The SIAM Activity Group on Linear Algebra promotes research in linear algebra and its applications. The group organizes a triennial SIAM Conference on Applied Linear Algebra and a triennial International Summer School on Numerical Linear Algebra (ISSNLA) for graduate students. They also support smaller, less formal conferences as requested by the membership. Every three years the activity group awards prizes for the best paper and the best poster in linear algebra.
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- **Sunday, October 25**
  4:00 PM – 8:00 PM
- **Monday, October 26**
  7:00 AM – 4:00 PM
- **Tuesday, October 27**
  7:30 AM – 4:00 PM
- **Wednesday, October 28**
  7:30 AM – 4:00 PM
- **Thursday, October 29**
  7:30 AM – 4:00 PM
- **Friday, October 30**
  7:30 AM – 2:30 PM

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265 Peachtree Street
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Standard Audio/Visual Set-Up in Meeting Rooms

SIAM does not provide computers for any speaker. When giving an electronic presentation, speakers must provide their own computers. SIAM is not responsible for the safety and security of speakers’ computers.

The Plenary Session Room will have two (2) screens, one (1) data projector and one (1) overhead projector. The data projectors support VGA connections only. Presenters requiring an HDMI or alternate connection must provide their own adaptor.

If you are a SIAM member, it only costs $10 to join the SIAM Activity Group on Linear Algebra (SIAG/LA). As a SIAG/LA member, you are eligible for an additional $10 discount on this conference, so if you paid the SIAM member rate to attend the conference, you might be eligible for a free SIAG/LA membership. Check at the registration desk.

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Internet Access

The Hyatt Regency offers wireless Internet access to hotel guests in the guest rooms and public areas of the hotel at no additional charge.

In addition, a limited number of computers with Internet access will be available during registration hours.

Registration Fee Includes

• Admission to all technical sessions
• Business Meeting
  (open to SIAG/LA members)
• Coffee breaks daily
• Poster Session
• Room set-ups and audio/visual equipment
• Welcome Reception

Conference Dinner Banquet

(separate fee applies; ticket required)

A conference dinner banquet will be held in the Regency V - Ballroom Level on Wednesday, October 28, 2015 at 6:00 PM. A limited number of tickets are available at SIAM Registration Desk for $56.00 per person until 12:00 PM on Tuesday, October 27. Tickets will not be sold after this time. The dinner banquet will include a four course meal.

Job Postings

Please check with the SIAM registration desk regarding the availability of job postings or visit http://jobs.siam.org.
Important Notice to Poster Presenters

The poster session is scheduled for Wednesday, October 28, 3:00 PM – 5:00 PM. Presenters are requested to put up their posters no later than 3:00 PM on Wednesday, the official start time of the session. Boards and push pins will be available to presenters beginning Monday, October 26, at 12:00 PM. Posters will remain on display through Friday, October 30. Poster displays must be removed by 10:15 AM. Posters remaining after this time will be discarded. SIAM is not responsible for discarded posters.

For information about preparing a poster, please visit http://www.siam.org/meetings/guidelines/presenters.php.

SIAM Books and Journals

Display copies of books and complimentary copies of journals are available on site. SIAM books are available at a discounted price during the conference. If a SIAM books representative is not available, completed order forms and payment (credit cards are preferred) may be taken to the SIAM registration desk. The books table will close at 12:00 PM on Friday, October 30.

Table Top Displays

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Comments?

Comments about SIAM meetings are encouraged! Please send to: Cynthia Phillips, SIAM Vice President for Programs (vpp@siam.org).

Get-togethers

- Welcome Reception
  Sunday, October 25
  6:00 PM – 8:00 PM

- Business Meeting
  (open to SIAG/LA members)
  Tuesday, October 27
  1:45 PM – 2:30 PM
  Complimentary soft drinks will be served.

- Poster Session and Coffee Break
  Wednesday, October 28
  3:00 PM – 5:00 PM

- Conference Dinner Banquet
  (separate fee applies; ticket required)
  Wednesday, October 28
  6:00 PM – 9:00 PM
  See page 3 for details.

Please Note

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SIAM is promoting the use of social media, such as Facebook and Twitter, in order to enhance scientific discussion at its meetings and enable attendees to connect with each other prior to, during and after conferences. If you are tweeting about a conference, please use the designated hashtag to enable other attendees to keep up with the Twitter conversation and to allow better archiving of our conference discussions. The hashtag for this meeting is #SIAMLA15.

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**Minitutorial**

**Monday, October 26**
**10:15 AM – 12:15 PM**

**MT1 Randomization in Numerical Linear Algebra: Theory and Practice**  
Room: International Ballroom North - Lower Level 1  
Organizer: **Ilse Ipsen**, North Carolina State University, USA

**Prize Lecture**

**Thursday, October 29**  
**1:45 PM – 2:30 PM**

**SIAG/Linear Algebra Prize Lecture** - Localizing Nonlinear Eigenvalues: Theory and Applications  
**David Bindel**, Cornell University, USA
Invited Plenary Speakers

** All Invited Plenary Presentations will take place in International Ballroom - Lower Level**

Monday, October 26
8:15 AM – 9:00 AM
IP1 Fast Approximation of the Stability Radius and the H∞
Norm for Large-Scale Linear Dynamical Systems
Michael L. Overton*, Courant Institute of Mathematical Sciences, New York University, USA

9:00 AM – 9:45 AM
IP2 Tuned Preconditioners for Inexact Two-Sided Inverse and Rayleigh Quotient Iteration
Melina Freitag, University of Bath, United Kingdom

1:45 PM – 2:30 PM
IP3 Sketching-Based Matrix Computations for Large-Scale Data Analysis
Haim Avron, Tel Aviv University, Israel

Tuesday, October 27
8:15 AM – 9:00 AM
IP4 Point-Spread Function Reconstruction in Ground-Based Astronomy
Raymond H. Chan, Chinese University of Hong Kong, Hong Kong

9:00 AM – 9:45 AM
IP5 Accelerating Direct Linear Solvers with Hardware and Algorithmic Advances
Xiaoye Sherry Li, Lawrence Berkeley National Laboratory, USA

* These speakers are supported in cooperation with the International Linear Algebra Society.
Invited Plenary Speakers

Wednesday, October 28
8:15 AM – 9:00 AM
IP6 Variational Gram Functions: Convex Analysis and Optimization
Maryam Fazel, University of Washington, USA

9:00 AM – 9:45 AM
IP7 Combinatorial Matrix Theory and Majorization
Geir Dahl*, University of Oslo, Norway

1:45 PM – 2:30 PM
IP8 Numerical Solution of Eigenvalue Problems Arising in the Analysis of Disc Brake Squeal
Volker Mehrmann, Technische Universitaet Berlin, Germany

Thursday, October 29
8:15 AM – 9:00 AM
IP9 Linear Algebra Computations for Parameterized Partial Differential Equations
Howard C. Elman, University of Maryland, College Park, USA

9:00 AM – 9:45 AM
IP10 Accurate Linear Algebra in Computational Methods for System and Control Theory
Zlatko Drmac, University of Zagreb, Croatia

Friday, October 30
8:15 AM – 9:00 AM
IP11 Low Rank Decompositions of Tensors and Matrices: Theory, Applications, Perspectives
Eugene Tyrtyshnikov, Russian Academy of Sciences, Russia

9:00 AM – 9:45 AM
IP12 Constrained Low Rank Approximations for Scalable Data Analytics
Haesun Park, Georgia Institute of Technology, USA

* These speakers are supported in cooperation with the International Linear Algebra Society.
SIAM Activity Group on Linear Algebra (SIAG/LA)
www.siam.org/activity/la

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Preconditioning and the Conjugate Gradient Method in the Context of Solving PDEs

Josef Málek and Zdeněk Strakoš
SIAM Spotlights 1

This is the first title in SIAM’s new Spotlights series of brief and enlightening books on timely topics. It discusses the interplay between modeling, analysis, discretization, matrix computation, and model reduction. The authors link PDE analysis, functional analysis, and calculus of variations with matrix iterative computation using Krylov subspace methods and address the challenges that arise during formulation of the mathematical model through to efficient numerical solution of the algebraic problem. The book’s central concept, preconditioning of the conjugate gradient method, is traditionally developed algebraically using the preconditioned finite-dimensional algebraic system. In this text, however, preconditioning is connected to the PDE analysis, and the infinite-dimensional formulation of the conjugate gradient method and its discretization and preconditioning are linked together. This text challenges commonly held views, addresses widespread misunderstandings, and formulates thought provoking open questions for further research.


Wim Michiels and Silviu-Iulian Niculescu
Advances in Design and Control 27

Time delays are important components of many systems in, for instance, engineering, physics, economics, and the life sciences, because the transfer of material, energy, and information is usually not instantaneous. Time delays may appear as computational communication lags, they model transport phenomena and heredity, and they arise as feedback delays in control loops. This monograph addresses the problem of stability analysis, stabilization, and robust fixed-order control of dynamical systems subject to delays, including both retarded- and neutral-type systems. In this revised edition, the authors make the leap from stabilization to the design of robust and optimal controllers and from retarded-type to neutral-type delay systems, thus enlarging the scope of the book within control. They include new, state-of-the-art material on numerical methods and algorithms to broaden the book’s focus and to reach additional research communities, in particular numerical linear algebra and numerical optimization and they increase the number and range of applications to better illustrate the effectiveness and generality of their approach.

Other titles of special interest

Control and Optimization with Differential-Algebraic Constraints
Edited by Lorenz T. Biegler, Stephen L. Campbell, and Volker Mehrmann
2012 • xx + 344 pages • Softcover • 978-1-611972-24-5
List $102.00 • Attendee $81.60 • SIAM Member $71.40 • DC23

Numerical Solution of Algebraic Riccati Equations
Dario A. Bini, Bruno Iannazzo, and Beatrice Meini
2013 • xxii + 389 pages • Softcover • 978-1-611972-32-8
List $71.50 • Attendee $57.20 • SIAM Member $50.05 • FA09

Linear Matrix Inequalities in System and Control Theory
Stephen Boyd, Laurent El Ghaoui, Eric Feron, and Venkatasubramanian Balakrishnan
1994 • x + 193 pages • Softcover • 978-0-898711-85-2
List $74.00 • Attendee $59.20 • SIAM Member $51.80 • AM15

Finite Dimensional Linear Systems
Roger W. Brockett
2015 • xxiv + 224 pages • Softcover • 978-1-611973-87-7
List $75.00 • Attendee $60.00 • SIAM Member $52.50 • CL56

Generalized Inverses of Linear Transformations
Stephen L. Campbell and Carl D. Meyer
2008 • xx + 272 pages • Softcover • 978-0-898716-71-9
List $70.00 • Attendee $56.00 • SIAM Member $52.50 • CL56

Linear and Nonlinear Functional Analysis with Applications
Philippe G. Ciarlet
2013 • xxiv + 832 pages • Hardcover • 978-1-611972-58-0
List $109.00 • Attendee $87.20 • SIAM Member $75.75 • OT116

Numerical Linear Algebra and Applications, Second Edition
Biswa Nath Datta
2010 • xxiv + 530 pages • Hardcover • 978-0-898716-85-6
List $84.00 • Attendee $67.20 • SIAM Member $58.80 • OT21

Direct Methods for Sparse Linear Systems
Timothy A. Davis
2006 • xx + 217 pages • Softcover • 978-0-898716-13-9
List $75.00 • Attendee $60.00 • SIAM Member $52.50 • FA02

Applied Numerical Linear Algebra
James W. Demmel
1997 • xx + 419 pages • Softcover • 978-0-898713-89-3
List $82.50 • Attendee $66.00 • SIAM Member $57.75 • OT56

Numerical Linear Algebra for High-Performance Computers
Jack J. Dongarra, Iain S. Duff, Danny C. Sorensen, and Henk A. van der Vorst
2000 • xxv + 552 pages • Hardcover • 978-0-898713-89-3
List $82.50 • Attendee $66.00 • SIAM Member $57.75 • OT56

Preconditioning and the Conjugate Gradient Method
in the Context of Solving PDEs

Josef Málek and Zdeněk Strakoš
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- geophysical science
- optimization
- uncertainty quantification
and more...

The collection, *Featured Lectures from our Archives*, includes audio and slides from 25 conferences since 2008, including talks by invited and prize speakers, select minisymposia, and minitutorials from the 2014 Annual Meeting and four 2014 SIAM meetings.

In addition, you can view brief video clips of speaker interviews and topic overviews from sessions at Annual Meetings starting in 2010, as well as the 2013 SIAM Conference on Computational Science and Engineering and the 2014 SIAM Conference on the Life Sciences.

Plans for adding more content from SIAM meetings abound, including presentations from six meetings in 2015.

New presentations are posted every few months as the program expands with sessions from additional SIAM meetings. Users can search for presentations by category, speaker name, and/or keywords.

The audio, slide, and video presentations are part of SIAM’s outreach activities to increase the public’s awareness of mathematics and computational science in the real world, and to bring attention to exciting and valuable work being done in the field. Funding from SIAM, the National Science Foundation, and the Department of Energy was used to support this project.

www.siam.org/meetings/presents.php
Sunday, October 25

Registration
4:00 PM-8:00 PM
Room: Embassy Hall Foyer - Lower Level 2

Welcome Reception
6:00 PM-8:00 PM
Room: Regency V - Ballroom Level

Monday, October 26

Registration
7:00 AM-4:00 PM
Room: Embassy Hall Foyer - Lower Level 2

Welcome Remarks
8:00 AM-8:15 AM
Room: International Ballroom - Lower Level 1

Monday, October 26

IP1
Fast Approximation of the Stability Radius and the $H_\infty$ Norm for Large-Scale Linear Dynamical Systems
8:15 AM-9:00 AM
Room: International Ballroom - Lower Level 1

Chair: Chen Greif, The University of British Columbia, Canada

The stability radius and the $H_\infty$ norm are well-known quantities in the robust analysis of linear dynamical systems with output feedback. These two quantities, which are reciprocals of each other in the simplest interesting case, respectively measure how much system uncertainty can be tolerated without losing stability, and how much an input disturbance may be magnified in the output. The standard method for computing them, the Boyd-Balakrishnan-Bruinsma-Steinbuch algorithm from 1990, is globally and quadratically convergent, but its cubic cost per iteration makes it inapplicable to large-scale dynamical systems. We present a new class of efficient methods for approximating the stability radius and the $H_\infty$ norm, based on iterative methods to find rightmost points of spectral value sets, which are generalizations of pseudospectra for modeling the linear fractional matrix transformations that arise naturally in analyzing output feedback. We also discuss a method for approximating the real structured stability radius, which offers additional challenges. Finally, we describe our new public-domain MATLAB toolbox for low-order controller synthesis, HIFOOS (H-infinity fixed-order optimization --- sparse). This offers a possible alternative to popular model order reduction techniques by applying fixed-order controller design directly to large-scale dynamical systems.

