ROBERT C. THOMPSON MATRIX MEETING 2008

"Conference in honor of professor Robert C. Thompson"

University of California, Santa Barbara October 18, 2008

BOOK OF ABSTRACTS

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ROBERT C. THOMPSON MATRIX MEETING 2008
RCTM California 2008

Conference in honor of professor Robert C. Thompson

October 18, 2008

Robert C. Thompson Matrix Meeting (formerly Southern California Matrix Meeting) is an informal one-day meeting to encourage the interaction and collaboration of researchers on matrices, including application, computation and theory.

This meeting will take place in the McCune Conference Room at the University of California, Santa Barbara, California, USA.

These meetings were originally initiated by Robert C. Thompson and Steve Pierce in the mid eighties.

The attendees in 2004 voted to change the name to honor Bob, deceased in 1995. Previous meetings include:

SoCalM 1983 – Toronto - SoCalM 1987 – San Diego - SoCalM 1988 – Santa Barbara - SoCalM 1989 – San Diego - SoCalM 1990 – Santa Barbara - SoCalM 1991 – Santa Barbara -SoCalM 1992 – San Diego - SoCalM 1993 – San Jose - SoCalM 1994 – Salt Lake City - SoCalM 1995 – San Diego - SoCalM 1997 – Northridge - SoCalM 1998 – San Jose - SoCalM 1999 – San Diego - SoCalM 2001a – Northridge - SoCalM 2001b – San Jose - SoCalM 2002 – Northridge - SoCalM 2004 – San Jose - RCTM 2005 – San Francisco RCTM 07 – Alabama

The Organizing Committee is:

- Maribel Bueno Cachadina, University of California, Santa Barbara
- Roberto S. Costas Santos, University of California, Santa Barbara
- Jane Day, San Jose State University

The Scientific Committee is:

- Maribel Bueno Cachadina, University of California, Santa Barbara
- Charles Johnson, College of William and Mary
- Wasin So, San Jose State University
- Fuzhen Zhang, Nova Southeastern University

Book of Abstracts

Contents

1 The calendar

Talks (25 min.)

2 Schedule

The conference will be held at the 6th floor of Humanities and Social Sciences building in the the McCune conference room (Room 6020). The building is located between parking lots 27 and 29.

Morning Session

9:00 - 9:30 Welcome by
Bruce Tiffney, Dean of the College of Creative Studies.
9:30 - 10:00 **Charles Johnson** (The College of William and Mary)
Why are so many matrix properties eventually true?
10:00 - 10:30 **Edward Poon** (Embry-Riddle University)
Maps preserving norms of Lie products
10:30 - 11:00 Coffee Break
11:00 - 11:30 **Fuzhen Zhang** (Nova Southeastern University)
New Results on Hua Matrix Inequalities
11:30 - 12:00 **Shahla Nasserasr** (The College of William and Mary)
TP_2 Completion Problem
12:00 - 12:30 **Wasin So** (San Jose State University)
Singular values inequalities and graph energy bounds

Lunch 12:30 - 2:00

Afternoon Session

2:00 - 2:30 **William Watkins** (California State University, Northridge)
Trace Minimal Graphs
2:30 - 3:00 **Jianhong Xu** (Southern Illinois University Carbondale)
Generalized Newton-Like Inequalities on Positive Stable Matrices
3:00 - 3:30 **Morteza Seddighin** (Indiana University East)
Extending Holder McCarty Inequality to Normal Matrices
3:30 - 4:00 Coffee break
4:00 - 4:30 **Roberto S. Costas-Santos** (UCSB)
On the determinant of a sum of matrices.
4:30 - 5:00 **Jane Day** (San Jose State University)
Edge Deletion and Graph Energy

Dinner at the University Center 6:00 - 8:00

3 Talks

On the determinant of a sum of matrices

Roberto S. Costas-Santos
UCSB

Abstract: Often in mathematics it is useful to summarize a multivariate phenomenon with a single number and in fact, the determinant – which is represented by det – is one of the simplest cases. In fact, this number it is defined only for square matrices and a lot of its properties are very well-known. For instance, the determinant is a multiplicative function, i.e. det(AB)=detA detB, but it is not, in general, an additive function. Another interesting function in the matrix analysis is the characteristic polynomial – in fact, given a matrix A, this function is defined by $p_A(t) = det(tI - A)$ where I is the identity matrix – which elements are, up a sign, the elementary symmetric functions associated to the eigenvalues of the matrix A. In the present paper new expressions related with the determinant of sum of matrices and the elementary symmetric functions are given. Moreover, the connection with the Mobius function and the partial ordered sets (poset) is presented. Finally, a problem related with the determinant of sum of matrices is solved.

