi^{\oplus}\eta$ is invertible. Let $\alpha = (1_X + \varphi^{\oplus}\eta)^{-1}$, $\beta = (1_X + \eta\varphi^{\oplus})^{-1}$, $\varepsilon = (1_X - \varphi\varphi^{\oplus})\eta\alpha(1_X - \varphi^{\oplus}\varphi)$, $\gamma = \alpha(1_X - \varphi^{\oplus}\varphi)\beta^{-1}\varphi\varphi^{\oplus}\beta$, $\sigma = \alpha\varphi^{\oplus}\varphi\alpha^{-1}(1_X - \varphi\varphi^{\oplus})\beta$, $\delta = \beta^{*}(\varphi^{\oplus})^{*}\eta^{*}(1_X - \varphi\varphi^{\oplus})\beta$. Then $f = \varphi + \eta - \varepsilon$ has a core inverse if and only if $1_X - \gamma$, $1_X - \sigma$ and $1_X - \delta$ are invertible. Moreover, the expression of the core inverse of f is presented. Let R be a unital $*$-ring and $J(R)$ its Jacobson radical, if $a \in R^{\oplus}$ with core inverse $a^{\oplus}$ and $j \in J(R)$, then $a + j \in R^{\oplus}$ if and only if $(1 - aa^{\oplus})j(1 + a^{\oplus}j)^{-1}(1 - a^{\oplus}a) = 0$. We also give the similar results for the dual core inverse.

Co-author: Jianlong Chen.

Name: Yuan Li

Affiliation: School of Mathematics and Information Science, Shaanxi Normal University, P.R.China

Email: liyuan0401@aliyun.com

Title: Decompositions of completely bounded maps into completely positive maps

Abstract: Let $K(\mathcal{H})$ and $\mathcal{B}(\mathcal{H})$ be the sets of all compact operators and all bounded linear operators on the Hilbert space $\mathcal{H}$, respectively. We mainly show that if $\Phi \in CB(K(\mathcal{H})^{*}, B(\mathcal{K}))$, then there exist $\Phi_i \in CP(K(\mathcal{H})^{*}, \mathcal{B}(\mathcal{K}))$ for $i = 1, 2, 3, 4$, such that $\Phi = (\Phi_1 - \Phi_2) + \sqrt{-1}(\Phi_3 - \Phi_4)$. However, $CP(K(\mathcal{H})^{*}, \mathcal{B}(\mathcal{K})) \nsubseteq CB(K(\mathcal{H})^{*}, B(\mathcal{K}))$, where $CB(V, W)$ and $CP(V, W)$ are the sets of all completely bounded maps and all completely positive maps from V into W, respectively.

Name: Minghua Lin

Affiliation: Department of Mathematics, Shanghai University, P.R.China

Email: m_ lin@i.shu.edu.cn

Title: A trace inequality for block positive semidefinite matrices

Abstract: This talk concerns a trace inequality formulated by Besenyei http://abesenyei.web.elte.hu /publications/trace.pdf. The talk consists of different proofs, extensions and related results of the trace inequality.

Name: Jianzhou Liu

Affiliation: Department of Mathematics and Computational Science, Xiangtan University, P.R.China

Email: liujz@xtu.edu.cn

Title: The disc theorem for the Schur complement of two class submatrices with r-diagonally dominant properties

Abstract: The distribution for eigenvalues of Schur complement of matrices plays an important role in many mathematical problems. In this talk, we firstly present some criteria for H-matrix. Then as application, for two class matrices whose submatrices are r-diagonally dominant and product r-diagonally dominant, we show that the eigenvalues of the Schur complement are located in the Geršgorin discs and the Ostrowski discs of the original matrices under certain conditions.

Co-author(s): Guangqi Li, Juan Zhang.

Name: Chi-Keung Ng

Affiliation: Chern Institute of Mathematics, Nankai University, P.R.China

Email: ckng@nankai.edu.cn

Title: Metric preserving bijection between normal state spaces (the type I case)

Abstract: Let M and N be type I von Neumann algebras with normal state spaces S_M and S_N respectively. Using von Neumann algebra technique as well as argument involving matrix valued measurable functions, we show that any metric preserving bijection from S_M to S_N is automatically affine and hence is induced by a Jordan *-isomorphism.

Co-author(s): A.T.M. Lau (Univ. Alberta, Canada); N.C. Wong (National Sun Yat Sen Univ., Taiwan).

