**Abstracts**

|  |
| --- |
| Title:**Fast algorithms for computing the characteristic polynomial of somegraph classes** Speaker:**Milica Andelić, Kuwait University, Kuwait**Abstract: The characteristic polynomial of any square matrix of order  can be computed in time  by the standard algorithm. So the same applies for computing the characteristic polynomial of graphs of order . For some special classes of graphs, however, like threshold and chain graphs, the time complexity bound can be significantly improved by exploiting their combinatorial structure. For example, for threshold graphs the bound is recently reduced to . In this talk we discuss some novel ideas based on the divisor technique to obtain another fast algorithm for computing the characteristic polynomial of threshold and chain graphs, as well as some other graph classes. |
| Title:**Square inequality and strong order relation**Speaker:**Tsuyoshi Ando, Hokkaido University, Japan (Emeritus)**Abstract:It is well-known that for  We pose a problem of finding  such that Let us introduce a strong order relation  by the requirement Simple observation will show that if  We present examples of  of the form  with  or  with  and real Those results have connections with the arithmetic-geometric mean inequality of Bhatia-Kittaneh: for every unitarily invariant norm  as well as an inequality involving the Kantorovich constant  of  where  |
| Title: **A Riemannian Inexact Newton-CG Method for Nonnegative Inverse Eigenvalue Problems: Nonsymmetric Case** Speaker: **Zheng-Jian Bai, Xiamen University, China**Abstract:In this talk, we consider the nonnegative inverse eigenvalue problem of finding a nonnegative matrix such that its spectrum is the prescribed self-conjugate set of complex numbers. We reformulate the nonnegative inverse eigenvalue problem as an underdetermined constrained nonlinear matrix equation over several matrix manifolds. Then we propose a Riemannian inexact Newton-CG method for solving the nonlinear matrix equation. The global and quadratic convergence of the proposed method is established. Finally, we report some numerical experiments to illustrate the efficiency of the proposed method.This is joint work with Zhi Zhao (HDU). |
| Title: **TBA**Speaker: **Rajendra Bhatia, Indian Statistical Institute, India**Abstract: |
| Title: **Some recent results on tensors and hypergraphs** Speaker: **Changjiang Bu, Harbin Engineering University, China** Abstract:In this talk, we report some recent results on eigenvalue inclusion sets of tensors, spectral radius of tensors, and principal eigenvector of hypergraphs. This is joint work with Jiang Zhou and Lizhu Sun |
| Title:**Product vectors of mutually unbiased bases in dimension six**Speaker: **Lin Chen, Beihang University, China**Abstract: We show that if a set of four mutually unbiased bases (MUBs) in contains the identity, then any other basis inthe set contains at most two product states and at the same time has Schmidt rank at least three. Here both theproduct states and the Schmidt rank are dened over the bipartite space. The talk is based on the paper [CY].[CY] Lin Chen and Li Yu, Product states and Schmidt rank of mutually unbiased bases in dimension six, preprint. quant-ph/arXiv:1610.04875. |
| Title: **Group extensions of the Riordan matrix group** Speaker: **Gi-Sang Cheon, Sungkyunkwan University, Korea**Abstract:Let  denote the ring of formal power series over the complex field. We consider two groups,  under multiplication and  under composition. The Riordan group  is the set of Riordan matrices whose -th column generating function is ,  where . The group  is isomorphic to the semidirect product of and . It may be viewed as a group extension of by . In this talk, we show that the group of three‐dimensional Riordan matrices is an extension of the Riordan group  by . This concept extends to the group of multi-dimensional Riordan matrices. As an application, we illustrate the use of the threedimensional Riordan matrices in multiple combinatorial sums and lattice counting problem in the threedimensional Euclidean space. This is joint work with Sung-Tae Jin (KIAS). |
| Title:**Linear matrix representations of hyperbolic forms**Speaker:**Mao-Ting Chien, Soochow University, Taiwan**Abstract: Peter Lax in 1958 conjectured that if  is a real hyperbolic ternary form of degree with , then there exist  real symmetric matrices  and  satisfying . William Helton and Victor Vinnikov confirmed in 2007 the Lax conjecture is true. In this talk, we study the linear matrix representations of the hyperbolic ternary forms associated to cyclic weighted shift matrices and unitary bordering matrices. |