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Edge Deletion and Graph Energy

Jane Day
San Jose State University

Abstract: This is joint work with Wasin So. The energy of a graph is the sum of the singular values of its adjacency matrix. We are interested in how the energy changes when an edge is removed. We have found infinite families of graphs for which removal of an edge does not change the energy, ones for which energy decreases, and ones for which energy increases. We give a sufficient condition for the energy to strictly decrease when one edge is deleted.

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Why are so many matrix properties eventually true?

Charles Johnson
The College of William and Mary

Abstract: Often a complicated or subtle matrix property will have simple necessary conditions that are not generally sufficient. There is now substantial and growing evidence that, under some form of powering, the more subtle property will eventually hold if the simple one is present. We give some recent examples verifying this phenomenon and ask if there is general theorem.

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Factorization of Matrices in Integral Semigroups

Audra E. Kosh
UCSB

Abstract: Factorization theory is a field of mathematics commonly studied in the commutative case. Non-commutative factorization theory, however, is a relatively unexplored field. Since matrix multiplication is (in general) non-commutative, different semigroups (and sometimes semirings) of matrices with entries from subsets of the integers are explored with the objective of finding factorization properties of these semigroups, such as the ?lengths? of factorizations into irreducibles. By finding these invariants, one can determine whether unique factorization exists, or, as is more common, the extent to which unique factorization fails.

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TP_2 Completion Problem

Shahla Nasserasr
The College of William and Mary

Abstract: A partial matrix is one in which some entries are specified and the remaining unspecified entries are free to be chosen. Such a matrix is called partial TP_2 if all 1-by-1 and 2-by-2 specified minors are positive. Each choice of values for the unspecified entries gives a completion of the partial matrix. If there is a completion in which the result is TP_2, then the matrix is called TP_2 completable. We consider the question of which partial TP_2 matrices have a TP_2 completion and, in particular, which patterns for the specified entries ensure that a partial TP_2 matrix has a TP_2 completion.

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Maps preserving norms of Lie products

Edward Poon
Embry-Riddle University

Abstract: Let $\|\cdot\|$ be a unitary similarity invariant norm on the set M_n of $n \times n$ complex matrices. A description is obtained for surjective maps ϕ on M_n satisfying $\|AB - BA\| = \|\phi(A)\phi(B) - \phi(B)\phi(A)\|$ for all $A, B \in M_n$. This work is joint with Chi-Kwong Li and Nung-Sing Sze.

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Extending Holder McCarty Inequality to Normal Matrices

Morteza Seddighin
Indiana University East

Abstract: In this paper we define the concept of a q-f anti-eigenvalue and use convex optimization techniques to generalize Hölder-McCarthy inequality. Let A be a positive operator on a Hilbert space H satisfying $M \geq A \geq m > 0$. Also let $f(t)$ be a real valued convex function on $[m, M]$ and q be a real number, then the inequality

$$(f(A)x, x) \leq \frac{(mf(M) - Mf(m))}{(q-1)(M-m)} \left(\frac{(q-1)\,(f(M) - f(m))}{q\,(mf(M) - Mf(m))} \right)^q (Ax, x)^q,$$

which holds for every vector x, under certain restrictions on f and q, is called the Hölder-McCarthy inequality. We will generalize the Hölder-McCarthy inequality from positive operators to accretive normal operators.

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Singular values inequalities and graph energy bounds

Wasin So
San Jose State University

Abstract: The energy of a simple graph is defined as the sum of the singular values of its adjacency matrix. The following results of Robert C. Thompson:

- singular value inequalities for matrix sum,
- singular value inequalities for complementary submatrices

are applied to bound the energy of graphs constructed from two graphs in the following ways:

- by identifying a vertex from each graph,
- by connecting the two graphs with parallel edges (both graphs must be of same order),
- by connecting one vertex from a graph to several vertices of the other graph.

The sharpness of these bounds will also be discussed.

Trace Minimal Graphs
William Watkins
California State University, Northridge

Abstract: Weighing designs from statistical design theory are related to certain regular graphs called trace-minimal graphs. These graphs satisfy an extremal property involving the traces of powers of their adjacency matrices.

Generalized Newton-Like Inequalities on Positive Stable Matrices
Jianhong Xu
Southern Illinois University Carbondale

Abstract: Recently Holtz showed that the elementary symmetric functions E_k defined on the spectrum of an M-matrix satisfy the well-known Newton's inequalities, i.e. $E_k^2 \geq E_{k-1}E_{k+1}$ for all k. Neumann and Xu extended this result by verifying that Newton-like inequalities in the form $E_k^2 \geq \lambda E_{k-1}E_{k+1}$ for some $\lambda > 0$ hold on the spectrum of the Drazin inverse of an M-matrix. Monov also studied Newton-like inequalities for the elementary symmetric functions on a set of self-conjugate variables in the right half-plane. This result applies to the case when those variables represent the spectrum of a real positive stable matrix.