Name: Yiu-Tung Poon

Affiliation: Department of Mathematics, Iowa State University, USA.

Email: ytpoon@iastate.edu

Title: A Generalized Hölder Type Eigenvalue Inequality

Abstract: In this note, we prove that if $A_1, \ldots, A_m$ are $n \times n$ contractive matrices and $p_1, \ldots, p_m > 0$ with $\frac{1}{p_1} + \frac{1}{p_2} + \cdots + \frac{1}{p_m} = 1$, then

$$\prod_{j=1}^{k} (1 - \lambda_j(|A_1 \cdots A_m|)^r) \geq \prod_{i=1}^{m} \prod_{j=1}^{k} (1 - \lambda_j(|A_i|)^{rp_i})^{\frac{1}{p_i}}$$

for each $k = 1, 2, \ldots, n$. This generalizes an inequality due to Marcus (1958).

Co-author(s): Jun-Tong Liu and Qing-Wen Wang.

Name: Xiaofei Qi

Affiliation: Department of Mathematics, Shanxi University, P.R.China

Email: qixf1981@sxu.edu.cn

Title: k-skew Lie products on prime rings with involution

Abstract: Let $\mathcal{R}$ be a ring with an involution $*$ and k a positive integer. The k-skew Lie product of $a, b \in \mathcal{R}$ is defined by ${}_*[a,b]_k = {}_*[a, {}_*[a,b]_{k-1}]$, where ${}_*[a,b]_0 = b$ and ${}_*[a,b]_1 = ab - ba^*$. In this paper, some useful properties of the k-skew Lie products on prime *-rings are given. Then, as an application of these results, k-skew commuting additive maps on prime *-rings are characterized.

Co-author(s): Yazhou Zhang, Department of Mathematics, Shanxi University, P.R. China.

Name: Raymond Nung-Sing Sze

Affiliation: Department of Applied Mathematics, The Hong Kong Polytechnic University, Hong Kong

Email: raymond.sze@polyu.edu.hk

Title: Time-energy costs of quantum channels

Abstract: A time-energy cost of a $r \times r$ unitary matrix U is defined as

$$\|U\|_{\max} = \max_{1 \le j \le r} |\theta_j|,$$

where $e^{i\theta_1}, \ldots, e^{i\theta_r}$ are the eigenvalues of U with $\theta_j \in (-\pi, \pi]$. A time-energy cost for a quantum channel K is defined as

$$\|K\|_{\max} = \min_{U} \|U\|_{\max} \quad \text{such that} \quad K(\rho_A) = \mathrm{Tr}_B \left(U(|0\rangle_B \langle 0| \otimes \rho_A) U^* \right),$$

where the channel K acts on quantum state ρ_A in system A, the unitary extension U acts on the composite system $A \otimes B$, and Tr_B is the partial trace over the system B. In this talk, we discuss some recent development in the time-energy cost and its connection to some fidelity function on quantum channels.

Co-author(s): C.H. Fred Fung (Huawei), H.F. Chau (HKU), and C.K, Li (William & Mary)

Name: Bit-Shun Tam

Affiliation: Department of Mathematics, Tamkang University, Taiwan.

Email: bsm01@mail.tku.edu.tw

Title: Nullities of Graphs with Given Order, Matching Number and Cyclomatic Number Revisited

Abstract: For a (simple) graph G, we denote by $|V(G)|, |E(G)|, \eta(G)$ and $m(G)$ respectively the order, the number of edges, the nulliy, and the matching number of G. It was shown by Wang and Wong (2014) that for every graph G, $|V(G)| - 2m(G) - c(G) \leq \eta(G) \leq |V(G)| - 2m(G) + 2c(G)$, where $c(G) := |E(G)| - |V(G)| + \theta(G)$ is the cyclomatic number of G, $\theta(G)$, being the number of components of G. Graphs G for which $\eta(G)$ attain the upper bound have been characterized by Song et.al. (2015), and graphs G for which $\eta(G)$ attain the lower bound have also been characterized independently by Rula et.al. (2016) and Wang (2016). Earlier Guo et.al. (2009) had also shown that for a unicyclic graph G, $\eta(G) - |V(G)| + 2m(G)$ can take only one of the values $-1, 0$ or 2, and they characterized the corresponding types of unicyclic graphs. In this paper, exploiting the concepts of canonical star associated with a rooted tree, the canonical unicyclic graph associated with a unicyclic graph and a crucial subgraph of a graph, we correct, complete and extend the work of previous authors on this topic. More complete lists of characterizations for the three types of unicyclic graphs, for nonsingular unicyclic graphs, and for graphs with the minimal or maximal nullity conditions are found. It is shown that if c, n are given positive integers with $n \geq 6c + 2$, then for any integer $k, -c \leq k \leq 2c, k \neq 2c - 1$, there exists a connected graph G of order n that satisfies $c(G) = c$ and $\eta(G) - |V(G)| + 2m(G) = k$, but there is no graph G of any order that satisfies $c(G) = c$ and $\eta(G) - |V(G)| + 2m(G) = 2c - 1$.