| Title: **What on earth does a quantum channel mean?** Speaker: **Man-Duen Choi, University of Toronto, Canada**Abstract: What is the role of matrix theory (alias, non-commutative analysis) onthe structure of quantum computer? I am surprised that so much of mypure math work of more than 40 years ago has been used in the study ofmodern quantum information. In order to release myself from quantumentanglements, I need to seek the new meanings of old values as well as torealize the new values of old meanings. |
| Title: **Entropy theory of sofic groups**Speaker:**Nhan-Phu Chung, Sungkyunkwan University, Korea**Abstract:Sofic groups were first introduced by Gromov as a common generalization of amenable groups and residually finite groups. In this talk, I will present recent results on entropy theory of sofic groups after seminal works of Bowen, Kerr-Li. |
| Title: **Inheritance Properties of Projection Methods for Algebraic Riccati Equations** Speaker: **Eric King-wah Chu, Monash University, Australia**Abstract:We consider the numerical solution of large-scale algebraic Riccati equations by projection methods. We propose a projection method or Krylov subspace interpretation of the doubling algorithm. More importantly, we prove that the solvability and the condition of the algebraic Riccati equation are inheritted by the projected equation, under mild and reasonable conditions. Note that the standard practice is to assume the solvability of the projected equations. Illustrative numerical examples are presented. This is joint work with Hung-Yuan Fan (National Taiwan Noraml University) and Liping Zhang (Zhejiang University of Technology). |
| Title: **Monotonically positive matrices**Speaker: **Jinyan Fan, Shanghai Jiaotong University, China**Abstract: A matrix  is monotonically positive (MP) if there exists a matrix  such that  and each column of  is monotonically nonincreasing or nondecreasing. In this talk, we discuss how to decide whether a symmetric matrix is MP or not. We propose a semidenite algorithm for it. If a matrix is not MP, a certificate for it can be obtained; if it is MP, an MP‐decomposition can be obtained. Some computational experiments will also be presented to show how to do this. |
| Title: **The singular acyclic matrices of even order with a P-set ofmaximum size**Speaker: **Carlos M. da Fonseca, Kuwait University, Kuwait**Abstract:Let  denote the nullity of a given ‐by‐ symmetric matrix . Set  for the principal submatrix of  obtained after deleting the rows and columns indexed by the nonempty subset of . When , we call  a P‐set of . The maximum size of a P‐set of  is denoted by . It is known that  and thisbound is not sharp for singular acyclic matrices of even order. In this talk, we will see the bound for this case and provide aclassification of allunderlying trees. Some illustrative examplesare provided.This is joint work with Zhibin Du,Zhaoqing University, China |
| Title: **Extremal Centralizers**Speaker: **Alexander E. Guterman, Lomonosov Moscow State University, Russia**Abstract: For a matrix  its centralizer  is the set of all matrices commuting with . For a set  its centralizer is the intersection of centralizers of all its elements. Centralizers are important and useful both in fundamental and applied sciences.A non-scalar matrix  is *minimal* if for every  with  it follows that . A non-scalar matrix  is *maximal* if for every non‐scalar  with  it follows that .We investigate and characterize minimal and maximal matrices over arbitrary fields.Our results are illustrated by applications to the theory of commuting graphs of matrix rings, to the preserver problems, namely to characterize commutativity preserving maps on matrices, and to the centralizers of high orders. The talk is based on several joint works with G. Dolinar, B. Kuzma, and P. Oblak. |
| Title: **Fuss-Catalan Matrices and Their Weighted Sums**Speaker: **Tian-Xiao He, Illinois Wesleyan University, USA**Abstract: We present the Riordan arrays called Fuss-Catalan matrices and constructed by the convolutions of the generating functions of Fuss-Catalan numbers. The weighted sums of the Fuss-Catalan matrices are discussed. The topics of the transformations between recursive sequences via Fuss-Catalan matrices are studied. This is joint work with Louis Shapiro (Howard University, USA). |
| Title: **Generalized log-majorization and multivariate Golden-Thompson type inequalities**Speaker: **Fumio Hiai, Tohoku University, Japan (Emeritus)**Abstract: We show a multivariate matrix norm inequality and certain variations thereof for unitarily invariant norms, whose special cases give multivariate generalizations of the Araki-Lieb-Thirring inequality and the Golden-Thompson inequality. The main technical contribution is a generalization of the concept of log-majorization that allows us to treat majorization with respect to logarithmic integral averages of singular value vectors. This is joint work with Robert König and Marco Tomamichel. |