This is joint work with Nicola Guglielmi, Mert Gurbuzbalaban and Tim Mitchell. This speaker is supported in cooperation with the International Linear Algebra Society.

Michael L. Overton
Courant Institute of Mathematical Sciences, New York University, USA
Monday, October 26

**IP2**

**Tuned Preconditioners for Inexact Two-Sided Inverse and Rayleigh Quotient Iteration**

9:00 AM-9:45 AM
Room: International Ballroom - Lower Level 1
Chair: Chen Greif, The University of British Columbia, Canada

Computing both right and left eigenvectors of a generalised eigenvalue problem simultaneously is of interest in several important applications. We provide convergence results for inexact two-sided inverse and Rayleigh quotient iteration, which extend the previously established theory to the generalized non-Hermitian eigenproblem and inexact solves with a decreasing solve tolerance. Moreover, we consider the simultaneous solution of the forward and adjoint problem arising in two-sided methods and extend the successful tuning strategy for preconditioners to two-sided methods, creating a novel way of preconditioning two-sided algorithms. This is joint work with Patrick Kuerschner (MPI Magdeburg, Germany).

**Melina Freitag**
University of Bath, United Kingdom

**Coffee Break**
9:45 AM-10:15 AM
Room: Embassy Hall - Lower Level 2

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Monday, October 26

**MT1**

**Randomization in Numerical Linear Algebra: Theory and Practice**

10:15 AM-12:15 PM
Room: International Ballroom North - Lower Level 1
Chair: Ilse Ipsen, North Carolina State University, USA

**Speakers:**
Ilse Ipsen, North Carolina State University, USA
Petros Drineas, Rensselaer Polytechnic Institute, USA
Michael Mahoney, University of California, Berkeley, USA

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Monday, October 26

**MS1**

**Recent Advances in Matrix Functions - Part I of II**

10:15 AM-12:15 PM
Room: International Ballroom South - Lower Level 1

For Part 2 see MS8

Matrix functions are an important tool in many areas of science and engineering. The development of improved algorithms for their computation continues to be a very active area of research. This minisymposium focuses on some recent advances, including functions of structured matrices, the action of a matrix function on a vector, multivariate matrix functions, and the design of algorithms that exploit modern computer architectures.

**Organizer:** Samuel Relton
University of Manchester, United Kingdom

**Organizer:** Nicholas Higham
University of Manchester, United Kingdom

**Organizer:** Edvin Deadman
University of Manchester, United Kingdom

10:15-10:40 **Error Estimation in Krylov Subspace Methods for Matrix Functions**
Marcel Schweitzer, Bergische Universität Wuppertal, Germany; Andreas J. Frommer, Bergische Universität, Germany

10:45-11:10 **Functions of Matrices with Kronecker Sum Structure**
Michele Benzi, Emory University, USA; Valeria Simoncini, Universita’ di Bologna, Italy

11:15-11:40 **First-Order Riemannian Optimization Techniques for the Karcher Mean**
Bruno Iannazzo, Università di Perugia, Italy; Margherita Porcelli, University of Bologna, Italy

11:45-12:10 **A High Performance Algorithm for the Matrix Sign Function**
Sivan A. Toledo, Tel Aviv University, Israel
Monday, October 26

MS2

Iterative Methods for Solving Families of Shifted Linear Systems - Part I of II

10:15 AM-12:15 PM

Room: Piedmont - Atlanta Conference Level

For Part 2 see MS9

Many problems which arise in the computational sciences can be reduced to the solution of a family of shifted linear systems with matrices differing by multiples of the identity. This relationship is frequently exploited when designing iterative solvers. However, doing so can also impose restrictions, e.g., on the choice of preconditioner. Thus, we seek methods which exploit the relationship between all shifted systems while allowing for robust preconditioning. The goal of this minisymposium is to bring together those developing such solvers and those who use them in applications, fostering communication and presenting this work to a broader audience.

Organizer: Kirk M. Soodhalter
Johannes Kepler University, Austria

Organizer: Martin B. van Gijzen
Delft University of Technology, Netherlands

10:15-10:40 Iterative Methods for Solving Shifted Linear Systems Built Upon a Block Matrix-vector Product
Kirk M. Soodhalter, Johannes Kepler University, Austria

10:45-11:10 One Matrix, Several Right Hand Sides: Efficient Alternatives to Block Krylov Subspace Methods
Andreas J. Frommer, Bergische Universität, Germany; Somaiyeh Rashedi, University of Tabriz, Iran

11:15-11:40 Mpgmres-Sh: Multipreconditioned GMRES for Shifted Systems
Tania Bakhos and Peter K. Kitaniidis, Stanford University, USA; Scott Ladenheim, Temple University, USA; Arvind Saibaba, Tufts University, USA; Daniel B. Szyld, Temple University, USA

11:45-12:10 Nested Krylov Methods for Shifted Linear Systems
Manuel Baumann and Martin B. van Gijzen, Delft University of Technology, Netherlands

continued in next column
Monday, October 26
MS4
Undergraduate Research in Linear Algebra
10:15 AM-12:15 PM
Room: Roswell - Atlanta Conference Level
Participating in mathematical research can be an extremely beneficial experience for undergraduate students. Linear Algebra is an ideal mathematical area for undergraduate research because it is more accessible to students, most of whom begin studying it their freshman or sophomore year, and because Linear Algebra has many mathematically beautiful and interesting problems, many of which are directly connected to real world situations, which is of further motivation to students. In this session we will discuss our experiences in supervising undergraduate research in Linear Algebra and share suggestions about how others can effectively do the same.

Organizer: David M. Strong
Pepperdine University, USA

10:15-10:40 Research in Linear Algebra with Undergraduates
David M. Strong, Pepperdine University, USA

10:45-11:10 Student Research on Infinite Toeplitz Matrices
Gil Strang, Massachusetts Institute of Technology, USA

11:15-11:40 Undergraduate Research Projects in Linear Algebra
Hugo J. Woerdeman, Drexel University, USA

11:45-12:10 Undergraduate Research in Linear Algebra 4
Charles Johnson, College of William & Mary, USA

Monday, October 26
MS5
Sparse Matrix-Matrix Multiplication: Applications, Algorithms, and Implementations - Part I of II
10:15 AM-12:15 PM
Room: Techwood - Atlanta Conference Level
For Part 2 see MS12
Sparse matrix-matrix multiplication is a fundamental kernel in computations ranging from the numerical (algebraic multigrid) to the combinatorial (graph and network analysis). Its performance is constrained by the kernel’s irregularity, depending on the sparsity structure of the matrices, and by its low arithmetic intensity, making data movement within the memory hierarchy and across processors a bottleneck. This minisymposium will discuss applications, implementations, algorithms, and means of characterizing the communication costs for sparse matrix-matrix multiplication.

Organizer: Grey Ballard
Sandia National Laboratories, USA

Organizer: Alex Druinsky
Lawrence Berkeley National Laboratory, USA

10:15-10:40 Hypergraph Partitioning for Sparse Matrix-Matrix Multiplication
Grey Ballard, Sandia National Laboratories, USA; Alex Druinsky, Lawrence Berkeley National Laboratory, USA; Nicholas Knight, New York University, USA; Oded Schwartz, Hebrew University of Jerusalem, Israel

10:45-11:10 Exploiting Sparsity in Parallel Sparse Matrix-Matrix Multiplication
Kadir Akbudak, Oguz Selvitopi, and Cevdet Aykanat, Bilkent University, Turkey

11:15-11:40 Generalized Sparse Matrix-Matrix Multiplication and Its Use in Parallel Graph Algorithms
Ariful Azad, Purdue University, USA; Aydin Buluc, Lawrence Berkeley National Laboratory, USA; John R. Gilbert, University of California, Santa Barbara, USA

11:45-12:10 The Input/Output Complexity of Sparse Matrix Multiplication
Morten Stöckel and Rasmus Pagh, IT University of Copenhagen, Denmark

Monday, October 26
MS6
Recent Spectral Approaches for Graph Clustering
10:15 AM-12:15 PM
Room: Vinings - Atlanta Conference Level
Clustering structures in networks are deeply related to spectral properties of suitable operators. Due to their generality, efficiency and rich theoretical foundations, spectral based techniques for graph clustering problems have been widely explored and applied to various research areas. The talks in this minisymposium sample some recent advances on the linear algebra approach to the problem of analysing the clustering structure of graphs and networks, also considering possible multilinear and nonlinear models and techniques.

Organizer: Francesco Tudisco
Saarland University, Germany

10:15-10:40 Eigenvectors of the Nonlinear Graph p-Laplacian and Application in Graph Clustering
Francesco Tudisco and Matthias Hein, Saarland University, Germany

10:45-11:10 Eigenvector Norms Matter in Spectral Graph Theory
Franklin Kenter, Rice University, USA

11:15-11:40 Local Clustering with Graph Diffusions and Spectral Solution Paths
Kyle Kloster and David F. Gleich, Purdue University, USA

11:45-12:10 Signed Laplacians and Spectral Clustering Via Quotient Space Metrics
Shipeng Liu, University of Durham, United Kingdom; Fatihcan M. Atay, Max Planck Institute for Mathematics in the Sciences, Germany
### Monday, October 26

#### CP1

**Inverse Problems**

**10:15 AM-12:15 PM**

**Room:** Marietta - Atlanta Conference Level  
**Chair:** Geoffrey Dillon, Virginia Tech, USA

- **10:15-10:30** An Augmented Hybrid Method for Large Scale Inverse Problems  
  Geoffrey Dillon, Texas Tech University, USA; Julienne Chung and Eric De Sturler, Virginia Tech, USA

- **10:35-10:50** On a Nonlinear Inverse Problem in Electromagnetic Sounding  
  Caterina Fenu, Gian Piero Deidda, and Giuseppe Rodriguez, University of Cagliari, Italy

- **10:55-11:10** Localized-Deim: An Overlapping Cluster Framework with Application in Model Reduction for Nonlinear Inversion  
  Alexander R. Grimm and Serkan Gugercin, Virginia Tech, USA

- **11:15-11:30** Matrix Affine Transformation Algorithm for Rank-Reducing Image Data Informatics Process  
  Jay Min Lee, Pohang Accelerator Lab, POSTECH, Korea; Youngjoo Chung, Daegu Gyeongbuk Institute of Science and Technology, Korea; Yonghoon Kwon, POSTECH, Korea

- **11:35-11:50** Efficiencies in Global Basis Approximation for Model Order Reduction in Diffuse Optical Tomography  
  Meghan O’Connell and Misha E. Kilmer, Tufts University, USA; Eric De Sturler, Serkan Gugercin, and Christopher A. Beattie, Virginia Tech, USA

- **11:55-12:10** Robust Multi-Instance Regression  
  Dimitri Papadimitriou, Bell Laboratories, Lucent Technologies, USA

### Monday, October 26

#### CP2

**Eigenvalue and SVD Problems: Part I**

**10:15 AM-12:15 PM**

**Room:** University - Atlanta Conference Level  
**Chair:** Kensuke Aishima, University of Tokyo, Japan

- **10:15-10:30** Iterative Refinement for Symmetric Eigenvalue Decomposition and Singular Value Decomposition  
  Kensuke Aishima, University of Tokyo, Japan; Takeshi Ogita, Tokyo Woman’s Christian University, Japan

- **10:35-10:50** Two-Level Orthogonal Arnoldi Method for Large Rational Eigenvalue Problems  
  Javier A. González Pizarro and Froilan Dopico, Universidad Carlos III de Madrid, Spain

- **10:55-11:10** A Communication-Avoiding Arnoldi-Type of the Complex Moment-Based Eigensolver  
  Akira Imakura and Tetsuya Sakurai, University of Tsukuba, Japan

- **11:15-11:30** Some Inverse Numerical Range Problems  
  Russell Carden, University of Kentucky, USA; M Jahromi, Shahid Bahonar University, Iran; Iran Katsoulas and Greece Maroulas, National Technical University of Athens, Greece

- **11:35-11:50** An Algorithm for Finding a 2-Similarity Transformation from a Numerical Contraction to a Contraction  
  Daeshik Choi, Southern Illinois University, Edwardsville, USA; Anne Greenbaum, University of Washington, USA

- **11:55-12:10** The Markovian Joint Spectral Radius: What It Is and How to Compute It Efficiently  
  Antonio Cicone and Nicola Guglielmi, Università degli Studi dell’Aquila, Italy; Vladimir Y. Protasov, Moscow State University, Russia

### Monday, October 26

#### IP3

**Sketching-Based Matrix Computations for Large-Scale Data Analysis**

**1:45 PM-2:30 PM**

**Room:** International Ballroom - Lower Level 1  
**Chair:** Petros Drineas, Rensselaer Polytechnic Institute, USA

Matrix computations lies at the core of a broad range of methods in data analysis and machine learning, and certain numerical linear algebra primitives (e.g. linear least-squares regression and principal component analysis) are widely and routinely used. Devising scalable algorithms that enable large scale computation of the aforementioned primitives is crucial for meeting the challenges of Big Data applications. Sketching, which reduces dimensionality through randomization, has recently emerged as a powerful technique for scaling-up these primitives in the presence of massive data, for an extensive class of applications. In this talk, we outline how sketching can be used to accelerate these core computations, and elaborate on the tradeoffs involved in their use. We will also demonstrate the utility of the presented algorithms for data analysis and machine learning applications.

- **Haim Avron**  
  Tel Aviv University, Israel

**Coffee Break**

**2:30 PM-3:00 PM**

**Room:** Embassy Hall - Lower Level 2

Lunch Break  
12:15 PM-1:45 PM  
Attendees on their own
Monday, October 26

**MS7**
Finding and Exploiting Structure in Data
3:00 PM-5:00 PM
Room: International Ballroom North - Lower Level 1

In recent years there has been tremendous progress in developing both a robust theoretical framework and a variety of practical algorithms for solving a wide range of inference and inverse problems when confronted with indirect, and often highly incomplete, observations. The key assumption that lies at the heart of these methods is that the data, while often seemingly high-dimensional, frequently exhibits low-dimensional structure that can be exploited to enable highly efficient acquisition and inference. This minisymposium will showcase several ways in which such structure can enable novel approaches in modern data processing applications.

Organizer: Mark Davenport
Georgia Institute of Technology, USA

- **3:00-3:25** Computationally-Efficient Approximations to Arbitrary Linear Dimensionality Reduction Operators
  Jarvis Haupt, University of Minnesota, USA

- **3:30-3:55** Recovering Planted Subgraphs via Convex Graph Invariants
  Venkat Chandrasekaran, California Institute of Technology, USA

- **4:00-4:25** More Data, Less Work: Sharp Data–Computation Tradeoffs for Linear Inverse Problems
  Mahdi Soltanolkotabi, University of Southern California, USA

- **4:30-4:55** A Data-dependent Weighted LASSO under Poisson Noise
  Xin Jiang, Duke University, USA; Patricia Reynaud-Bouret, University of Nice, France; Vincent Rivoirard, University of Paris, Dauphine, France; Laure Sansonnet, Argo ParisTech, France; Rebecca Willett, University of Wisconsin, Madison, USA

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**MS8**
Recent Advances in Matrix Functions - Part II of II
3:00 PM-5:00 PM
Room: International Ballroom South - Lower Level 1

- **For Part 1 see MS1**
  Matrix functions are an important tool in many areas of science and engineering. The development of improved algorithms for their computation continues to be a very active area of research. This minisymposium focuses on some recent advances, including functions of structured matrices, the action of a matrix function on a vector, multivariate matrix functions, and the design of algorithms that exploit modern computer architectures.