Co-author(s): Tsu-Hsien Huang (Tamkang University)

Name: Tin-Yau Tam

Affiliation: Department of Mathematics and Statistics, Auburn University, USA

Email: tamtiny@auburn.edy

Title: Weak log majorization and determinantal inequalities

Abstract: We will discuss a determinantal inequality of I. Matic and its generalization. We will also discuss a weak majorization result which is complementary to a determinantal inequality of D. Choi.

Co-author(s): Pingping Zhang, Chongqing University of Posts and Telecommunications, P.R.China.

Name: Kuo-Zhong Wang

Affiliation: Department of Applied Mathematics, National Chiao Tung University, Taiwan

Email: kzwang@math.nctu.edu.tw

Title: Numerical radius of matrix commutators and Jordan products

Abstract: It is known that the numerical radius of the commutator (resp., Jordan product) $AB - BA$ (resp., $AB + BA$) of two $n \times n$ matrices A and B is related to those of A and B

by $w(AB \pm BA) \leq 2\sqrt{2}w(A)\|B\|$. In this talk, we give complete characterizations of A and B for which the equality is attained.

Name: Qing-Wen Wang

Affiliation: Department of Mathematics, Shanghai University, P.R.China

Email: wqw@t.shu.edu.cn

Title: Decompositions of some matrices over an arbitrary division ring with applications

Abstract: In this talk, we give all the dimensions of identity matrices in the equivalence canonical form of four matrices over an arbitrary division ring F with compatible sizes: $A \in \mathbb{F}^{m\times n}$,$B \in \mathbb{F}^{m\times p_1}, E \in \mathbb{F}^{q_1\times n}, F \in \mathbb{F}^{q_2\times n}$ and $G \in \mathbb{F}^{q_3\times n}$. As applications, we derive some necessary and sufficient conditions for the solvability to some well known systems of matrix equations over an arbitrary division ring using rank conditions. We also construct a simultaneous decomposition for a set of seven general matrices over an arbitrary division ring F with compatible sizes: $A \in \mathbb{F}^{m\times n}, B \in \mathbb{F}^{m\times p_1}, C \in \mathbb{F}^{m\times p_2}, D \in \mathbb{F}^{m\times p_3}, E \in \mathbb{F}^{q_1\times n}, F \in \mathbb{F}^{q_2\times n}$ and $G \in \mathbb{F}^{q_3\times n}$. As applications of the simultaneous matrix decomposition, we give some solvability conditions, general solutions, as well as the range of ranks of the general solutions to some generalized Sylvester matrix equations over an arbitrary division ring F.

Co-authors: Zhuo-Heng He, Yang Zhang.

Name: Ya-Shu Wang

Affiliation: Department of Applied Mathematics, National Chung Hsing University, Taiwan

Email: yashu@nchu.edu.tw

Title: Orthogonally additive maps on Figá-Talamanca-Herz algebras

Abstract: In this talk, we will introduce the Figá-Talamanca-Herz algebras $A_p(G)$ and the representation of linear orthogonally multiplicative maps on $A_p(G)$.

Name: Ngai-Ching Wong

Affiliation: Department of Applied Mathematics, National Sun Yat-sen University, Taiwan

Email: wong@math.nsysu.edu.tw

Title: Generalized circular projections

Abstract: Being expected as Banach space substitutes of the orthogonal projections on Hilbert spaces, generalized bicircular projections also extend bicontractive projections on JB*-triples. In this talk, we study some geometric properties related to them. In particular, we provide some structure theorems of generalized circular projections on continuous functions,

and an often mentioned special case of JB*-triples, i.e., Hilbert C*-modules over continuous functions.