In this talk, we generalize the notion of Newton-like inequalities to the form $E_kE_l \geq \lambda E_{k-1}E_{l+1}$ for the same $\lambda > 0$ as in Monov's work and for all $k \leq l$. We show that such generalized Newton-like inequalities continue to hold for the elementary symmetric functions defined on the spectrum of a real positive stable matrix. Our result includes Monov's but turns out to be stronger.

New Results on Hua Matrix Inequalities

Fuzhen Zhang
Nova Southeastern University

Abstract: Hua presented an elegant matrix identity in 1955. His research was followed by some famous mathematicians in late 50s through 80s. In recent years, T. Ando et al revisited the HuaÕs matrix identity and obtained some interesting results. The purpose of this talk is to show some newest results on this topic.

List of Participants

1. Maribel Bueno Cachadina, UCSB
2. Berkeley Churchill, UCSB
3. Roberto S. Costas-Santos, UCSB
4. Jane Day, San Jose State University
5. Wilson Florero, San Jose State University
6. Wen Gu, UCSB
7. Charles Johnson, The College of William and Mary
8. Audra E. Kosh, UCSB
9. Shahla Nasserasr, The College of William and Mary
10. Linda Patton, Cal Poly San Luis Obispo
11. Steve Pierce, San Diego State University
12. Edward Poon, Embry-Riddle University
13. Morteza Seddighin, Indiana University
14. Wasin So, San Jose State University
15. David Strong, Pepperdine University
16. Joseph Swearngin, UCSB
17. William Watkins, California State University, Northridge
18. Ann Watkins, California State University, Northridge
19. Jianhong Xu, Southern Illinois University Carbondale
20. Fuzhen Zhang, Nova Southeastern University

4 Accommodation

Blocks of rooms at Best Western South Coast Inn have been reserved.

The price quoted, 140 USD, is a special group rate for the conference. There is only a limited number of rooms available at this price. **Please mention that you are with the Mathematics conference at UCSB at the time of making the reservation.**
Best Western South Coast Inn: about 5 minutes from UCSB. With complimentary internet, airport shuttle and a shuttle service to the campus (Breakfast buffet served daily from 6am-10pm. Specialty Coffees available in the lobby 24 hours. Free hardwired/Wi-Fi internet access, Hospitality hours Monday-Thursday 5pm-7pm) 5620 Calle Real, Goleta, CA 93117. (800) 350-3614, 805-967-3200. Rate 140 USD +10% tax (Weekends), 125 USD + 10% tax (weekdays) single or double. (continental breakfast included in the price).

The other hotel of interest (because of its downtown location) is El Prado Inn : about 10-15 minutes from UCSB. Upper State Street downtown location. Near bus stop for the express bus to UCSB. 1601 State Street, Santa Barbara, CA 93101 (800) 669-8979, (805) 966-0807. Ask for the UCSB rate. 85 USD (+ taxes) weekends and 75 USD(+ taxes) weekdays.

5 How to arrive

Airports: Santa Barbara has its own municipal airport, served by major airlines United and American. The Santa Barbara airport is close to the UCSB campus and the conference hotel, which also provides complimentary shuttle service from and to the airport. The Los Angeles International Airport is about two hours drive.

Directions: From Santa Barbara Airport (SBA): The conference hotel, the South Coast Inn, provides shuttle service from and to the airport. Simply use the airport courtesy phone to call the Inn for pickup. You can also take a taxi. Cab fare should be about 10 USD. If you are renting a car at the airport, turn right as you exit the rental car lot, onto William Moffet Lane.

From Los Angeles International Airport (LAX): We recommend the Santa Barbara Airbus, particularly if you must return to LAX for your departing flight. The Airbus is reliable, and offers a reasonable round-trip fare of approximately 80 USD. The nearest Airbus drop-off point to the UCSB campus is 5755 Thornwood Drive, in Goleta; so once you arrive, you'll need to call a cab, or the hotel shuttle for delivery to your local destination. If you are driving from LAX, exit the airport lot at Sepulveda Blvd., and follow Sepulveda Blvd. to the 405 North Freeway entrance. Follow 405 North to 101 North (Ventura Freeway). Remain on the 101 (for approximately one and a half hours) into Santa Barbara.

On Campus Parking: If you drive to the campus you may park in designated lots only; look for campus maps which show the pay parking areas. The fee charged for parking is 8 USD per day. You can pay by the pay machines around the parking lots.