Organizer: Samuel Relton
University of Manchester, United Kingdom

- **3:00-3:25** The Leja Method: Backward Error Analysis and Implementation
  Marco Caliari, University of Verona, Italy; Peter Kandolf, Alexander Osterman and Stefan Rainer, Universität Innsbruck, Austria

- **3:30-3:55** An Algorithm for the Lambert W Function on Matrices
  Massimiliano Fasi and Nicholas Higham, University of Manchester, United Kingdom; Bruno Iannazzo, Università di Perugia, Italy

- **4:00-4:25** An Exponential Integrator for Polynomially Perturbed Linear ODEs
  Antti Koskela and Elias Jarlebring, KTH Royal Institute of Technology, Sweden; M.E. Hochstenbach, Eindhoven University of Technology, Netherlands

- **4:30-4:55** Estimating the Condition Number of $(A)b$
  Edvin Deadman, University of Manchester, United Kingdom

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**MS9**
Iterative Methods for Solving Families of Shifted Linear Systems - Part II of II
3:00 PM-5:00 PM
Room: Piedmont - Atlanta Conference Level

For Part 1 see MS2

Many problems which arise in the computational sciences can be reduced to the solution of a family of shifted linear systems with matrices differing by multiples of the identity. This relationship is frequently exploited when designing iterative solvers. However, doing so can also impose restrictions, e.g., on the choice of preconditioner. Thus, we seek methods which exploit the relationship between all shifted systems while allowing for robust preconditioning. The goal of this minisymposium is to bring together those developing such solvers and those who use them in applications, fostering communication and presenting this work to a broader audience.

Organizer: Kirk M. Soodhalter
Johannes Kepler University, Austria

- **3:00-3:25** Solving Linear Systems with Nonlinear Parameter Dependency
  Karl Meerbergen, Roel Van Beeumen, and Wim Michiels, Katholieke Universiteit Leuven, Belgium

- **3:30-3:55** Perfectly Matched Layers and Rational Krylov Subspaces with Adaptive Shifts for Maxwell Systems
  Vladimir L. Druskin, Schlumberger-Doll Research, USA; Rob Remis, Delft University of Technology, Netherlands

- **4:00-4:25** Parallelization of the Rational Arnoldi Method
  Mario Berljafa and Stefan Guettel, University of Manchester, United Kingdom

- **4:30-4:55** Interpolatory Techniques for Model Reduction of Multivariate Linear Systems using Error Estimation
  Mian Ilyas Ahmad, Max Planck Institute, Magdeburg, Germany; Lihong Feng, Max Planck Institute for Dynamics of Complex Systems, Germany; Peter Benner, Max Planck Institute, Magdeburg, Germany
Monday, October 26

**MS10**

**Polynomial Eigenvalue Problems - Part II of II**

3:00 PM-5:00 PM

*Room: Spring - Atlanta Conference Level*

*For Part 1 see MS3*

Polynomial Eigenvalue Problems arise in many applications from signal processing, quantum physics or computer aided design, and in the modeling and analysis of vibrating systems, mechanical structures, or electrical circuits. Much progress has been made in the last few years both from the theory and the development of algorithms in this area. The minisymposium will survey the most recent theoretical developments oriented to applications. We cover a range of topics including inverse problems, linearizations and l-ifications, and perturbation theory of structured matrix polynomials. The minisymposium is dedicated to the memory of Leiba Rodman, who passed away last March 2, 2015.

Organizer: Fernando De Teran  
*Universidad Carlos III de Madrid, Spain*

Organizer: Vanni Noferini  
*University of Manchester, United Kingdom*

Organizer: María I. Bueno  
*University of California, Santa Barbara, USA*

3:00-3:25 **Recent Advances on Inverse Problems for Matrix Polynomials**  
Froilán M. Dopico, Universidad Carlos III, Madrid, Spain; Fernando De Teran, Universidad Carlos III de Madrid, Spain; D. Steven Mackey, Western Michigan University, USA; Paul Van Dooren, Université Catholique de Louvain, Belgium

3:30-3:55 **A Factorized Form of the Inverse Polynomial Matrix Problem**  
Paul M. Van Dooren, Université Catholique de Louvain, Belgium

4:00-4:25 **Generic Low Rank Perturbations of Structured Matrices**  
Leonhard Batzke and Christian Mehl, TU Berlin, Germany; Andre C. Ran, Vrije Universiteit Amsterdam, The Netherlands; Leiba Rodman, College of William & Mary, USA

4:30-4:55 **Matrix Functions: The Contributions of Leiba Rodman**  
Peter Lancaster, University of Calgary, Canada

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Monday, October 26

**MS11**

**Online Linear Algebra Education: Are MOOCs The Answer?**

3:00 PM-5:00 PM

*Room: Roswell - Atlanta Conference Level*

The Massive Open Online Course (MOOC) has been touted as a major disruptive force in education. Some see it as the path towards affordable quality education for all. In this minisymposium, we discuss the practical experiences gained from four different online courses that focus on linear algebra offered through MIT OpenCourseWare, Coursera, and edX.

Organizer: Robert A. van de Geijn  
*University of Texas at Austin, USA*

3:00-3:25 **Experience with OpenCourseWare Online Video Lectures**  
Gilbert Strang, Massachusetts Institute of Technology, USA

3:30-3:55 **Coding the Matrix: Linear Algebra through Computer Science Applications**  
Philip Klein, Brown University, USA

4:00-4:25 **LAFF Long and Prosper?**  
Maggie E. Myers and Robert A. van de Geijn, University of Texas at Austin, USA

4:30-4:55 **When Life is Linear Worldwide**  
Tim Chartier, Davidson College, USA

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Monday, October 26

**MS12**

**Sparse Matrix-matrix Multiplication: Applications, Algorithms, and Implementations - Part II of II**

3:00 PM-5:00 PM

*Room: Techwood - Atlanta Conference Level*

Sparse matrix-matrix multiplication is a fundamental kernel in computations ranging from the numerical (algebraic multigrid) to the combinatorial (graph and network analysis). Its performance is constrained by the kernel’s irregularity, depending on the sparsity structure of the matrices, and by its low arithmetic intensity, making data movement within the memory hierarchy and across processors a bottleneck. This minisymposium will discuss applications, implementations, algorithms, and means of characterizing the communication costs for sparse matrix-matrix multiplication.

Organizer: Grey Ballard  
*Sandia National Laboratories, USA*

Organizer: Alex Druinsky  
*Lawrence Berkeley National Laboratory, USA*

3:00-3:25 **Analyzing Spgemm on Gpu Architectures**  
Steven Dalton and Luke Olson, University of Illinois at Urbana-Champaign, USA

3:30-3:55 **A Framework for SpGEMM on GPUs and Heterogeneous Processors**  
Weifeng Liu and Brian Vinter, University of Copenhagen, Denmark

4:00-4:25 **The Distributed Block-Compressed Sparse Row Library: Large Scale and GPU Accelerated Sparse Matrix Multiplication**  
Alfio Lazzaro, Ole Schuett, and Joost VandeVondele, ETH Zürich, Switzerland

4:30-4:55 **Strong Scaling and Stability: SpAMM Acceleration for the Matrix Square Root Inverse and the Heaviside Function**  
Matt Challacombe, Los Alamos National Laboratory, USA
Active subspaces are an emerging set of tools for working with nonlinear functions of many variables. The active subspace is the span of the eigenvectors of the average outer product of the function’s gradient with itself. These eigenvectors reduce the dimension of the function’s inputs to enable otherwise infeasible studies with the function---e.g., optimization or uncertainty quantification. This minisymposium will explore the linear algebra aspects of active subspaces.

Organizer: Paul Constantine
Colorado School of Mines, USA

3:00-3:25 Active Subspaces in Theory and Practice
Paul Constantine, Colorado School of Mines, USA

3:30-3:55 Recovery of Structured Multivariate Functions
Jan Vybiral, Technical University Berlin, Germany; Massimo Fornasier, Technical University of Munich, Germany; Karin Schnass, University of Innsbruck, Austria

4:00-4:25 Sketching Active Subspaces
Armin Eftekhari, First Name Eftehari, Paul Constantine, and Michael B. Wakin, Colorado School of Mines, USA

4:30-4:55 Adaptive Algebraic Multigrid for Lattice QCD
Matthias Rottmann, Bergische Universität Wuppertal, Germany; Andreas J. Frommer, Bergische Universität, Germany; Karsten Kahl, University of Wuppertal, Germany; Björn Leder, Bergische Universität Wuppertal, Germany; Stefan Krieg, Forschungszentrum Jülich, Germany

4:40-4:55 Multigrid Preconditioning for the Overlap Operator in Lattice QCD
Artur Strebel, Bergische Universität Wuppertal, Germany; James Brannick, Pennsylvania State University, USA; Andreas J. Frommer, Bergische Universität, Germany; Karsten Kahl, University of Wuppertal, Germany; Björn Leder and Matthias Rottmann, Bergische Universität Wuppertal, Germany

Eigenvalue and SVD Problems: Part II

3:00-3:15 Divide-and-conquer Method for Symmetric-definite Generalized Eigenvalue Problems of Banded Matrices on Manycore Systems
 Yusuke Hirota and Toshiyuki Imamura, RIKEN, Japan

 Toshiyuki Imamura, RIKEN, Japan

3:40-3:55 Dynamic Parallelization for the Reduction of a Banded Matrix to Triangular Form
 Nadezda Mozartova, Intel Corporation, USA; Sergey V Kuznetsov, Intel Corporation, Russia; Aleksandr Zotkevich, Intel Corporation, USA

4:00-4:15 Performance of the Block Jacobi-Davidson Method for the Solution of Large Eigenvalue Problems on Modern Clusters
 Melven Roehrig-Zoellner and Jonas Thies, German Aerospace Center (DLR), Germany; Achim Basermann, German Aerospace Center (DLR), Simulation and Software Technology (SISTEC), Germany; Florian Fritzen and Patrick Aulbach, German Aerospace Center (DLR), Germany

4:20-4:35 Performance Comparison of Feast and Primm in Computing Many Eigenvalues in Hermitian Problems
 Eloy Romero Alcalde and Andreas Stathopoulos, College of William & Mary, USA

4:40-4:55 The Implicit Hari-Zimmermann Algorithm for the Generalized Svd
 Sanja Singer, University of Zagreb, Croatia; Vedran Novakovic, STFC Daresbury Laboratory, United Kingdom; Sasa Singer, University of Zagreb, Croatia
Recent Advances in Numerical Linear Algebra for Image Processing - Part I of II

10:15 AM-12:15 PM
Room: International Ballroom North - Lower Level 1

For Part 2 see MS21

Methods of numerical linear algebra play an important role in the solution and analysis of ill-posed problems. Conversely, the desire to compute solutions of ill-posed problems has spurred the development of efficient and robust algorithms based on numerical linear algebra. This minisymposium highlights some of the latest advances in numerical linear algebra for the analysis and solution of linear and nonlinear ill-posed problems. The topics considered include iterative and direct solution methods, regularization techniques, single- and multi-parameter regularization, and determination of the regularization operators and regularization parameters. The applications considered comprise image deblurring, remote sensing, compressed sensing, and adaptive optics.

Organizer: Lothar Reichel
Kent State University, USA

Organizer: Ronny Ramlau
Johannes Kepler University, Austria

10:15-10:40 Fractional Tikhonov Regularization and the Discrepancy Principle for Deterministic and Stochastic Noise Models
Daniel Gerth, Technical University of Chemnitz, Germany; Esther Klann, University of Linz, Austria; Lothar Reichel, Kent State University, USA; Ronny Ramlau, Johannes Kepler University, Austria

10:45-11:10 Unbiased Predictive Risk Estimator for Regularization Parameter Estimation in the Context of Iteratively Reweighted Lsqr Algorithms for Ill-Posed Problems
Rosemary A. Renaut, Arizona State University, USA; Saeed Vatankhah, University of Tehran, Iran

continued on next page
### Tuesday, October 27

#### MS15

**Advances in Fast Iterative Solvers for Sparse Linear Systems - Part I of II**

**10:15 AM-12:15 PM**

Room: International Ballroom South - Lower Level 1

For Part 2 see MS22

New developments in various applications across science, engineering, economics and industry continue to demand improvements in the effectiveness and efficiency of fast iterative solvers. This in turn poses many problems of theoretical and practical interest in the field of numerical linear algebra. In this minisymposium, speakers will present some recent advances in this area, covering a range of topical and interesting issues.

Organizer: Chen Greif  
University of British Columbia, Canada

Organizer: Alison Ramage  
University of Strathclyde, United Kingdom

10:15-10:40 On Nonsingular Saddle-Point Systems with a Maximally Rank Deficient Leading Block  
Chen Greif, University of British Columbia, Canada

10:45-11:10 Sparse Approximate Inverse Preconditioners, Revisited  
Edmond Chow, Georgia Institute of Technology, USA

11:15-11:40 A Tridiagonalization Method for Saddle-Point and Quasi-Definite Systems  
Dominique Orban, École Polytechnique de Montréal, Canada

11:45-12:10 Iterative Solver for Linear Systems Arising in Interior Point Methods for Semidefinite Programming  
Jacek Gondzio, University of Edinburgh, United Kingdom; Stefania Bellavia, Università di Firenze, Italy; Margherita Porcelli, University of Bologna, Italy

#### MS16

**Matrix Equations and Matrix Geometric Means**

**10:15 AM-12:15 PM**

Room: Piedmont - Atlanta Conference Level

Matrix and tensor equations and matrix geometric means are central topics of research in both theoretical and numerical linear algebra, because of their beautiful mathematical properties and the large number of applications in which they arise. Many challenges are still ahead, as it is important to deeply understand the theoretical properties and to exploit the maximum of available structure in order to reduce the computational cost of algorithms, especially in large-scale problems. We aim to draw a picture of some recent lines of research in this field.