| Title: **A class of separable states in infinite-dimensional systems**Speaker: **Jinchuan Hou, Taiyuan University of Technology** Abstract: We introduce a conception of SOT-separability for bounded positive operators and establish a Radon-Nikodym type theorem for spectral measure. Then we apply these to present a class of separable bipartite quantum states via the semi super strong positive partial transposition (semi-SSPPT) structure which generalizes SSPPT structure introduced in [Phys. Rev. A **77**, 022113(2008); J. Phys. A: Math. Theor. 45 505303 (2012)]. |
| Title: **An extremal problem on 0-1 matrices**Speaker: **Zejun Huang, Hunan University, China**Abstract: Let  and  be integers larger than or equal to 2. What is the maximum number of nonzero entries in an matrix  such that both  and  are 0-1 matrices? Characterize the matrices that attain the maximum number. This is joint work withZhenhua Lyu, Pu Qiao, Xingzhi Zhan. |
| Title: **Arithmetically Cohen-Macaulay sheaves on the double plane**Speaker: **Sukmoon Huh, Sungkyunkwan University, Korea**Abstract: A classical question is to ask if a general homogeneous polynomial can be written as a determinant of linear forms, and the positive answer for cubic polynomials in four variables was given about 150 years ago. But the negative answer for bigger number of variables can be easily given, due to the singularities of determinantal hypersurfaces. But the question is still open for a suitable power of polynoimals. In algebraic geometry, this question is translated to vanishing of certain cohomologies of some vector bundles on a hypersurface defined by the given polynomial. A weaker condition of vanishing enables us to define a new category of sheaves, called the arithmetically Cohen-Macaulay (for short, aCM) sheaves. They are locally Cohen-Macaulay and with no intermediate cohomology. They are expected to measure the complexity of the base variety and play a role of building blocks for the derived categories of coherent sheaves. In this talk, we report our recent result on the classification of aCM sheaves on quadric surfaces. This is joint work with Edoardo Ballico (Trento), Francesco Malaspina (Torino), Joan Pons-Llopis (Kyoto). |
| Title: **Generation of ray class fields modulo 2 or 3 by using the Weber function**Speaker: **Ho Yun Jung, Sungkyunkwan University, Korea**Abstract: Let  be an imaginary quadratic field with ring of integers . Let  be an elliptic curve with complex multiplication by , and let  be the Weber function on . Let . We show that the Weber function alone when evaluated at a certain -torsion point on  generates the ray class field of modulo . This would be a partial answer to the question raised by Hasse and Ramachandra. This is joint work with Ja Kyung Koo, Dong Hwa Shin. |
| Title:**Illusory Shapes via First-Order Phase Transition and Approximation**Speaker: **Yoon Mo Jung, Sungkyunkwan University, Korea**Abstract:We propose a new variational illusory shape (VIS) model via phase fields and phase transitions. It is inspired by the first‐order variational illusory contour model proposed by Jung and Shen (J Visual Commun Image Represent 19:42-55, 2008). Under the new VIS model, illusory shapes are represented by phase values close to 1 while the rest by values close to 0. The 0–1 transition is achieved by an elliptic energy with a double‐well potential, as in the theory of -convergence. The VIS model is non-convex, with the zero field as its trivial global optimum. To seek visually meaningful local optima that can induce illusory shapes, an iterative algorithm is designed and its convergence behavior is closely studied. Several generic numerical examples confirm the versatility of the model and the algorithm.This is joint work with Jianhong Jackie Shen (UIUC). |
| Title: **On the innite product exponents of meromorphic modular formsfor certain**  **arithmetic groups**Speaker: **Chang Heon Kim, Sungkyunkwan University, Korea**Abstract:In this talk I will obtain a formulae for the innite product exponents ofmeromorphic modular forms for certain arithmetic groups whichare determined by the divisors of the modular forms. As an application Iwill reprove the formula for the number of representations of a given integeras a sum of four squares. This is joint work with SoYoung Choi. |
| Title: **The -Selberg integral and reverse plane partitions**Speaker: **Jang Soo Kim,Sungkyunkwan University, Korea**Abstract:In this talk we will introduce a combinatorial interpretation for ‐integrals. Then we will show that Askey’s ‐Selberg integral can be restated as the generating function for the reverse plane partitions contained in a square with certain weights. As a special case we obtain the well known “trace” generating function for the reverse plane partitions. This is joint work with Dennis Stanton (University of Minnesota). |