Name: Pei Yuan Wu

Affiliation: Department of Applied Mathematics, National Chiao Tung University, Taiwan

Email: pywu@math.nctu.edu.tw

Title: Operators with real parts at least $-1/2$

Abstract: Matrices B of the form $B = A(I_n - A)^{-1}$ (n at least 3), where A is an S_n-matrix, that is, A is a contraction with eigenvalues in the open unit disc and with rank $(I_n - A*A) = 1$, play the role of basic building blocks for general matrices C with real parts at least $-1/2$. In this talk, we will discuss properties of such matrices B and show how an extension model for a matrix C with Re C at least $-1/2$ can be built up from such B's.

Name: An-Bao Xu

Affiliation: College of Mathematics and Econometrics, Hunan University, P.R.China

Email: xuanbao777@163.com

Title: Varied parametric quasi-soft thresholding for compressed sensing

Abstract: Compressed sensing is a new theory of signal acquisition and processing. l_0 norm minimization problem is the major problem of compressed sensing. Its purpose is to find the most sparsest solution in the infinite solutions of the underdetermined equation to construct the original signal (vector). This paper first analyzes four basic algorithms for this norm minimization problem: iterative soft thresholding algorithm, iterative hard thresholding algorithm, iterative firm thresholding algorithm and the quasi-soft thresholding algorithm (or MC+). Then the parametrization of the quasi-soft thresholding operator are updated adaptively to obtain the varied parametric quasi-soft thresholding algorithm. The convergence of the algorithm is proved. And the numerical results show that the new algorithm can effectively improve the accuracy of signal reconstruction.

Name: Changqing Xu

Affiliation: School of Mathematics and Physics, Suzhou University of Science and Technology, P.R.China

Email: cqxurichard@usts.edu.cn

Title: Covariance matrices and covariance tensors

Abstract: In multivariate statistics, matrices play very important role. For example, covariance matrices and the generalized inverses of covariance matrices are extensively studied for

the probability density function and the estimation of the unknown parameters in the statistical models. On the one hand, a covariance matrix reflects the correlation of the random variables under investigation, which is crucial for us to simplify the model and make possible for the prediction of the incoming data. On the other hand, the shortage of the information in a covariance matrix on the multi-relation of a multiset of some variables (instead of a pair of variables) makes hard for us to guarantee the simplicity and the efficiency of the model. In this talk, we will introduce the concept of covariance tensor, which can be applied to tackle this issue. We will also show that a covariance tensor is a symmetric and positive semidefinite tensor.

Co-author(s): Zhibing Chen (Shenzhen Univ) and Liqun Qi (HK PolyU)

Name: Wei-Ru Xu

Affiliation: Department of Mathematics, East China Normal University, P.R. China

Email: weiruxu@foxmail.com

Title: Procrustes problems and inverse eigenproblems for Multilevel block $\boldsymbol{\alpha}$-circulants

Abstract: Let $\boldsymbol{n} = (n_1, n_2, \ldots, n_k)$ and $\boldsymbol{\alpha} = (\alpha_1, \alpha_2, \ldots, \alpha_k)$ be integer k-tuples with $\alpha_i \in \{1, 2, \ldots, n_i - 1\}$ and $n_i \geq 2$ for all $i = 1, 2, \ldots, k$. Multilevel block $\boldsymbol{\alpha}$-circulants (see, [LAA, 431 (2009) 1833-1847]) are $(k+1)$-level block matrices, where the first k levels have the block α_i-circulant structure with orders $n_1, n_2, \ldots, n_k \geq 2$ and the entries in the $(k+1)$-st level are unstructured rectangular matrices with the same size $d_1 \times d_2$ ($d_1, d_2 \geq 1$). When $k = 1$, Trench [NLAA, 20 (2013) 349-356] discussed Procrustes problems and inverse problems of unilevel block α-circulants (see, [LAA, 430 (2009) 2012-2025]) and their approximations. But the results are not perfect for the case $\gcd(\boldsymbol{\alpha}, \boldsymbol{n}) > 1$ (i.e. $\gcd(\alpha_1, n_1) > 1$). In this talk, I will discuss Procrustes problems for multilevel block $\boldsymbol{\alpha}$-circulants. The obtained results can further make up for the deficiency when $k = 1$. When $d_1 = d_2 \geq 1$, inverse eigenproblems for this kind of matrices are also solved. By using the related results, an artificial Hopfield neural network system can be designed such that it possesses the prescribed equilibria, where the Jacobian matrix of this system has the constrained multilevel $\boldsymbol{\alpha}$-circulative structure.