Organizer: Bruno Iannazzo  
Università di Perugia, Italy

Organizer: Raf Vandebril  
Katholieke Universiteit Leuven, Belgium

10:15-10:40 Averaging Block-Toeplitz Matrices with Preservation of Toeplitz Block Structure  
Ben Jeuris and Raf Vandebril, Katholieke Universiteit Leuven, Belgium

10:45-11:10 Theory and Algorithms of Operator Means  
Miklos Palfia, Kyoto University, Japan

11:15-11:40 Using Inverse-free Arithmetic in Large-scale Matrix Equations  
Volker Mehrmann, Technische Universität Berlin, Germany; Federico Poloni, University of Pisa, Italy

11:45-12:10 Preconditioned Riemannian Optimization for Low-Rank Tensor Equations  
Bart Vandereycken, Université de Genève, Switzerland; Daniel Kressner and Michael Steinlechner, EPFL, Switzerland
Tuesday, October 27

**MS17**

Matrix and Tensor Decompositions and Applications: Part I of II

10:15 AM-12:15 PM

Room: Spring - Atlanta Conference Level

For Part 2 see MS24

This session will provide opportunities to present and exchange ideas on new matrix and tensor methods for established application areas in signal and image processing as well as in new application areas in machine learning, compressed sensing and big data science.

Organizer: Carmeliza Navasca  
University of Alabama at Birmingham, USA

Organizer: Dana Lahat  
Gipsa-Lab, France

Organizer: Mariya Ishteva  
Vrije Universiteit Brussel, Belgium

10:15-10:40 Tensors and Structured Matrices of Low Rank  
Mariya Ishteva and Ivan Markovsky, Vrije Universiteit Brussel, Belgium

10:45-11:10 Generating Polynomials and Symmetric Tensor Decomposition  
Jiawang Nie, University of California, San Diego, USA

11:15-11:40 On the Convergence of Higher-order Orthogonality Iteration and Its Extension  
Yangyang Xu, Rice University, USA

11:45-12:10 Alternating Least-Squares Variants for Tensor Approximation  
Nathaniel McClatchey and Martin J. Mohlenkamp, Ohio University, USA

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Tuesday, October 27

**MS18**

Communication Costs: New Algorithms and Lower Bounds - Part I of II

10:15 AM-12:15 PM

Room: Roswell - Atlanta Conference Level

For Part 2 see MS25

The relative costs of communication compared to computation continue to increase, and historically computation-bound algorithms in numerical linear algebra are becoming communication bound. In order to make efficient use of today’s and future hardware, algorithms must be designed in a way that reduces the amount of communication they perform, both across the network and within the memory hierarchy. This minisymposium discusses recent progress in both the practice of designing and implementing algorithms and in the theory of deriving lower bounds on communication costs of algorithms.

Organizer: Nicholas Knight  
New York University, USA

Organizer: Oded Schwartz  
Hebrew University of Jerusalem, Israel

10:15-10:40 Communication-optimal Loop Nests  
Nicholas Knight, New York University, USA

10:45-11:10 Communication Lower Bounds for Distributed-Memory Computations  
Michele Scquizzato, University of Houston, USA; Francesco Silvestri, University of Padova, Italy

11:15-11:40 Minimizing Communication in Tensor Contraction Algorithms  
Edgar Solomonik, ETH Zürich, Switzerland

11:45-12:10 A Computation and Communication-Optimal Parallel Direct 3-Body Algorithm  
Penporn Koanantakool, University of California, Berkeley, USA

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Tuesday, October 27

**MS19**

New Numerical Linear Algebra Methods Meet New Challenges of Physics - Part I of II

10:15 AM-12:15 PM

Room: Techwood - Atlanta Conference Level

For Part 2 see MS26

Numerical linear algebra is the building block of many computational physics and chemistry applications. Recent advances in numerical linear algebra algorithms have led to acceleration of scientific discovery through computation. On the other hand, new numerical algebra problems and algorithms for solving these problems have been identified in several applications. New perspectives on some existing algorithms have also emerged from the interaction between numerical linear algebraists and application scientists. This minisymposium will highlight some of these new developments.

Organizer: Chao Yang  
Lawrence Berkeley National Laboratory, USA

Organizer: Yousef Saad  
University of Minnesota, USA

10:15-10:40 Numerical Tensor Algebra in Modern Quantum Chemistry and Physics  
Garnet Chan, Princeton University, USA

10:45-11:10 Efficient Algorithms for Transition State Calculations  
Weiguo Gao, Fudan University, China

11:15-11:40 Compression of the Electron Repulsion Integral Tensor  
Jianfeng Lu, Duke University, Italy

11:45-12:10 Reduced Density Matrix Methods in Theoretical Chemistry and Physics  
David A. Mazziotti, University of Chicago, USA
Tuesday, October 27

**MS20**

**Generalizations of Positive Matrices - Part I of II**

**10:15 AM-12:15 PM**

**Room:** Vinings - Atlanta Conference Level

**For Part 2 see MS27**

Positive and nonnegative matrices and their generalizations, including positive (semi)definite matrices, eventually positive matrices, totally positive matrices, etc. play a vital role in many applications, especially to statistics. Generalizations of the study of positive matrices include various directions such as cones of matrices and matrices that share Perron-Frobenius structure. This mini-symposium will present recent results on generalizations of positive matrices and their applications.

**Organizer:** Leslie Hogben  
Iowa State University, USA

**Organizer:** Ulrica Wilson  
Morehouse College, USA

10:15-10:40 Perron-Frobenius Theory of Generalizations of Nonnegative Matrices  
Leslie Hogben, Iowa State University, USA

10:45-11:10 Geometric Mapping Properties of Semipositive Matrices  
Michael Tsatsomeros, Washington State University, USA

11:15-11:40 On Powers of Certain Positive Matrices  
Shaun M. Fallat, University of Regina, Canada

11:45-12:10 Inverses of Acyclic Matrices and Parter Sets  
Bryan L. Shader, University of Wyoming, USA; Curtis Nelson, Brigham Young University, USA

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Tuesday, October 27

**CP5**

**Graphs and Linear Algebra**

**10:15 AM-12:15 PM**

**Room:** Marietta - Atlanta Conference Level

**Chair:** To Be Determined

10:15-10:30 Heuristics for Optimizing the Communicability of Digraphs  
Francesca Arrigo, University of Insubria, Italy; Michele Benzi, Emory University, USA

10:35-10:50 Generalizing Spectral Graph Partitioning to Sparse Tensors  
Lars Eldén, Linköping University, Sweden

10:55-11:10 Graph Partitioning with Spectral Blends  
James P. Fairbanks, Georgia Institute of Technology, USA; Geoffrey D. Sanders, Lawrence Livermore National Laboratory, USA

11:15-11:30 On the Relation Between Modularity and Adjacency Graph Partitioning Methods  
Hansi Jiang and Carl Meyer, North Carolina State University, USA

11:35-11:50 Detecting Highly Cyclic Structure with Complex Eigenpairs  
Christine Klymko and Geoffrey D. Sanders, Lawrence Livermore National Laboratory, USA

11:55-12:10 Orthogonal Representations, Projective Rank, and Fractional Minimum Positive Semidefinite Rank: Connections and New Directions  
Leslie Hogben and Kevin Palmowski, Iowa State University, USA; David Roberson, Nanyang Technological University, Singapore; Simone Severini, University College London, United Kingdom

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Tuesday, October 27

**CP6**

**Eigenvalue and SVD Problems: Part III**

**10:15 AM-12:15 PM**

**Room:** University - Atlanta Conference Level

**Chair:** To Be Determined

10:15-10:30 A Multigrid Krylov Method for Eigenvalue Problems  
Zhao Yang, Oklahoma State University, USA; Ronald Morgan, Baylor University, USA

10:35-10:50 Inverse Eigenvalue Problems for Totally Nonnegative Matrices in Terms of Discrete Integrable Systems  
Kanae Akaiwa and Yoshimasa Nakamura, Kyoto University, Japan; Masashi Iwasaki, Kyoto Prefectural University, Japan; Hisayoshi Tsutsuji, Akira Yoshida, and Koichi Kondo, Doshisha University, Japan

10:55-11:10 A Kinetic Ising Model and the Spectra of Some Jacobi Matrices  
Carlos Fonseca, Kuwait University, Kuwait; Said Kouachi, Qassim University, Saudi Arabia; Dan Mazilu and Irina Mazilu, Washington and Lee University, USA

11:15-11:30 The Molecular Eigenproblem and Applications  
Erik Verriest and Nak-Seung Hyun, Georgia Institute of Technology, USA

11:35-11:50 Spectral Properties of the Boundary Value Problems for the Discrete Beam Equation  
Jun Ji and Bo Yang, Kennesaw State University, USA

11:55-12:10 Matrix Nearness Problems for General Lyapunov-Type Stability Domains  
Vladimir Kostic, University of Novi Sad, Serbia; Agnieszka Miedlar, Technische Universität Berlin, Germany

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**Lunch Break**

**12:15 PM-1:45 PM**

Attendees on their own
Tuesday, October 27
SIAG/LA Business Meeting
1:45 PM-2:30 PM
Room: International Ballroom - Lower Level 1
Complimentary soft drinks will be served.

Coffee Break
2:30 PM-3:00 PM
Room: Embassy Hall - Lower Level 2

Tuesday, October 27
MS21
Recent Advances in Numerical Linear Algebra for Image Processing - Part II of II
3:00 PM-5:00 PM
Room: International Ballroom North - Lower Level 1
For Part 1 see MS14
Methods of numerical linear algebra play an important role in the solution and analysis of ill-posed problems. Conversely, the desire to compute solutions of ill-posed problems has spurred the development of efficient and robust algorithms based on numerical linear algebra. This minisymposium highlights some of the latest advances in numerical linear algebra for the analysis and solution of linear and nonlinear ill-posed problems. The topics considered include iterative and direct solution methods, regularization techniques, single- and multi-parameter regularization, and determination of the regularization operators and regularization parameters. The applications considered comprise image deblurring, remote sensing, compressed sensing, and adaptive optics.
Organizer: Lothar Reichel
Kent State University, USA
Organizer: Ronny Ramlau
Johannes Kepler University, Austria

3:00-3:25 Vector Extrapolation for Image Restoration
Hassane Sadok, Université du Littoral Calais Cedex, France

3:30-3:55 Psf Reconstruction for Extremely Large Telescopes
Roland Wagner, Radon Institute for Computational and Applied Mathematics, Austria

4:00-4:25 Randomized Tensor Singular Value Decomposition
Jiani Zhang, Shuchin Aeron, Arvind Saibaba, and Misha E. Kilmer, Tufts University, USA

4:30-4:55 Multidirectional Subspace Expansion for Single-Parameter and Multi-Parameter Tikhonov Regularization
Ian Zwaan, TU Eindhoven, The Netherlands; M.E. Hochstenbach, Eindhoven University of Technology, Netherlands

Tuesday, October 27
MS22
Advances in Fast Iterative Solvers for Sparse Linear Systems - Part II of II
3:00 PM-5:00 PM
Room: International Ballroom South - Lower Level 1
For Part 1 see MS15
New developments in various applications across science, engineering, economics and industry continue to demand improvements in the effectiveness and efficiency of fast iterative solvers. This in turn poses many problems of theoretical and practical interest in the field of numerical linear algebra. In this minisymposium, speakers will present some recent advances in this area, covering a range of topical and interesting issues.
Organizer: Chen Greif
University of British Columbia, Canada
Organizer: Alison Ramage
University of Strathclyde, United Kingdom

3:00-3:25 A Multilevel Preconditioner for Data Assimilation with 4D-Var
Kirsty Brown, University of Strathclyde, United Kingdom; Igor Gejadze, Irstea, France; Alison Ramage, University of Strathclyde, United Kingdom

3:30-3:55 Fast Iterative Solvers for a Coupled Cahn-Hilliard/Navier-Stokes System
Jessica Bosch and Martin Stoll, Max Planck Institute, Magdeburg, Germany

4:00-4:25 Preconditioning a Mass-Conserving DG Discretization of the Stokes Equations
Scott Maclachlan, Memorial University, Newfoundland, Canada

4:30-4:55 Asynchronous Optimized Schwarz Methods
Daniel B. Szyld, Temple University, USA
Tuesday, October 27

**MS23**

**Preconditioning and Iterative Methods for Complex Linear Systems**

**3:00 PM-5:00 PM**

*Room: Piedmont - Atlanta Conference Level*

Introduction of The Minisymposium: Large sparse and specially structured complex linear systems arise widely in computational science and engineering applications. Transformed into the block two-by-two real linear systems, the complex linear systems could be solved by typical algorithms with real arithmetic. The accuracy, efficiency and robustness of the solvers are strongly dependent on the quality of the preconditioners adopted. However, the current preconditioning methods are not sophisticate and should be further explored. This minisymposium should aim to improve the theoretical results and the implement efficiency of the typical preconditioners and the iteration methods and inspire new preconditioning techniques and (preconditioned) iteration methods. The inexact solution of the intermediate variables should be paid more attention. Besides, theoretical analysis and numerical implementation related to the preconditioned iterative methods should be discussed.

Organizer: Zeng-Qi Wang
Shanghai Jiaotong University, China

**3:00-3:25 Title Not Available at Time of Publication**

Xin He, Delft University of Technology, Netherlands

**3:30-3:55 Preconditioners for Linear Systems Arising From The Eddy Current Problem**

Jianyu Pan and Xin Guan, East China Normal University, China

**4:00-4:25 An Alternating Positive Semidefinite Splitting Preconditioner for Saddle Point Problems from Time-harmonic Eddy Current Models**

Zhiru Ren, Chinese Academy of Sciences, China; Yang Cao, Nantong University, China

**4:30-4:55 Title Not Available at Time of Publication**

Guo-Feng Zhang and Zhong Zheng, Lanzhou University, China

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**MS24**

**Matrix and Tensor Decompositions and Applications: Part II of II**

**3:00 PM-5:00 PM**

*Room: Spring - Atlanta Conference Level*

**For Part 1 see MS17**

This session will provide opportunities to present and exchange ideas on new tensor methods for established application areas in signal and image processing as well as in new application areas in machine learning, compressed sensing and big data science.

Organizer: Carmeniza Navasca
University of Alabama at Birmingham, USA

**For Part 1 see MS18**

The relative costs of communication compared to computation continue to increase, and historically computation-bound algorithms in numerical linear algebra are becoming communication bound. In order to make efficient use of today's and future hardware, algorithms must be designed in a way that reduces the amount of communication they perform, both across the network and within the memory hierarchy. This minisymposium discusses recent progress in both the practice of designing and implementing algorithms and in the theory of deriving lower bounds on communication costs of algorithms.

Organizer: Nicholas Knight
New York University, USA

**3:00-3:25 The Decomposition of Matrices**

Ke Ye and Lek-Heng Lim, University of Chicago, USA

**3:30-3:55 On the Uniqueness of Coupled Matrix Block Diagonalization in the Joint Analysis of Multiple Datasets**

Dana Lahat and Christian Jutten, Gipsa-Lab, France

**4:00-4:25 “Sequentially Drilled” Joint Congruence Decompositions (SeDJoCo): The Simple Case and the Extended Case**

Yao Cheng, Ilmenau University of Technology, Germany; Arie Yeredor, Tel Aviv University, Israel; Martin Haardt, Ilmenau University of Technology, Germany

**4:30-4:55 Localization and Reconstruction of Brain Sources Using a Constrained Tensor-based Approach**

Laurent Albera and Ahmad Karfoul, Université de Rennes 1 & Inserm, France; Hanna Becker, Gipsa-Lab, France; Remi Gribonval, INRIA Rennes, France; Amar Kachenoura and Lofti Senhadji, Université de Rennes 1, France; Guillotet Philippe, Technicolor R&D France, France; Isabelle Merlet, Université de Rennes 1 & Inserm, France

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**MS25**

**Communication Costs: New Algorithms and Lower Bounds - Part II of II**

**3:00 PM-5:00 PM**

*Room: Roswell - Atlanta Conference Level*

**For Part 1 see MS17**

This session will provide opportunities to present and exchange ideas on new tensor methods for established application areas in signal and image processing as well as in new application areas in machine learning, compressed sensing and big data science.