| **Title: On a verifiable criterion of matrix** **-stability**Speaker: **Olga Y. Kushel, Shanghai University, Shanghai, China**Abstract:Here we consider a criterion of matrix -stability, which is based on the properties of submatrices and the estimates of their traces. The criterion is given in terms of a finite number of determinantal conditions. We also study some other concepts related to -stability, such as -stability. |
| Title: **Lattice reductions for NTRU variant problems and their applications**Speaker:**Soonhak Kwon, Sungkyunkwan University, Korea**Abstract:We explain NTRU cryptosystem proposed byHoffstein, Pipher and Silverman around 1996. No fundamental flawin NTRU has been found yet and NTRU is standardized in IEEE P1363.It is a practical alternative to RSA and ECC, and so far nopolynomial time quantum algorithm for breaking NTRU is known,while ECC and RSA are vulnerable to quantum algorithm of Shor. Wediscuss several NTRU problems and their related topics, and mention some applications of NTRU and lattice based problems. |
| Title: **The role of phases in detecting three qubit entanglement**Speaker: **Seung-Hyeok Kye, Seoul National University, Korea**Abstract:We propose separability criteria for three qubit states in terms of diagonal and anti-diagonal entries to detect entanglement with positive partial transposes. We report here that the phases of anti-diagonal entries play a crucial role. In some cases, the anti-diagonal phases of separable states must satisfy even an identity. These criteria are strong enough to detect PPT entanglement with nonzero volume. Our criteria give us complete characterizations of separability when entries of a state are zero except for diagonal and anti-diagonals, with a common magnitude for anti-diagonals. This talk is based on the preprint arXiv:1610.06645 with Kyung Hoon Han under the same title. |
| Title: **Thompson's type partial ordering on diagonal elements and singular values of**  **real matrices**Speaker: **Pan-Shun Lau, The Hong Kong Polytechnic University, Hong Kong**Abstract: Thompson(1977) gave necessary and sufficient conditions on the existence of a square real matrix with prescribed diagonal elements and prescribed singular values. The result asserts a Thompson's type partial ordering between the diagonal elements and singular values of real matrices. In the talk, we shall introduce a new partial ordering relation on by using two special classes of matrices and show that this partial ordering is equivalent to Thompson's type partial ordering. The new partial ordering is then applied to study an inclusion relation and convexity of linear image of special orthogonal orbit of real matrices. |
| Title:**Barycentric Maps on Spaces of Positive Matrices and Operators**Speaker: **Jimmie Lawson, Louisiana State University, USA**Abstract: We present important ideas and results from work with Yongdo Lim and recent extensions concerning barycentric maps on spaces of positive matrices and operators, continuous maps from various classes of Borel measures on  to  that one views as abstract versions of choosing a barycenter or center of mass. We consider a useful tool for their study, namely deriving them from certain types of multivariable operator means by an extension process. We consider extensions to barycentric maps on the integral Borel probability measures, those on which the -Wasserstein metric is defineed, the smaller clase of measures with bounded support, and the even smaller class of measures with compact support. The first two are defined in terms of a metric, and our focus in this presentation is on  equipped with the Thompson metric. The talk is based on joint work with Yongdo Lim, Sejong Kim. |
| Title: **Quantum states with prescribed reduced states, and special Quantum channels**Speaker: **Chi-Kwong Li, College of William & Mary, USA**Abstract:We considerthe set of quantum states with prescribed reduced states, and the set of quantum channels with special properties. In particular, we study the geometrical properties of these sets, andspecial elements attaining optimal values of certain functions. This is joint work with Yiu-Tung Poon (Iowa State University), Diane Pelejo (College ofWilliam &Mary). |
| Title: **Structure-Preserving QR Algorithms for the Bethe-Salpeter Eigenvalue Problems**Speaker: **Tiexiang Li, Southeast University, China**Abstract: In this talk, we present an efficient QR algorithm for solvingthe Bethe-Salpeter Eigenvalue Problems , where  is -hermitian with respect to . Based on newly introduced -orthogonal transformations, the QR algorithm preserves the -hermitian structure of  throughout the whole process, and thus guarantees the computed eigenvalues to appear pairwise  as they should. With the help of a newly established implicit -orthogonality theorem, we incorporate the implicit multi-shift technique to accelerate the convergence of the QR algorithm. Numerical experiments are given to show the effectiveness of the algorithm. |