Co-author(s): Guo-Liang Chen (Supervisor).

Name: Yu Yang

Affiliation: Department of Mathematics, National University of Singapore, Singapore

Email: a0086285@u.nus.edu

Title: Schmidt numbers under local projections and construction of positive partial transpose entangled states.

Abstract: The Schmidt number is a fundamental parameter characterizing the properties of quantum states, and local projections are fundamental operations in quantum physics. We investigate the relation between the Schmidt numbers of bipartite states and their projected

states. We show that there exist bipartite positive-partial-transpose (PPT) entangled states of any prescribed Schmidt number.

Co-author(s): Prof. Lin Chen, Prof. Wai-Shing Tang.

Name: Jin Zhong

Affiliation: Jiangxi University of Science and Technology, P.R.China

Email: zhongjin1984@126.com

Title: Minimum rank problem for the regular classes of (0,1)-matrices

Abstract: Let $\mathscr{B}(n,k)$ be the set of all (0,1)-matrices of order n with constant line sum k and let $\tilde{\nu}(n,k)$ be the minimum rank over $\mathscr{B}(n,k)$. We prove that $\hat{\nu}(n,k) = \lfloor n/k \rfloor + k$ if and only if $n \equiv \pm 1 \pmod{k}$ and then answer a question posed by Pullman and Stanford. We also show that $\tilde{\nu}(n,k) = \lfloor n/k \rfloor + k$ if and only if (n,k) satisfies one of the following three relations: (i) $n \equiv \pm 1 \pmod{k}$, $k = 2$ or 3; (ii) $n = k+1$, $k \geq 2$; (iii) $n = 4q+3$, $k = 4$ and $q \geq 1$. Moreover, we obtain the exact values of $\tilde{\nu}(n,4)$ for all $n \geq 4$ and determine all the possible ranks of regular (0,1)-matrices in $\mathscr{B}(n,4)$. Finally, we also present some positive integer pairs (n,k) such that $\tilde{\nu}(n,k) < \hat{\nu}(n,k) < \lfloor n/k \rfloor + k$, which gives a positive answer to another question posed by Pullman and Stanford.

Name: Fuzhen Zhang

Affiliation: Department of Mathematics, Nova Southeastern University, USA

Email: zhang@nova.edu

Title: Harnack Inequalities: From Harmonic Analysis through Poincare Conjecture to Matrix Determinant

Abstract: With a brief survey on the Harnack inequalities in various forms in Functional Analysis, in Partial Differential Equations, and in Perelmans solution of the Poincare Conjecture, we discuss the Harnack inequality in Linear Algebra and Matrix Analysis. We present an extension of Tungs inequality of Harnack type and study the equality case.

Co-author(s): Minghua Lin.

Name: Jianxing Zhao

Affiliation: College of Data Science and Information Engineering, Guizhou Minzu University, P.R. China

Email: zjx810204@163.com; zhaojianxing@gzmu.edu.cn

Title: Singular value inclusion sets for rectangular tensors

Abstract: Two singular value inclusion sets for rectangular tensors are given. These sets provide two upper bounds and lower bounds for the largest singular value of nonnegative rectangular tensors, which can be taken as an initial value of an algorithm presented by Zhou *et al.* (Linear Algebra Appl. 2013; 438: 959–968) such that the sequences produced by this algorithm converge rapidly to the largest singular value of an irreducible nonnegative rectangular tensor.

Co-author(s): Chaoqian Li.

Name: Bo Zhou

Affiliation: School of Mathematical Sciences, South China Normal University, P.R.China

Email: zhoubo@scnu.edu.cn

Title: Sharp bounds for spectral radius of nonnegative matrices

Abstract: We present sharp upper and lower bounds for spectral radius of nonnegative matrices using row sums, average 2-row sums, and average 3-row sums, respectively. Applications to various matrices associated to a graph are also considered.

Co-author(s): Xing Duan, Hongying Lin, Rundan Xing (South China Normal University).

Name: Mengmeng Zhou

Affiliation: School of Mathematics, Southeast University, P.R.China

Email: mmz9209@163.com

Title: Integral representations of two generalized core inverses

Abstract: In this talk, we present integral representations of the DMP and core-EP inverse, which based on the full-rank decomposition of a given matrix. In particular, integral representations of the core and dual core inverse are given. All of these integral representations do not require any restriction on the spectrum of matrix.