Organizer: Carmeniza Navasca
University of Alabama at Birmingham, USA

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Tuesday, October 27

**MS26**

**New Numerical Linear Algebra Methods Meet New Challenges of Physics - Part II of II**

3:00 PM-5:00 PM

**Room: Techwood - Atlanta Conference Level**

For Part I see MS19

Numerical linear algebra is the building block of many computational physics and chemistry applications. Recent advances in numerical linear algebra algorithms have led to acceleration of scientific discovery through computation. On the other hand, new numerical algebra problems and algorithms for solving these problems have been identified in several applications. New perspectives on some existing algorithms have also emerged from the interaction between numerical linear algebraists and application scientists. This minisymposium will highlight some of these new developments.

Organizer: Chao Yang

Lawrence Berkeley National Laboratory, USA

Organizer: Yousef Saad

University of Minnesota, USA

3:00-3:25 Randomized Estimation of Spectral Densities of Large Matrices Made Accurate

Lin Lin, Lawrence Berkeley National Laboratory, USA


Jean-Luc Fattebert and Daniel Osei-Kuffuor, Lawrence Livermore National Laboratory, USA

4:00-4:25 Towards Large and Fast Density Functional Theory Calculations

Phanish Suryanarayana, Georgia Institute of Technology, USA

4:30-4:55 Challenges and Opportunities for Solving Large-scale Eigenvalue Problems in Electronic Structure Calculations

Eric Polizzi, University of Massachusetts, Amherst, USA

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Tuesday, October 27

**MS27**

**Generalizations of Positive Matrices - Part II of II**

3:00 PM-5:00 PM

**Room: Vinings - Atlanta Conference Level**

For Part 1 see MS20

Positive and nonnegative matrices and their generalizations, including positive (semi)definite matrices, eventually positive matrices, totally positive matrices, etc. play a vital role in many applications, especially to statistics. Generalizations of the study of positive matrices include various directions such as cones of matrices and matrices that share Perron-Frobenius structure. This minisymposium will present recent results on generalizations of positive matrices and their applications.

Organizer: Leslie Hogben

Iowa State University, USA

Organizer: Ulrica Wilson

Morehouse College, USA

3:00-3:25 The Jordan Form of An Irreducible Eventually Nonnegative Matrix

Ulrica Wilson, Morehouse College, USA

3:30-3:55 Arrangements of Equal Minors in the Positive Grassmannian

Miriam Farber and Alexander Postnikov, Massachusetts Institute of Technology, USA

4:00-4:25 Preserving Positivity for Matrices with Sparsity Constraints

Bala Rajaratnam, Stanford University, USA; Dominique Guillot, University of Delaware, USA; Apoorva Khare, Stanford University, USA

4:30-4:55 Critical Exponents and Positivity

Apoorva Khare, Stanford University, USA; Dominique Guillot, University of Delaware, USA; Bala Rajaratnam, Stanford University, USA

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Tuesday, October 27

**CP7**

**Mathematical Software and High Performance Computing**

3:00 PM-5:00 PM

**Room: Marietta - Atlanta Conference Level**

Chair: Hartwig Anzt, University of Tennessee, USA

3:00-3:15 Block-Asynchronous Jacobi Iterations with Overlapping Domains

Hartwig Anzt, University of Tennessee, USA; Edmond Chow, Georgia Institute of Technology, USA; Daniel B. Szyld, Temple University, USA; Jack J. Dongarra, University of Tennessee, Knoxville, USA

3:20-3:35 Performance Evaluation of the Choleskyqr2 Algorithm

Takeshi Fukaya, Hokkaido University, Japan; Yuji Nakatsukasa, University of Tokyo, Japan; Yuka Yanagisawa, Waseda University, Japan; Yusaku Yamamoto, University of Electro-Communications, Japan

3:40-3:55 High Performance Resolution of Dense Linear Systems Using Compression Techniques and Application to 3D Electromagnetics Problems

David Goudin, Cedric Augonnet, Agnes Pujols, and Muriel Sesques, CEA/CESTA, France

4:00-4:15 Batched Matrix-Matrix Multiplication Operations for Intel Xeon Processor and Intel Xeon Phi Co-Processor

Murat E. Guney, Sarah Knepper, Kazushige Goto, Vamsi Sripathi, Greg Henry, and Shane Story, Intel Corporation, USA

4:20-4:35 Data Sparse Technique

Yuval Harness, Luc Giraud, and Emmanuel Agullo, INRIA, France; Eric Drave, Stanford University, USA

4:40-4:55 A Newly Proposed BLAS Extension (xGEMMT) to Update a Symmetric Matrix Efficiently

Sarah Knepper, Kazushige Goto, Murat E. Guney, Greg Henry, and Shane Story, Intel Corporation, USA
Wednesday, October 28

IP7

Combinatorial Matrix Theory and Majorization
9:00 AM-9:45 AM
Room:International Ballroom - Lower Level 1
Chair: Beatrice Meini, University of Pisa, Italy

Majorization theory provides concepts for comparing mathematical objects according to “how spread out” their elements are. In particular, two $n$ vectors may be ordered by comparing the partial sums of the $k$ largest components for $k \leq n$. This is a fruitful concept in many areas of mathematics and its applications, e.g., in matrix theory, combinatorics, probability theory, mathematical finance and physics.

In this talk we discuss some combinatorial problems for classes of matrices where majorization plays a role. This includes $(0,1)$-matrices with line sum and pattern constraints, doubly stochastic matrices and Laplacian matrices of graphs. An extension of majorization to partially ordered sets is presented. We also discuss a problem motivated by mathematical finance which leads to interesting questions in qualitative matrix theory.

This speaker is supported in cooperation with the International Linear Algebra Society.

Geir Dahl
University of Oslo, Norway

Coffee Break
9:45 AM-10:15 AM
Room:Embassy Hall - Lower Level 2
**Wednesday, October 28**

**MS28**

**Complex Networks**

**10:15 AM-12:15 PM**

*Room: International Ballroom North - Lower Level 1*

Network Science has become fundamental to a number of fields in the natural and social sciences, as well as for engineering, computer science, and just about any field of study concerned with the analysis of complex systems and data sets consisting of many interconnected entities. Graph theory and linear algebra play a central role in the analysis of networks, which in turn provides a powerful stimulus for research in these areas. The talks in this invited minisymposium will address different mathematical and computational challenges arising in the structural analysis of complex networks.

Organizer: Michele Benzi  
Emory University, USA

Organizer: Christine Klymko  
Lawrence Livermore National Laboratory, USA

10:15-10:40 **Dynamic Network Centrality with Edge Multidamping**  
*Mary Aprahamian, University of Manchester, United Kingdom*

10:45-11:10 **Solving Graph Laplacians for Complex Networks**  
*Erik G. Boman, Sandia National Laboratories, USA; Kevin Deweese, University of California, Santa Barbara, USA*

11:15-11:40 **On Growth and Form of Networks**  
*Ernesto Estrada, University of Strathclyde, United Kingdom*

11:45-12:10 **Using the Heat Kernel of a Graph for Local Algorithms**  
*Olivia Simpson, University of California, San Diego, USA*

**Wednesday, October 28**

**MS29**

**Krylov Methods**

**10:15 AM-12:15 PM**

*Room: International Ballroom South - Lower Level 1*

Krylov subspace methods have been and continue to be among the top ways for solving large systems of linear equations and large eigenvalue problems. As scientists push toward solving a larger variety of problems and solving them more accurately, the linear algebra problems become more challenging and better methods are needed. Here we look at new developments for Krylov methods. These include methods that combine linear equations and eigenvalue computation, that combine multigrid with Krylov and that are geared for modern computer architectures. Preconditioning and other convergence acceleration techniques and links to model reduction will also be considered.

Organizer: Ron Morgan  
Baylor University, USA

Organizer: Eric De Sturler  
Virginia Tech, USA

10:15-10:40 **Near-Krylov for Eigenvalues and Linear Equations Including Multigrid and Rank-1**  
*Ron Morgan, Baylor University, USA*

10:45-11:10 **Efficient Iterative Algorithms for Linear Stability Analysis of Incompressible Flows**  
*Minghao W. Rostami, Worcester Polytechnic Institute, USA; Howard C. Elman, University of Maryland, College Park, USA*

11:15-11:40 **Krylov Methods in Adaptive Finite Element Computations**  
*Agnieszka Miedlar, Technische Universität Berlin, Germany*

11:45-12:10 **Constraint Preconditioning for the Coupled Stokes-Darcy System**  
*Scott Ladenheim and Daniel B. Szyld, Temple University, USA; Prince Chidyagwai, Loyola University, USA*

**Wednesday, October 28**

**MS30**

**Matrix Scaling - Theory and Algorithms**

**10:15 AM-12:15 PM**

*Room: Piedmont - Atlanta Conference Level*

Diagonal scaling is an important preprocessing step in a wide range of numerical algorithms. Scaling can also be used to highlight certain features or to provide different normal forms for matrices. In this minisymposium four talks will explore new research in the use of scalings in numerical linear algebra, principally in connection to solving linear systems and eigenproblems. As well as new techniques for using scaling to help solve NLA problems there will be some discussion of the algorithms used to compute these scalings.

Organizer: James Hook  
University of Manchester, United Kingdom

Organizer: Ron Morgan  
Baylor University, USA

10:15-10:40 **Squish Scalings**  
*James Hook, University of Manchester, United Kingdom*

10:45-11:10 **Max-Balancing Hungarian Scalings**  
*Francoise Tisseur, James Hook, and Jennifer Pestana, University of Manchester, United Kingdom*

11:15-11:40 **Hungarian Scaling of Polynomial Eigenproblems**  
*Marianne Akian, Stephane Gaubert, and Andrea Marchesini, INRIA and CMAP, Ecole Polytechnique, France; Francoise Tisseur, University of Manchester, United Kingdom*

11:45-12:10 **Using Matrix Scaling to Identify Block Structure**  
*Philip Knight, University of Strathclyde, United Kingdom*
Numerical Linear Algebra in Large-scale Optimization
10:15 AM-12:15 PM
Room:Spring - Atlanta Conference Level
Many large-scale optimization methods involve solving linear systems quickly and reliably at each iteration. Often matrix sparsity and structure are exploited to make these calculations computationally feasible. This minisymposium will highlight the latest contributions from various optimization approaches, including trust-region methods, sequential quadratic programming, and derivative-free optimization.
Organizer: Roummel F. Marcia
University of California, Merced, USA

10:15-10:40 Obtaining Singular Value Decompositions in a Distributed Environment
Ben-Hao Wang and Joshua Griffin, SAS Institute, Inc., USA

10:45-11:10 Linear Algebra Software in Nonlinear Optimization
Elizabeth Wong, University of California, San Diego, USA

11:15-11:40 A High-Accuracy SR1 Trust-Region Subproblem Solver for Large-Scale Optimization
Jennifer Erway, Wake Forest University, USA

11:45-12:10 Compact Representation of Quasi-Newton Matrices
Roummel F. Marcia, University of California, Merced, USA

Numerical Linear Algebra Issues in the Solution of Stochastic PDEs
10:15 AM-12:15 PM
Room:Roswell - Atlanta Conference Level
The numerical treatment of mathematical models that also account for uncertainties in the data gives rise to a wide class of new linear algebra problems. These are characterized by a high level of complexity, caused by both the exploding number of variables, and the presence of many parameters whose variability is crucial for assessing the model reliability and for subsequent simulation purposes. The aim of the minisymposium is to present new numerical linear algebra techniques, system solvers and preconditioners, specifically designed to efficiently solve these problems, by appropriately handling memory consumption and by limiting computational costs.
Organizer: Valeria Simoncini
Universita' di Bologna, Italy

10:15-10:40 Hierarchical Low Rank Approximation for Extreme Scale Uncertainty Quantification
Lars Grasedyck, RWTH Aachen University, Germany; Jonas Ballani, EPFL, Switzerland; Christian Loebbert, RWTH Aachen University, Germany

10:45-11:10 Low-Rank Cross Approximation Methods for Reduction of Parametric Equations
Sergey Dolgov, Max Planck Institute, Magdeburg, Germany

Bedrich Sousedík, University of Maryland, Baltimore County, USA; Howard C. Elman, University of Maryland, College Park, USA

11:45-12:10 Interpolation of Inverse Operators for Preconditioning Parameter-Dependent Equations and Projection-Based Model Reduction Methods
Anthony Nouy, Ecole Centrale de Nantes, France

Numerical Rootfinding: Computational Methods & Applications
10:15 AM-12:15 PM
Room:Techwood - Atlanta Conference Level
Despite an overwhelming body of published research on the numerical computation of roots of uni- and multivariate polynomials, the development of efficient and accurate/stable algorithms remains a challenge. In this minisymposium we present some of the latest developments and techniques in this field, including fast and stable computation of univariate polynomial roots, along with roots or poles of meromorphic functions, conditioning analysis of multivariate rootfinding via resultants, and local optimization for the computations of zeros of complex harmonic mappings. By bringing together strong researchers with diverse backgrounds, we hope to stimulate new research directions and foster future collaborations.
Organizer: Yuji Nakatsukasa
University of Tokyo, Japan
Organizer: Robert Luce
EPFL, Switzerland

10:15-10:40 Global and Local Methods for Solving the Gravitational Lens Equation
Robert Luce, EPFL, Switzerland

10:45-11:10 Fast and Stable Computation of the Roots of Polynomials
Thomas Mach, Katholieke Universiteit Leuven, Belgium; Jared Aurentz, University of Oxford, United Kingdom; Raf Vandebril, Katholieke Universiteit Leuven, Belgium; David S. Watkins, Washington State University, USA

11:15-11:40 Stable Polefinding-Rooffinding and Rational Least-Squares Fitting Via Eigenvalues
Shinji Ito and Yuji Nakatsukasa, University of Tokyo, Japan

11:45-12:10 Resultant Methods for Multidimensional Rootfinding Are Exponentially Unstable
Vanni Noferini, University of Manchester, United Kingdom; Alex Townsend, Massachusetts Institute of Technology, USA
Wednesday, October 28

**MS34**

**Randomness in Spectral Analysis**

10:15 AM-12:15 PM

Room: Vining - Atlanta Conference Level

Spectral methods have become a fundamental tool with a broad range of applications in several areas including machine learning, data mining, web search and ranking, scientific computing, and computer vision. This minisymposium addresses the use of spectral methods when randomness is heavily involved, such as randomized spectral algorithms and the spectral analysis of random inputs. The speakers will present recent advances concerning both theoretical and practical problems, including improvements over classical perturbation bounds (such as Weyl’s inequality and the Davis-Kahan theorem), advancements in independent component analysis, and new spectral algorithms for the stochastic block model.