| Title: **The dimension of the solution space of matrix equation**Speaker:  **Li Liang, Harbin Institute of Technology, China**Abstract:In this paper, we will use the generalized singular-value decomposition(GSVD) to investigate matrix equationwhereso that we will obtain the dimension of the solution space of the equation. Meanwhile, we will give some applications of the main results in Graph Theory.This is joint work with Sheng Chen, Yunbo Tian. |
| **Title: Low coherence frames via alternating projections and von Neumann algebras**Speaker: **Lek-Heng Lim, University of Chicago, USA**Abstract: We will discuss a technique for building finite frames in  with optimal coherence — a problem that has become exceptionally important in part because of the advent of compressive sensing in signal and image processing. Our technique will search for*group frames*, i.e., generated by cyclic vectors under the action of a non‐commutative group , and uses a combination of ideas drawn from numerical analysis, operator algebra, and representation theory. More specifically, our group frames will come from a space of operators associated with the von Neumann algebra  and we transform our search for a proper cyclic vector into a problem of finding the intersection between a convex set determined by  and a special subset of Hermitian rank‐one operators. We then apply an alternating projection algorithm to search for elements in the intersection with various extrapolationtechniques to accelerate convergence. This is joint work with Liwen Zhang (University of Chicago). |
| Title: **Parametrized contractive barycenteric maps and  ergodic theorems on thecone of positive definite matrices** Speaker: **Yongdo Lim, SungkyunkwanUniversity, Korea** Abstract: We construct a one parameter family of contractive (with respect to the Wasserstein metric, alternatively Kantorovich‐Rubinstein distance) barycentric maps of probability measures with bounded support on the Banach Finsler manifold of positive definite matrices of fixed size, the Finsler structure being derived from the operator norm. It interpolates continuously and monotonically the harmonic, arithmetic and Cartan barycenters. We show that each contractive barycentric map is monotonic for the stochastic order induced by the cone and establish stochastic approximations and  ergodic theoremsfor the parameterized contractive barycenters. |
| Title: **Power majorization between the roots of two polynomials** Speaker: **Minghua Lin, Shanghai University, China**Abstract: Let  and  be two -tuples of real numbers. We say that  is majorized by  if for every convex function . Mainly motivated by the study of -means, for two -tuples of positive real numbers, we say that  is power majorized by  provided that whenever , with reversal of the inequality sign when . It is shown that if two hyperbolic polynomials have a particular factorization into quadratics, then their roots satisfy a power majorization relation whenever key coefficients in their factorizations satisfy a corresponding majorization relation. In particular, a numerical observation by Klemes on the power majorization between the eigenvalues of two 4x4 matrices is confirmed. This is joint work with Gord Sinnamon. |
| Title: **Distribution of Laplacian eigenvalues of graphs** Speaker: **Seyed Ahmad Mojallal, Sungkyunkwan University, Korea**Abstract:Let  be a graph of order  with  edges and clique number . Let  be the Laplacian eigenvalues of graph  and let  be the largest positive integer such that . In particular, we provide the answer to Problem 2.3 raised in Pirzada and Ganie (2015) [1]. Moreover, we characterize all connected threshold graphs with ,  and . We obtain Nordhaus‐Gaddum‐type results for . Some relations between  with other graph invariants are obtained. |
| Title: **Two topics from quantum computing you may be interested in**Speaker: **Mikio Nakahara, Kindai University, Japan**Abstract:I present two topics from quantum computing that the participants may be interested in. The first subject is the IBM cloud quantum computer. Recently IBM offers access to their superconducting quantum computer via Internet. I will demonstrate how to use it with several examples including quantum circuits we found. The second subject is finding the smallest matrix element of a diagonal matrix of dimension . Classically it requires  steps to find the smallest element but it can be reduced to polynomial steps with a quantum computer. I outline application of this protocol to traveling salesman problem. |