Organizer: Sean O’Rourke
University of Colorado Boulder, USA

Organizer: Van Vu
Yale University, USA

10:15-10:40 Singular Values and Vectors under Random Perturbation
Sean O’Rourke, University of Colorado Boulder, USA; Van Vu, Yale University, USA; Ke Wang, University of Minnesota, USA

10:45-11:10 Applications of Matrix Perturbation Bounds with Random Noise in Matrix Recovery Problems
Sean O’Rourke, University of Colorado Boulder, USA; Van Vu, Yale University, USA; Ke Wang, University of Minnesota, USA

11:15-11:40 The Stochastic Block Model and Communities in Sparse Random Graphs: Detection at Optimal Rate
Anup Rao, Yale University, USA

11:45-12:10 Robust Tensor Decomposition and Independent Component Analysis
Santosh Vempala, Georgia Institute of Technology, USA; Navin Goyal, Microsoft Research, India; Ying Xiao, Palantir, USA

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Wednesday, October 28

**CP9**

**Matrix Functions and Nonlinear Eigenvalue Problems**

10:15 AM-12:15 PM

Room: Marietta - Atlanta Conference Level

Chair: Sarah W. Gaaf, Eindhoven University of Technology, Netherlands

10:15-10:30 Approximating the Leading Singular Triplets of a Large Matrix Function
Sarah W. Gaaf, Eindhoven University of Technology, Netherlands; Valeria Simoncini, Universita’ di Bologna, Italy

10:35-10:50 Inverse Probing for Estimating $\text{diag}(f(A))$
Jesse Laeuchli and Andreas Stathopoulos, College of William & Mary, USA

10:55-11:10 The Waveguide Eigenvalue Problem and the Tensor Infinite Arnoldi Method
Giampaolo Mele and Elias Jarlebring, KTH Royal Institute of Technology, Sweden; Olof Runborg, KTH Stockholm, Sweden

11:15-11:30 Verified Solutions of Delay Eigenvalue Problems with Multiple Eigenvalues
Shinya Miyajima, Gifu University, Japan

11:35-11:50 Taylor’s Theorem for Matrix Functions and Pseudospectral Bounds on the Condition Number
Samuel Relton and Edvin Deadman, University of Manchester, United Kingdom

11:55-12:10 Contour Integration Via Rational Krylov for Solving Nonlinear Eigenvalue Problems
Roel Van Beeumen, Karl Meerbergen, and Wim Michiels, Katholieke Universiteit Leuven, Belgium

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Wednesday, October 28

**CP10**

**Matrix Factorizations and Numerical Stability**

10:15 AM-12:15 PM

Room: University - Atlanta Conference Level

Chair: Nicola Mastronardi, Istituto per le Applicazioni del Calcolo “Mauro Picone”, Italy

10:15-10:30 On the Factorization of Symmetric Indefinite Matrices into Anti-Triangular Ones
Nicola Mastronardi, Istituto per le Applicazioni del Calcolo “Mauro Picone”, Italy; Paul Van Dooren, Universite Catholique de Louvain, Belgium

10:35-10:50 A Block Gram-Schmidt Algorithm with Reorthogonalization and Conditions on the Tall, Skinny QR
Jesse L. Barlow, Pennsylvania State University, USA

10:55-11:10 Block Methods for Solving Banded Symmetric Linear Systems
Linda Kaufman, William Paterson University, USA

11:15-11:30 Gram-Schmidt Process with Respect to Bilinear Forms
Miro Rozloznik, Czech Academy of Sciences, Czech Republic

11:35-11:50 Roundoff Error Analysis of the Choleskyqr2 and Related Algorithms
Yusaku Yamamoto, University of Electro-Communications, Japan; Yuji Nakatsukasa, University of Tokyo, Japan; Yuuka Yanagisawa, Waseda University, Japan; Takeshi Fukaya, Hokkaido University, Japan

11:55-12:10 Mixed-Precision Orthogonalization Processes
Ichitaro Yamazaki, University of Tennessee, Knoxville, USA; Jesse L. Barlow, Pennsylvania State University, USA; Stanimire Tomov, Jakub Kurzak, and Jack J. Dongarra, University of Tennessee, Knoxville, USA

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**Lunch Break**

12:15 PM-1:45 PM

Attendees on their own
We present adaptive numerical methods for the solution of parametric eigenvalue problems arising from the discretization of partial differential equations modeling disc brake squeal. The eigenvectors are used for model reduction to achieve a low order model that can be used for optimization and control. The model reduction method is a variation of the proper orthogonal decomposition method. Several important challenges arise, some of which can be traced back to the finite element modeling stage. Compared to the current industrial standard our new approach is more accurate in vibration prediction and achieves a better reduction in model size. This comes at the price of an increased computational cost, but it still gives useful results when the traditional method fails to do so. We illustrate the results with several numerical experiments, some from real industrial models and indicate where improvements of the current black box industrial codes are advisable. We then also discuss the use of adaptive methods such as the adaptive finite element model and the algebraic multilevel substructuring method for the discussed problem, and we point out the challenges and deficiencies in these approaches.

Volker Mehrmann
Technische Universitaet Berlin, Germany

A New Regularization Method for Computational Color Constancy
Malena I. Espanol and Michael Wranzky,
University of Akron, USA

Design and Analysis of a Low-Memory Multigrid Algorithm
Stefan Henneking, Georgia Institute of Technology, USA

Anderson Acceleration of the Alternating Projections Method for Computing the Nearest Correlation Matrix
Nicholas Higham and Nataša Strabić
University of Manchester, United Kingdom

Block Preconditioning for Time-Dependent Coupled Fluid Flow Problems
Victoria Howle and Ashley Meek, Texas Tech University, USA

Structured Computations of Block Matrices with Application in Quantum Monte Carlo Simulation
Chengming Jiang, Zhaojun Bai, and Richard Scalettar, University of California, Davis, USA

MHD Stagnation Point over a Stretching Cylinder with Variable Thermal Conductivity
Farzana Khan, Quaid-i-Azam University, Islamabad, Pakistan

On Simple Algorithm Approximating Arbitrary Real Powers $A^\alpha$ of a Matrix from Number Representation System
Yeonji Kim, Pusan National University, Busan (Pusan), Republic of Korea; Jong-Hyeon Seo, Daegu Gyeongbuk Institute of Science and Technology, Korea; Hyun-Min Kim, Pusan National University, Busan (Pusan), Republic of Korea

Cycles of Linear and Semilinear Mappings
Tetiana Klymchuk, Taras Shevchenko University of Kyiv, Ukraine

Regularization of the Kernel Matrix via Covariance Matrix Shrinkage Estimation
Tomer Lancewiczki, University of Tennessee, USA

Computationally Enhanced Projection Methods for Symmetric Lyapunov Matrix Equations
Davide Palitta and Valeria Simoncini, Universita’ di Bologna, Italy

continued in next column

continued in next column
IP9
Linear Algebra Computations for Parameterized Partial Differential Equations
8:15 AM-9:00 AM
Room:International Ballroom - Lower Level 1
Chair: Alison Ramage, University of Strathclyde, United Kingdom
The numerical solution of partial differential equations (PDEs) often entails the solution of large linear systems of equations. This compute-intensive task becomes more challenging when components of the problem such as coefficients of the PDE depend on parameters that are uncertain or variable. In this scenario, there is a need to compute many solutions for a single simulation, and for accurate discretizations, costs may be prohibitive. We discuss new computational algorithms designed to improve efficiency in this setting, with emphasis on new algorithms to handle stochastic problems and new approaches for reduced-order models.

Howard C. Elman
University of Maryland, College Park, USA
Thursday, October 29

IP10

Accurate Linear Algebra in Computational Methods for System and Control Theory
9:00 AM-9:45 AM
Room: International Ballroom - Lower Level 1
Chair: Zdenek Strakos, Charles University, Czech Republic
We discuss the importance of robust and accurate implementation of core numerical linear algebra procedures in computational methods for system and control theory. In particular, we stress the importance of error and perturbation analysis that identifies relevant condition numbers and guides computation with noisy data, and careful software implementation. The themes used as case studies include rational matrix valued least squares fitting (e.g., least squares fit to frequency response measurements of an LTI system), model order reduction issues (e.g., the Discrete Empirical Interpolation Method (DEIM)), accurate computation with structured matrices such as scaled Cauchy, Vandermonde and Hankel matrices.

Zlatko Drmac
University of Zagreb, Croatia

Coffee Break
9:45 AM-10:15 AM
Room: Embassy Hall - Lower Level 2

Thursday, October 29

MS35

A Celebration in Honor of Dianne P. O’Leary on the Occasion of her Retirement - Part I of II
10:15 AM-12:15 PM
Room: International Ballroom North - Lower Level 1
For Part 2 see MS42
Dianne P. O’Leary has made broad contributions to numerical linear algebra, numerical optimization, and scientific computing since the 1970s, and this minisymposium is a celebration of those accomplishments. Her contributions include fundamental work in preconditioned (block) conjugate gradient algorithms, multisplitting iterative methods, numerical solution of ill-poised problems, iterative methods in optimization, Markov chain analysis, and much more. Her work has found application in image processing, quantum computing, information retrieval, text summarization, and biomedicine, and many other areas. The talks in this minisymposium will highlight the breadth and depth of Dianne O’Leary’s influential career.

Organizer: Misha E. Kilmer
Tufts University, USA
Organizer: Tamara G. Kolda
Sandia National Laboratories, USA
Organizer: James G. Nagy
Emory University, USA
Organizer: Julianne Chung
Virginia Tech, USA
10:15-10:40 A Hybrid LSMR Algorithm for Large-Scale Tikhonov Regularization
Julianne Chung, Virginia Tech, USA;
Katrina Palmer, Appalachian State University, USA

10:45-11:10 Solving Eigenvalue and Linear System Problems on GPU for Three-Dimensional Photonic Device Simulations
Weichung Wang, National Taiwan University, Taiwan
11:15-11:40 A Flexible Regression Model for Count Data
Kimberly F. Sellers, Georgetown University, USA
11:45-12:10 Lanczos Bidiagonalization with Subspace Augmentation for Discrete Inverse Problems
Per Christian Hansen, Technical University of Denmark, Denmark

continued in next column
Thursday, October 29

**MS36**

**Linear Algebra for PDE-constrained Optimization**

10:15 AM-12:15 PM

**Room:** International Ballroom South - Lower Level 1

Real-world processes from far-reaching areas of science and industry may be formulated as PDE-constrained optimization problems. As these problems typically lead to huge scale matrix systems upon discretization, it is therefore crucial to develop fast and efficient numerical solvers tailored specifically to the application at hand. In this minisymposium we wish to draw upon and combine state-of-the-art methods for solving these systems, using techniques from multigrid, block preconditioning, domain decomposition, and others. We also provide an outlook to future challenges in the field, as well as practical scientific applications of these important problems.

**Organizer:** Tyrone Rees

*Rutherford Appleton Laboratory, United Kingdom*

10:15-10:40

**The Iterative Solution of Systems from Pde Constrained Optimization: An Overview**

*Ytyone Rees, Rutherford Appleton Laboratory, United Kingdom*

10:45-11:10

**Rotated Block Two-by-Two Preconditioners Based on PnHss**

*Zhong-Zhi Bai, Chinese Academy of Sciences, China*

11:15-11:40


*Andrei Draganescu, University of Maryland, Baltimore County, USA; Jyoti Saraswat, Thomas More College, USA*

**Thursday, October 29**

**MS37**

**Large-Scale Eigenvalue Computations - Part I of II**

10:15 AM-12:15 PM

**Room:** Piedmont - Atlanta Conference Level

For Part 2 see MS44

The increasing complexity of modern physical simulations and data analysis tasks, as well as advances in computational hardware, are introducing new challenges for existing eigensolver technologies. Such challenges include, among others, solution of yet larger eigenvalue problems, efficient computation of interior eigenpairs, approximation of large invariant subspaces, problems with nonlinearity and structure. This minisymposium addresses recent developments in methodologies for large-scale eigenvalue computations and highlights applications where they play a critical role.

**Organizer:** Meiyue Shao

*Lawrence Berkeley National Laboratory, USA*

10:15-10:40

**Eigenvalues and Beyond**

*Andrew Knyazev, Mitsubishi Electric Research Laboratories, USA*

10:45-11:10

**Spectrum Slicing by Polynomial and Rational Function Filtering**

*Yousef Saad, University of Minnesota, USA*

11:15-11:40

**Implementation of LOBPCG for Symmetric Eigenvalue Problems in SLEPc**

*Jose E. Roman, Universidad Politecnica de Valencia, Spain*

**Thursday, October 29**

**MS38**

**Fast Solvers in Numerical Linear Algebra - Part I of II**

10:15 AM-12:15 PM

**Room:** Spring - Atlanta Conference Level

For Part 2 see MS45

The numerical solution of large linear algebra problems is involved in the inner most loop of many academic and industrial simulations and is consequently often the most time-consuming computation in many large-scale computer simulations in science and engineering. The design of numerical kernels with reduced computational costs (flops and memory footprint) is of prime interest on the route to extreme scale. In this minisymposium, we intend to review a few of the recent advents in these directions covering data-sparse calculations and FMM calculations.

**Organizer:** Olivier Coulaud

*INRIA, France*

10:15-10:40

**Fast Solvers for H2 Matrices Using Sparse Algebra**

*Mohammad Hadi Pour Ansari, Eric F. Darve, Zhengyu Huang, and Pieter Coulier, Stanford University, USA*

10:45-11:10

**Title Not Available at Time of Publication**

*Gunnar Martinsson, University of Colorado Boulder, USA*

11:15-11:40

**A Tensor Train Decomposition Solver for Integral Equations on Two and Three Dimensions**

*Denis Zorin and Eduardo Corona, Courant Institute of Mathematical Sciences, New York University, USA; Abtin Rahimian, Georgia Institute of Technology, USA*

11:45-12:10

**Data Sparse Techniques for Parallel Hybrid Solvers**

*Yuval Harness, INRIA, France; Eric F. Darve, Stanford University, USA; Luc Giraud and Emmanuel Agullo, INRIA, France*
Thursday, October 29
MS39
Recent Developments in Low-rank Preconditioning Techniques
10:15 AM-12:15 PM
Room: Roswell - Atlanta Conference Level
This minisymposium presents latest advances in low-rank approximation-based preconditioning techniques. These new preconditioners seek data sparsity rather than the standard non-zero sparsity in the matrices and offer promising alternatives to the incomplete LU-type preconditioners on modern high performance computers. We bring together researchers who study these techniques with different methodologies and initiate an effort to assemble the different ideas to further improve the performance of these techniques.
Organizer: Yuanzhe Xi
University of Minnesota, USA
Organizer: Yousef Saad
University of Minnesota, USA
10:15-10:40 An Algebraic Multilevel Preconditioner with Low-Rank Corrections for General Sparse Symmetric Matrices
Yuanzhe Xi, Yousef Saad, and Ruipeng Li,
University of Minnesota, USA
10:45-11:10 A Robust Algebraic Schur Complement Preconditioner Based on Low Rank Corrections
Laura Grigori, INRIA, France; Frederic Nataf, Laboratoire Jacques-Louis Lions, France; Soleiman Yousef, IFPEN, France
11:15-11:40 Approximating Kernel Matrix with Recursive Low-Rank Structure
Jie Chen, Argonne National Laboratory, USA
11:45-12:10 A Comparison of Different Low-Rank Approximation Techniques
François-Henry Rouet, Lawrence Berkeley National Laboratory, USA; Patrick Amestoy, Université de Toulouse, France; Cleve Ashcraft, Livermore Software Technology Corporation, USA; Alfredo Buttari, CNRS, France; Pieter Ghysels, Lawrence Berkeley National Laboratory, USA; Jean-Yves L’Excellent, INRIA-LIP-ENS Lyon, France; Xiaoye Sherry Li, Lawrence Berkeley National Laboratory, USA; Theo Mary, Université de Toulouse, France; Clément Weisbecker, Livermore Software Technology Corporation, USA

Thursday, October 29
MS40
Multilinear Algebra, Markov Chains, and Hypergraphs - Part I of II
10:15 AM-12:15 PM
Room: Techwood - Atlanta Conference Level
For Part 2 see MS47
There was a rich interplay between matrix algebra, Markov chains, and graph theory with key results such as the link between the existence of a stationary distribution of a Markov chain, the connectedness of the associated graph, and the convergence of the power method. Recent results have shown various generalizations of these ideas to the cases of higher-order Markov chains and hypergraphs through the use of multilinear algebra on hypermatrices or tensors. In this minisymposium, we seek to survey the state of the art and identify key challenges and open questions regarding these connections.
Organizer: David F. Gleich
Purdue University, USA
Organizer: Lek-Heng Lim
University of Chicago, USA
10:15-10:40 Spacey Random Walks, Tensor Eigenvalues, and Multilinear PageRank
David F. Gleich, Purdue University, USA; Lek-Heng Lim, University of Chicago, USA; Austin Benson, Stanford University, USA
10:45-11:10 Spectral Clustering with Tensors
Austin Benson, Stanford University, USA; David F. Gleich, Purdue University, USA; Jure Leskovec, Stanford University, USA
11:15-11:40 Eigenvalues of Tensors and a Second Order Markov Chain
Shenglong Hu, University of Chicago, USA
11:45-12:10 The Anatomy of the Second Dominant Eigenvalue in a Transition Probability Tensor --- The Power Iteration for Markov Chains with Memory
Moody T. Chu, North Carolina State University, USA; Sheng-Jhih Wu, Soochow University, China

Thursday, October 29
MS41
Hierarchically Rank-Structured Matrix Techniques - Part I of II
10:15 AM-12:15 PM
Room: Vinings - Atlanta Conference Level
For Part 2 see MS46
Recent years have seen significant advances in the field of rank-structured methods that extend the fundamental ideas of multipole and panel-clustering methods to general non-local solution operators. While there exist various more or less closely related methods, the unifying aim of these methods is to reduce the computational complexity of matrix computations through the exploitation of efficient hierarchically structured low-rank approximations. In this minisymposium, we aim to present and discuss recent new developments such as efficient linear complexity algorithms, the construction of direct solvers for partial differential and integral equations, as well as aspects of implementation.
Organizer: Sabine Le Borne
Hamburg University of Technology, Germany
Organizer: Jianlin Xia
Purdue University, USA
10:15-10:40 Hierarchical Matrix Factorization of the Inverse
Sabine Le Borne, Hamburg University of Technology, Germany
10:45-11:10 H-Matrices for Elliptic Problems: Approximation of the Inverses of FEM and BEM Matrices
Markus Melenk, Markus Faustmann, and Dirk Praetorius, Vienna University of Technology, Austria
11:15-11:40 Fast Direct Solvers as Preconditioners for Time Evolution Problems
Adrianna Gillman, Rice University, USA
11:45-12:10 Solving the Bethe-Salpeter Eigenvalue Problem using Low-rank Tensor Factorization and a Reduced Basis Approach
Peter Benner, Max Planck Institute, Magdeburg, Germany; Venera Khoromskaia, Max Planck Institute for Mathematics in the Sciences, Germany; Boris Khoromskij, Max Planck Institut Leipzig, Germany
Thursday, October 29

**CP11**

**Structured Matrix Computations**

10:15 AM-12:15 PM

Room: Marietta - Atlanta Conference Level

Chair: To Be Determined

10:15-10:30 A Fast Structured Eigensolver for Toeplitz Matrices

Xin Ye and Jianlin Xia, Purdue University, USA; Raymond H. Chan, Chinese University of Hong Kong, Hong Kong

10:35-10:50 A New Asynchronous Solver for Banded Linear Systems

Michael A. Jandron and Anthony Ruffa, Naval Undersea Warfare Center, USA; James Baglama, University of Rhode Island, USA

11:05-11:10 The Inverse of Two Level Toeplitz Operator Matrices

Selcuk Koyuncu, University of North Georgia, USA; Hugo Woerdeman, Drexel University, USA

11:15-11:30 Recursive, Orthogonal, Radix-2, Stable Dct-Dst Algorithms and Applications

Sirani M. Perera, Embry-Riddle Aeronautical University, USA

11:35-11:50 Structured Condition Numbers for the Solution of Parameterized Quasiseparable Linear Systems

Kenet J. Pomés Portal, Universidad Carlos III de Madrid, Spain; Froilán M. Dopico, Universidad Carlos III, Spain

11:55-12:10 Local Fourier Analysis of Pattern Structured Operators

Hannah Rittich, Matthias Bolten, and Karsten Kahl, University of Wuppertal, Germany

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Thursday, October 29

**CP12**

**Numerical Linear Algebra on GPUs**

10:15 AM-12:15 PM

Room: University - Atlanta Conference Level

Chair: Marc Baboulin, INRIA/University of Paris-Sud, France

10:15-10:30 Solving Dense Symmetric Indefinite Linear Systems on GPU Accelerated Architectures

Marc Baboulin, INRIA/University of Paris-Sud, France; Jack J. Dongarra, University of Tennessee, Knoxville, USA; Adrien Remy, University of Paris, France; Stanimire Tomov and Ichitaro Yamazaki, University of Tennessee, Knoxville, USA

10:35-10:50 A Parallel Divide-and-Conquer Algorithm for Computing the Moore-Penrose Inverses on Gpu

Xuzhou Chen, Fitchburg State University, USA; Jun Ji, Kennesaw State University, USA

10:55-11:10 Exploring qr Factorization on Gpu for Quantum Monte Carlo Simulation

Eduardo F. D'azevedo, Paul Kent, and Ying Wai Li, Oak Ridge National Laboratory, USA

11:15-11:30 Comparing Hybrid and Native GPU Acceleration for Linear Algebra

Mark Gates, University of Tennessee, USA; Azzam Haidar and Stanimire Tomov, University of Tennessee, Knoxville, USA

11:35-11:50 Efficient Eigensolver Algorithm on Accelerator Based Architecture

Azzam Haidar, University of Tennessee, Knoxville, USA; Piotr Luszczek, University of Tennessee, USA; Stanimire Tomov and Jack J. Dongarra, University of Tennessee, Knoxville, USA

11:55-12:10 Batched Matrix Computations on Hardware Accelerators Based on Gpus.

Azzam Haidar, University of Tennessee, Knoxville, USA; Ahmad Ahmad, University of Tennessee, USA; Stanimire Tomov and Jack J. Dongarra, University of Tennessee, Knoxville, USA

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**SP1**

**SIAG/Linear Algebra Prize Lecture - Localizing Nonlinear Eigenvalues: Theory and Applications**

1:45 PM-2:30 PM

Room: International Ballroom - Lower Level 1

Chair: Danny C. Sorensen, Rice University, USA

Vibrations are everywhere, and so are the eigenvalues that describe them. Physical models that include involve damping, delay, or radiation often lead to nonlinear eigenvalue problems, in which we seek complex values for which an (analytic) matrix-valued function is singular. In this talk, we show how to generalize eigenvalue localization results, such as Gershgorin’s theorem, Bauer-Fike, and pseudospectral theorems, to the nonlinear case. We demonstrate the usefulness of our results on examples from delay differential equations and quantum resonances.

David Bindel
Cornell University, USA

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Coffee Break

2:30 PM-3:00 PM

Room: Embassy Hall - Lower Level 2

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Lunch Break

12:15 PM-1:45 PM

Attendees on their own
Thursday, October 29

MS42
A Celebration in Honor of Dianne P. O’Leary on the Occasion of her Retirement - Part II of II
3:00 PM-5:00 PM
Room: International Ballroom North - Lower Level 1
For Part I see MS35
Dianne P. O’Leary has made broad contributions to numerical linear algebra, numerical optimization, and scientific computing since the 1970s, and this minisymposium is a celebration of those accomplishments. Her contributions include fundamental work in preconditioned (block) conjugate gradient algorithms, multisplitting iterative methods, numerical solution of ill-posed problems, iterative methods in optimization, Markov chain analysis, and much more. Her work has found application in image processing, quantum computing, information retrieval, text summarization, and biomedicine, and many other areas. The talks in this minisymposium will highlight the breadth and depth of Dianne O’Leary’s influential career.

Organizer: Misha E. Kilmer
Tufts University, USA

Organizer: Tamara G. Kolda
Sandia National Laboratories, USA

Organizer: James G. Nagy
Emory University, USA

Organizer: Julianne Chung
Virginia Tech, USA

3:00-3:25 Towards Textbook Multigrid for the Helmholtz Equation
Oliver G. Ernst, TU Chemnitz, Germany

3:30-3:55 Symmetric Tensor Analysis
Tamara G. Kolda, Sandia National Laboratories, USA

4:00-4:25 Matrix Computations and Text Summarization
John M. Conroy, Institute for Defense Analyses, USA

4:30-4:55 Blocks, Curves, and Splits: A Glimpse into the O’Leary Toolbox
Margaret H. Wright, Courant Institute of Mathematical Sciences, New York University, USA

MS43
The Least Squares Challenge: Modern Methods and Applications
3:00 PM-5:00 PM
Room: International Ballroom South - Lower Level 1
The method of least squares (LS) is a commonly used approach to find an approximate solution of overdetermined or inexactly specified systems of equations. Since the 18th century, the solution of LS problems has been and continues to be a fundamental method in scientific data fitting and LS solvers are used across a wide range of disciplines. However, despite recent progress, solving LS problems efficiently and accurately remains a tough challenge. The aim of this minisymposium is to bring together researchers working on the development of new robust algorithms and software for linear and non-linear LS problems.

Organizer: Jennifer Scott
Rutherford Appleton Laboratory, United Kingdom

Organizer: Miroslav Tuma
Czech Republic Academy of Science, Czech Republic

3:00-3:25 The State-of-the-Art of Preconditioners for Sparse Linear Least Squares
Jennifer Scott and Nick Gould, Rutherford Appleton Laboratory, United Kingdom

3:30-3:55 LU Preconditioning for Full-Rank and Singular Sparse Least Squares
Michael A. Saunders, Nick W. Henderson, and Ding Ma, Stanford University, USA

4:00-4:25 Solving Large Scale NNLS Problems Arising in Computer Vision
Sameer Agarwal, Google, Inc., USA

4:30-4:55 Modulus Iterative Methods for Least Squares Problems with Box Constraints
Ning Zheng, The Graduate University for Advanced Studies, Sokendai, Japan; Ken Hayami, National Institute of Informatics, Japan; Jun-Feng Yin, Tongji University, China

MS44
Large-Scale Eigenvalue Computations - Part II of II
3:00 PM-5:00 PM
Room: Piedmont - Atlanta Conference Level
For Part I see MS37
The increasing complexity of modern physical simulations and data analysis tasks, as well as advances in computational hardware, are introducing new challenges for existing eigensolver technologies. Such challenges include, among others, solution of yet larger eigenvalue problems, efficient computation of interior eigenpairs, approximation of large invariant subspaces, problems with nonlinearity and structure. This minisymposium addresses recent developments in methodologies for large-scale eigenvalue computations and highlights applications where they play a critical role.

Organizer: Meiuye Shao
Lawrence Berkeley National Laboratory, USA

Organizer: Eugene Vecharynski
Lawrence Berkeley National Laboratory, USA

3:00-3:25 Preconditioned Locally Harmonic Residual Methods for Interior Eigenvalue Computations
Eugene Vecharynski, Lawrence Berkeley National Laboratory, USA

3:30-3:55 Preconditioned Solvers for Nonlinear Hermitian Eigenproblems with Variational Characterization
Fei Xue, University of Louisiana, Lafayette, USA; Daniel B. Szyld, Temple University, USA; Eugene Vecharynski, Lawrence Berkeley National Laboratory, USA

4:00-4:25 A Structure-preserving Lanczos Algorithm for the Complex J-symmetric Eigenproblem
Heike Fassbender, TU Braunschweig, Germany; Peter Benner, Max Planck Institute, Magdeburg, Germany; Chao Yang, Lawrence Berkeley National Laboratory, USA

continued on next page
Thursday, October 29

MS44
Large-Scale Eigenvalue Computations - Part II of II
3:00 PM-5:00 PM
continued

4:30-4:55 Structure Preserving Algorithms for Solving the Bethe-Salpeter Eigenvalue Problem
Meiyue Shao, Lawrence Berkeley National Laboratory, USA; Felipe da Jornada, University of California, Berkeley, USA; Chao Yang, Lawrence Berkeley National Laboratory, USA; Jack Deslippe, National Energy Research Scientific Computing Center, USA; Steven Louie, University of California, Berkeley, USA