| Title: **Interlacing families and the Hermitian spectral norm of digraphs** Speaker: **Suil O, Sungkyunkwan University, Korea** Abstract:Recently, Marcus, Spielman, and Srivastava proved the existenceof innite families of bipartite Ramanujan graphs of every degree at least 3by using the method of interlacing families of polynomials. In this talk, weapply their method to prove that for any connected graph G, there exists anorientation of G such that the spectral radius of the corresponding Hermitianadjacency matrix is at most that of the universal cover of G. This is joint work withGary Greaves and Bojan Mohar. |
| Title: **The cyclic rank completion problem with regular blocks**Speaker: **Edgar Silva Pereira, Federal University of Rio Grande do Norte, Brazil**Abstract:A tight upper bound is obtained for the minimal completion rank of a partial  block matrix  whose block‐pattern is a single bipartite cycle of order  and with specified blocks of order  having non‐vanishing determinant. Some related problems and possible generalizations are stated. |
| Title: **Compression, Matrix Range and Completely Positive Map** Speaker: **Yiu-Tung Poon, Iowa State University, USA**Abstract:We discuss some results on compression, matrix range and completely positive map. |
| Title: **Generalized inverses of a regular matrix over max algebra**Speaker: **Seok-Zun Song, Jeju National University, Korea**Abstract: For an matrix  over the max algebra, a *generalized inverse* of  is an  matrix  over the max algebra satisfying.In this talk, we present the general structure of matrices having generalized inverses. Also, we obtain that a matrix has a generalized inverse if and only if it has a space decomposition. Using this decomposition, we characterize reflexive generalized inverses of matrices. Furthermore, we establish necessary and sufficient conditions for a matrix to possess various types of generalized inverses including a Moore‐Penrose inverse. |
| Title: **Unitary similarity invariant function preservers of products of operators** Speaker: **Raymond Nung-Sing Sze, The Hong Kong Polytechnic University, Hong Kong**Abstract:Let  denote the Banach algebra of all bounded linear operators on a complex Hilbert space with , and let  and  subsets of  which contain all rank one operators. Suppose  is an unitary invariant norm, the pseudo spectra, the pseudo‐spectrum radius, the ‐numerical range, or the ‐numerical radius for some finite rank operator . In this talk, we determined for surjective maps  satisfying  for all .This is joint work with Jianlian Cui (Tsinghua University), Chi-Kwong Li (The College of William & Mary). |
| Title: **A spectral property of circulants and root location of polynomials**Speaker: **Mikhail Tyaglov, Shanghai Jiao Tong University, China**Abstract:Using the so-called one-rank perturbation method introduced by Yu. Barkovsky for circulant matrices, we improve a theorem by W. Cheung and T. Ng (former de Bruin and Sharma's conjecture) to the following one:Let ,  be the roots of a polynomial  of degree , and let ,  be the roots of its derivative . If , then where equality holds if, and only if, all  lie on a straight line passing through the origin of the complex plane.We also extend this fact by giving an estimate to  for arbitrary complex polynomials. Moreover, we obtain some new majorization estimates for critical points for polynomials. This is a joint work with Olga Kushel (Shanghai University). |
| Title: **Error Bounds For Approximate Deflating SubspacesFor Linear Response Eigenvalue Problems**Speaker: **Wei-Guo Wang, Ocean University of China, China**Abstract:Consider the linear response eigenvalue problem (LREP) for , where  and  are positive semidefinite and one of them is definite. Given a pair of approximate deflating subspaces of , it can be shown that LREP can be transformed into one for  that is nearly decoupled into two smaller LREPs upon congruence transformations on  and  that preserve the eigenvalues of . In this paper, we establish a bound on how far the pair of approximate deflating subspaces is from a pair of exact ones, using the closeness of  from being decoupled.This is joint work with Lei-Hong Zhang (Shanghai University of Finance and Economics) and Ren-Cang Li (University of Texas at Arlington). |
| Title: **Chebyshev accelerated preconditioned MHSS iteration methods for a class of block two-by-twolinear systems of skew-Hamiltonian coefficient matrices**Speaker: **Zeng-Qi Wang, Shanghai Jiao Tong University, China**Abstract:In this talk, the Chebyshev accelerated preconditioned modified Hermitian and skew-Hermitian splitting(CAPMHSS) iteration method is presented for solving the linear systemsof equations which have certain skew-Hamiltonian coefficient matrices.The new method is proved to be convergent as long as the eigenvalues bounds are notunderestimated. The error bound is displayed also. Even when the spectral information is lack, CAPMHSS iteration method could be considered as an exponentially convergent scheme by fixing the parameters certain values. In this case, the convergent rate is independent on the problem. Besides, the sub linear systems ineachiterationare allowed to be solved inexactly, which leads to the practical CAPMHSS iteration method.The error bound of the practical method is derived also. We discuss the implementation of CAPMHSS for solving two models arising from the Galerkin finite-element discretizations of distributed control problems and complex symmetric linear systems in detail. The numerical results show the robustness and efficiency of the new methods. It is shown that CAPMHSS iteration methods are competitive with the PMHSS preconditioned Krylov subspace methods. |
| Title: **Special least squares solutions of the quaternion matrix equations  and** Speaker: **Musheng Wei, Shanghai Normal University, China**Abstract: In this talk, by applying particular structure of the real representations of quaternion matrices and the Moore‐Penrose generalized inverse, we derive the expressions of the minimal norm least squares solution, the pure imaginary least squares solution, and the real least squares solution for the quaternion matrix equations  and and, respectively. The resulting formulas only involve real matrices, which are simpler than those reported in the literature. The corresponding algorithms only perform real arithmetic which also consider particular structure of the real representations of quaternion matrices, therefore are very efficient and easily understood. Numerical examples are provided to illustrate the efficiency of our algorithms. This is joint work with Fengxia Zhang, Ying Li, Jianli Zhao (Liaocheng University) |
| Title: **A New Method for Computing -functions and Their Condition Numbers of Large Sparse Matrices**Speaker: **Gang Wu, China University of Mining and Technology, China.**Abstract: In this talk, we propose a new method for computing the ‐functions of an ‐by‐ large sparse matrix with low rank or with fast decaying singular values. The key is to reduce the computation of ‐functions of a large matrix to ‐functions of some small matrices of size ‐by‐, where  is the numerical rank of the large matrix in question. For storage, the new method only needs to store two ‐by‐ sparse matrices and some ‐by‐ matrices, rather than some ‐by‐ possibly dense matrices. The error analysis on the proposed method is given. Based on the new method, we then propose two novel strategies for estimating the 2‐norm condition numbers of the ‐functions of large matrices. Numerical experiments illustrate the numerical behavior of the new algorithms and show the effectiveness of our theoretical results. |
| Title: **Combinatorics of Boolean Linear Dynamics**Speaker: **Yaokun Wu, Shanghai Jiao Tong University, China**Abstract:In this talk, we present our elementary analysis of some basic dynamical behaviors under the iterationsof several Boolean multi-linear maps. This work is one small step for us to go beyond thefamiliar world of irreducible nonnegative matrices.This is joint work with Zongchen Chen, Chengyang Qian, Zeying Xu, Yinfeng Zhu. |
| Title: **A long way from completely positive matrices to completely positive tensors**Speaker: **Changqing Xu, Suzhou University of Science and Technology, China**Abstract:In this talk I will talk about the recent progress on the study of completely positive(cp) tensors and completely positive matrices.I will also introduce the concept of Gramian tensors, doubly nonnegative tensors, copositive tensors, and totally positive tensors. Some recent applications of cp matrices and cp tensors are also addressed. Finally I will introduce the inverse of the fourth-order tensors. This is a joint work with Zhibing Chen of Shenzhen University and Liqun Qi of Hong Kong Polytechnic University. |
| Title: **Some norm inequalities for matrix means**Speaker: **Takeaki Yamazaki, Toyo University, Japan**Abstract: This talk is based on [BLY2016]. In what follows, a capital letter means a positive definite matrix on . For positive definite matrices  and , the (‐weighted) geometric mean  is defined by  and if ,  denotes , simply. As an extension of geometric mean, the power mean is very famous. For positive definite matrices  and , the (non‐weighted) power mean  is defined byIt satisfies the following norm inequality for any ,  and spectral norm  [LY2013]:  It is not known whether (1) holds for any unitarily invariant norm or not.In this talk, we shall show (1) for  and ‐norms , firstly.**Theorem 1.** *Let  and  be positive definite matrices. Then for*, Next, we shall introduce the similar type of inequalities of Theorem 1, i.e., we shall introduce the following results.**Theorem 2.** *Let  and  be positive definite matrices and . Then for ,** [(i)] ,
* [(ii)] .

The left-hand sides of (i) and (ii) in Theorem 2 are called the Heron and Heinz means, respectively. Lastly, we shall consider an extension of Theorem 1 to the power mean of -positive definite matrices. The power mean of -positive definite matricesis defined in [LP2012].**Theorem 3.** *Let  be positive definite matrices and . Then for ,* **References**[BLY2016] R. Bhatia, Y. Lim and T. Yamazaki, *Some norm inequalities for matrix means*, Linear Algebra Appl., **501** (2016), 112–122.[LP2012] Y. Lim and M. Pálfia, *Matrix power means and the Karcher mean* J. Funct. Anal., **262** (2012), 1498–1514.[LY2013] Y. Lim and T. Yamazaki, *On some inequalities for the matrix power and Karcher means*, Linear Algebra Appl., **438** (2013), 1293–1304. |
| Title: **Unitary eigenvalues of a general complex tensor** Speaker: **Hongmei Yao, Harbin Engineering University, China**Abstract:In this paper, a general complex tensor is embedded into a complex symmetric tensor. We show the connection between the unitary eigenvalue of a general complex tensor and the unitary symmetric eigenvalue of a complex symmetric tensor. Then we convert the unitary eigenvalue of a general complex tensor to the Z-eigenvalue of a real symmetric tensor. Then the upper bound on the number of distinct unitary eigenvalues of the general complex tensor is given. Finally, using the result of the best complex symmetric rank one approximation of complex symmetric tensors, we get the result on the best complex rank one approximation of a general complex tensor.This is joint work with Xia Liu(Harbin Engineering University), Lei Liu (Shandong University),Can Zhang(Harbin Engineering University), Changjiang Bu (Harbin Engineering University). |
| Title: **Elliptic rook and le numbers** Speaker: **Meesue Yoo, Sungkyunkwan University, Korea**Abstract:In this talk, we construct elliptic analogues of the rook numbersand le numbers by attaching elliptic weights to the cells in a board. Weshow that our elliptic rook and le numbers satisfy elliptic extensions ofcorresponding factorization theorems which in the classical case was established by Goldman, Joichi and White and by Garsia and Remmel in thele number case. This factorization theorem can be used to dene ellipticanalogues of various kinds of Stirling numbers of the rst and second kind,and Abel numbers. We also give analogous results for matchings of graphs,elliptically extending the result of Haglund and Remmel. This is joint work with Michael Schlosser |
| Title: **Coordinate Gradient Descent Methods and Incremental Gradient Methods for Regularized Optimization**Speaker: **Sangwoon Yun, Sungkyunkwan University, Korea**Abstract:We consider the regularized optimization problem whose objective function is the sum of a smooth function and a convex regularization.The special cases of this regularized optimization problem are bounded constrained minimization problem, linearly constrained minimization problem,L1-regularized least squares problem, L1-regularized logistic regression problem, support vector machine optimization problem and sparse covarianceselection problem. The coordinate gradient descent method is proposed tosolve the regularized optimization problem when the (possibly nonsmooth)convex regularization has a particular structure such as separability. Inmachine learning, the smooth function part of the objective function hasoften the form of the sum of several functions. In this case, the incrementalgradient method is proposed to solve the regularized optimization problem. This is joint work with Paul Tseng (UW), Kim-Chuan Toh (NUS). |
| Title: **The equivalence of hypercontractivity and logarithmic Sobolev inequality for -Ornstein-Uhlenbeck semigroup** Speaker: **Lunchuan Zhang, Renmin University of China, China**Abstract:We prove the equivalence of hypercontractivity and logarithmic Sobolev inequality for ‐Ornstein‐Uhlenbeck semigroup,where  is ‐Gaussian functor. That is, we obtain the following result:Given and . Let Ent(a):=, denote the entropy of a positive element  where  is a faithful, normal trace on the von Neumann algebra  DefineThe following statements are equivalent:1. Ent
2. for all  and
 |
| Title: **Entry patterns and algebraically positive matrices**Speaker: **Xingzhi Zhan, East China Normal University, China**Abstract: We introduce two new concepts and study their basic properties.Several open problems will be posed. This is joint work with Zejun Huang, Steve Kirkland and Pu Qiao. |
| Title: **Polytopes of Stochastic Tensors III**Speaker: **Fuzhen Zhang, Nova Southeastern University, USA**Abstract: This is continuation of the two previous talks on the topic. We will update the development and present new results.A square matrix is doubly stochastic if its entries are all nonnegative and each row and column sum is 1. A celebrated result known as Birkhoff’s theorem about doubly stochastic matrices states that an matrix is doubly stochastic if and only if it is a convex combination of some  permutation matrices (a.k.a Birkhoff polytope). The Birkhoff polytope of  stochastic matrices in  is of dimension  with  facets and  vertices.We study the generalization of the Birkhoff’s theorem in higher dimensions. An stochastic tensor is a nonnegative array (hypermatrix) in which every sum over one index is 1. We study the polytope of all these tensors with focus on the lower and upper bounds for the number of vertices of the polytope; we shall also discuss further questions. |
|  |