Thursday, October 29

MS45
Fast Solvers in Numerical Linear Algebra - Part II of II
3:00 PM-5:00 PM
Room: Spring - Atlanta Conference Level
For Part 1 see MS38
The numerical solution of large linear algebra problems is involved in the inner most loop of many academic and industrial simulations and is consequently often the most time-consuming computation in many large-scale computer simulations in science and engineering. The design of numerical kernels with reduced computational costs (flops and memory footprint) is of prime interest on the route to extreme scale. In this minisymposium, we intend to review a few of the recent advents in these directions covering data-sparse calculations and FMM calculations
Organizer: Olivier Coulaud
INRIA, France
Organizer: Eric F. Darve
Stanford University, USA
Organizer: Xiaoye Sherry Li
Lawrence Berkeley National Laboratory, USA
3:00-3:25 Algebraic Operations with H2-Matrices
Steffen Börm, University of Kiel, Germany; Knut Reimer, Kiel University, Germany
3:30-3:55 Fast Hierarchical Randomized Methods for the Approximation of Large Covariance Matrices
Pierre Blanchard and Olivier Coulaud, INRIA, France; Eric F. Darve, Stanford University, USA
4:00-4:25 Comparison of FMM and HSS at Large Scale
Rio Yokota, Tokyo Institute of Technology, Japan; Francois-Henry Rouet and Xiaoye Sherry Li, Lawrence Berkeley National Laboratory, USA
4:30-4:55 Fast Numerical Linear Algebra for Kohn-Sham Density Functional Theory via Compression
Anil Damle and Lexing Ying, Stanford University, USA

Thursday, October 29

MS46
Hierarchically Rank-structured Matrix Techniques - Part II of II
3:00 PM-5:00 PM
Room: Vinings - Atlanta Conference Level
For Part 1 see MS41
Recent years have seen significant advances in the field of rank-structured methods that extend the fundamental ideas of multipole and panel-clustering methods to general non-local solution operators. While there exist various more or less closely related methods, the unifying aim of these methods is to reduce the computational complexity of matrix computations through the exploitation of efficient hierarchically structured low-rank approximations. In this minisymposium, we aim to present and discuss recent new developments such as efficient linear complexity algorithms, the construction of direct solvers for partial differential and integral equations, as well as aspects of implementation.
Organizer: Sabine Le Borne
Hamburg University of Technology, Germany
Organizer: Jianlin Xia
Purdue University, USA
3:00-3:25 Some Recent Progress on Algorithms for FMM Matrices
Shivkumar Chandrasekaran, University of California, Santa Barbara, USA; Kristen Lessel, University of California, Santa Barbara, USA
3:30-3:55 Fast Linear Solvers for Weakly Hierarchical Matrices
Eric F. Darve, Pieter Coulier, and Mohammad Hadi Pour Ansari, Stanford University, USA
4:00-4:25 MHS Structures for the Direct Solution of Multi-Dimensional Problems
Jianlin Xia, Purdue University, USA
4:30-4:55 A Stable and Efficient Matrix Version of the Fast Multipole Method
Difeng Cai and Jianlin Xia, Purdue University, USA
Thursday, October 29

MS47
Multilinear Algebra, Markov Chains, and Hypergraphs - Part II of II
3:00 PM-5:00 PM
Room: Techwood - Atlanta Conference Level
For Part 1 see MS40
There was a rich interplay between matrix algebra, Markov chains, and graph theory with key results such as the link between the existence of a stationary distribution of a Markov chain, the connectedness of the associated graph, and the convergence of the power method. Recent results have shown various generalizations of these ideas to the cases of higher-order Markov chains and hypergraphs through the use of multilinear algebra on hypermatrices or tensors. In this minisymposium, we seek to survey the state of the art and identify key challenges and open questions regarding these connections.

Organizer: David F. Gleich
Purdue University, USA
Organizer: Lek-Heng Lim
University of Chicago, USA

3:00-3:25 Positive Diagonal Scaling of a Nonnegative Tensor to One with Prescribed Slice Sums
Shmuel Friedland, University of Illinois, Chicago, USA

3:30-3:55 The Laplacian Tensor of a Multi-Hypergraph
Kelly Pearson, Murray State University, USA

4:00-4:25 A Semi-Tensor Product Approach for Probabilistic Boolean Networks
Xiaojing Cheng, Yushan Qiu, Wenpin Hou, and Wai-Ki Ching, University of Hong Kong, China

4:30-4:55 Open Problems and Concluding Discussions
David F. Gleich, Purdue University, USA; Lek-Heng Lim, University of Chicago, USA

Thursday, October 29

MS48
Parallel Sparse Linear Solvers
3:00 PM-5:00 PM
Room: Roswell - Atlanta Conference Level
The numerical solution of large sparse systems of linear equations is important in computational science. Although this is a mature field, the trend of higher concurrency in computer architectures suggests we revisit strategies for complete and incomplete factorizations. This minisymposium will feature current work in parallel linear solvers, both sparse direct and approximate (incomplete) factorizations for preconditioning iterative solvers.

Organizer: Erik G. Boman
Sandia National Laboratories, USA
Organizer: Siva Rajamanickam
Sandia National Laboratories, USA

3:00-3:25 Parallel Multilevel Incomplete LU Factorization Preconditioner with Variable-Block Structure
Masha Sosonkina, Old Dominion University, USA; Bruno Carpentieri, University of Groningen, Netherlands

3:30-3:55 Basker: A Scalable Sparse Direct Linear Solver for Many-Core Architectures
Joshua D. Booth, Siva Rajamanickam, and Erik G. Boman, Sandia National Laboratories, USA

4:00-4:25 A Sparse Direct Solver for Distributed Memory GPU and Xeon Phi Accelerated Systems
Priyush Sao, Xing Liu, and Richard Vuduc, Georgia Institute of Technology, USA; Xiaoye Sherry Li, Lawrence Berkeley National Laboratory, USA

4:30-4:55 Parallel Iterative Incomplete Factorizations and Triangular Solves
Aftab Patel, Georgia Institute of Technology, USA; Siva Rajamanickam and Erik G. Boman, Sandia National Laboratories, USA; Edmond Chow, Georgia Institute of Technology, USA

Thursday, October 29

CP13
Krylov Subspace Methods
3:00 PM-5:00 PM
Room: Marietta - Atlanta Conference Level
Chair: To Be Determined

3:00-3:15 Recycling Krylov Subspace Methods for Sequences of Linear Systems with An Application to Lattice Qcd
Nemanja Bozovic, University of Wuppertal, Germany; Andreas J. Frommer, Bergische Universität, Germany; Matthias Bolten, University of Wuppertal, Germany

3:20-3:35 Generalized Jacobi Matrices and Band Algorithms
Iveta Hnetynkova, Charles University, Czech Republic; Martin Plesinger, Technical University of Liberec, Czech Republic

3:40-3:55 Symmetric Inner-Iteration Preconditioning for Rank-Deficient Least Squares Problems
Keiichi Morikuni, University of Tsukuba, Japan

4:00-4:15 On Solving Linear Systems Using Adaptive Strategies for Block Lanczos Method
Christian E. Schaerer and Pedro Torres, National University of Asuncion, Paraguay; Amit Bhaya, Federal University of Rio de Janeiro, Brazil

4:20-4:35 On Rotations and Approximate Rational Krylov Subspaces
Raf Vandebril and Thomas Mach, Katholieke Universiteit Leuven, Belgium; Miroslav Pranic, University of Banja Luka, Bosnia and Herzegovina

4:40-4:55 Improving Thick-Restarting Lanczos Method by Subspace Optimization For Large Sparse Eigenvalue Problems
Lingfei Wu and Andreas Stathopoulos, College of William & Mary, USA
Constrained Low Rank Approximations for Scalable Data Analytics

**Registration**
7:30 AM-2:30 PM
Room: Embassy Hall Foyer - Lower Level 2

**Closing Remarks**
8:00 AM-8:15 AM
Room: International Ballroom - Lower Level 1

**IP11**
Low Rank Decompositions of Tensors and Matrices: Theory, Applications, Perspectives
8:15 AM-9:00 AM
Room: International Ballroom - Lower Level 1
Chair: James G. Nagy, Emory University, USA

Numerical data are frequently organized as d-dimensional matrices, also called tensors. However, only small values of d are allowed since the computer memory is limited. In the case of many dimensions, special representation formats are crucial, e.g. so called tensor decompositions. Recently, the known tensor decompositions have been considerably revisited and the two of them, previously used only in theoretical physics, are now recognized as the most adequate and useful tools for numerical analysis. These two are the Tensor-Train and Hierarchical-Tucker decompositions. Both are intrinsically related with low-rank matrices associated with a given tensor. We present these decompositions and the role of low-rank matrices for the construction of efficient numerical algorithms.

**Eugene Tyrtyshnikov**
Russian Academy of Sciences, Russia

**Coffee Break**
9:45 AM-10:15 AM
Room: Embassy Hall - Lower Level 2
Friday, October 30

MS49
Recent Advances in Numerical Linear Algebra for Inverse Problems - Part I of II
10:15 AM-12:15 PM
Room: International Ballroom North - Lower Level 1

For Part 2 see MS55
Being able to compute reliable solutions to inverse problems is integral in many scientific applications. However, inverse problems are typically large-scale and ill-posed, presenting significant mathematical and computational challenges. Numerical linear algebra has been and continues to be essential in the development of robust and scalable algorithms to tackle these challenges. This minisymposium will highlight state-of-the-art research on numerical linear algebra for solving inverse problems from a wide range of applications including image deblurring, tomographic reconstruction, and hyperspectral imaging.

Organizer: Julianne Chung
Virginia Tech, USA
Organizer: Marco Donatelli
University of Insubria, Como, Italy

10:15-10:40 A Tensor-Based Dictionary Approach to Tomographic Image Reconstruction
Sara Soltani, Technical University of Denmark, Denmark; Misha E. Kilmer, Tufts University, USA; Per Christian Hansen, Technical University of Denmark, Denmark

10:45-11:10 Solving Sequential Strongly Underdetermined Systems Using Sherman-Morrison Iterations
Matthias Chung, Julianne Chung, and Joseph Slagel, Virginia Tech, USA

11:15-11:40 Efficient Iterative Methods for Quantitative Susceptibility Mapping
Lars Ruthotto, Emory University, USA

11:45-12:10 Some Inverse Problems in Optical Imaging for Remote Sensing
Robert Plemmons, Wake Forest University, USA

Friday, October 30

MS50
Innovative Methods for Eigenvalue Solutions - Part I of II
10:15 AM-12:15 PM
Room: International Ballroom South - Lower Level 1

For Part 2 see MS56
This minisymposium is concerned with innovative methods for eigenvalue solutions. Modern large-scale scientific computing and engineering simulations pose significant challenges to classical eigensolvers. New efficient and reliable methods are desired. In recent years, there are quite some exciting developments, such as those based on contour integrals, domain decompositions, stochastic methods, SS methods, structured techniques, etc. The minisymposium intends to discuss a wide spectrum of innovative eigensolvers, their analysis, and the related practical applications.

Organizer: Raymond H. Chan
Chinese University of Hong Kong, Hong Kong
Organizer: Jianlin Xia
Purdue University, USA

10:15-10:40 Domain Decomposition Algorithms for Large Hermitian Eigenvalue Problems
Yousef Saad, University of Minnesota, USA; Vasilis Kalantzis, University of Patras, Greece

10:45-11:10 A Contour Integral-based Parallel Eigensolver with Higher Complex Moments
Tetsuya Sakurai, Yasunori Futamura, and Akira Imakura, University of Tsukuba, Japan

11:15-11:40 On the Orthogonality of Eigenvectors Obtained from Parallel Spectral Projection Methods
Peter Tang, Intel Corporation, USA

11:45-12:10 A Contour-Integral Based Algorithm for Counting the Eigenvalues Inside a Region in the Complex Plane
Guojian Yin, Chinese Academy of Sciences, China

Friday, October 30

MS51
Preconditioning Techniques For Non-Symmetric or Symmetric Indefinite Matrices - Part I of II
10:15 AM-12:15 PM
Room: Piedmont - Atlanta Conference Level

For Part 2 see MS57
It is well-known that preconditioning is the key factor for the efficient solution of large sparse linear systems and eigenproblems. While for Symmetric Positive Definite matrices a number of robust and efficient algorithms are available for both sequential and parallel computations, the same does not hold true for Non-Symmetric and/or Symmetric Indefinite problems. The most frequent occurrence is the lack of robustness, with unstable numerical behaviors in both the preconditioner computation and application. This minisymposium aims at presenting the most recent advances on this topic, gathering worldwide experts to share experiences, challenges and new ideas.

Organizer: Massimiliano Ferronato
University of Padova, Italy
Organizer: Carlo Janna
University of Padova, Italy
Organizer: Miroslav Tuma
Czech Republic Academy of Science, Czech Republic

10:15-10:40 Iterative Construction of Non-Symmetric Factored Sparse Approximate Preconditioners
Carlo Janna, Massimiliano Ferronato, and Andrea Franceschini, University of Padova, Italy

10:45-11:10 Monte Carlo Synthetic Acceleration Methods for Sparse Linear Systems
Michele Benzi, Emory University, USA; Tom Evans and Steven Hamilton, Oak Ridge National Laboratory, USA; Massimiliano Lupo Pasini, Emory University, USA; Stuart Slattery, Oak Ridge National Laboratory, USA

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MS51
Preconditioning Techniques For Non-Symmetric or Symmetric Indefinite Matrices - Part I of II
10:15 AM-12:15 PM
continued

11:15-11:40 Parallel Algorithms for Computing Functions of Matrix Inverses
Matthias Bollhoefer, TU Braunschweig, Germany

11:45-12:10 A Parallel Multifrontal Solver and Preconditioner Using Hierarchically Semiseparable Structured Matrices
Pieter Ghysels, Xiaoye Sherry Li, and Francois-Henry Rouet, Lawrence Berkeley National Laboratory, USA

Friday, October 30
MS52
Matrix Equations in Control Theory
10:15 AM-12:15 PM
Room: Spring - Atlanta Conference Level
Matrix equations play a fundamental role in control theory. Well known equations of the Lyapunov and Riccati types arise in the stability analysis and stabilization of control systems. In recent years, a large number of results on linear and nonlinear matrix equations have been developed. This mini-symposium highlights recent advances and developments both analytical and numerical, of linear and nonlinear matrix equations with their applications in control systems analysis and design.
Organizer: Hermann Mena
University of Innsbruck, Austria

10:15-10:40 A Matrix Equation Approach for Incremental Linear Discriminant Analysis
Delin Chu, National University of Singapore, Republic of Singapore

10:45-11:10 Conditioning Number of Solutions of Matrix Equations in Stability Analysis
Mingqing Xiao, Southern Illinois University, Carbondale, USA

11:15-11:40 Splitting Schemes for Differential Riccati Equations
Tony Stillfjord, University of Gothenburg, Sweden

11:45-12:10 Riccati Equations Arising in Stochastic Control
Hermann Mena, University of Innsbruck, Austria

Friday, October 30
MS53
High-dimensional Approximation in Low Rank Tensor Formats - Part I of II
10:15 AM-12:15 PM
Room: Roswell - Atlanta Conference Level
For Part 2 see MS59
High-dimensional approximation has seen a revival since new linear algebra-based low rank formats are available that scale linearly in the dimension. For these new formats, the Hierarchical Tucker (HT) or Tensor Train (TT), there are many emerging hot topics like iterative approximation schemes and their convergence, completion for missing data, applications in uncertainty quantification, parametric model reduction, and many other directions of research. In this minisymposium we will present the theoretical foundation, new algorithms and analysis, and the use in applications.
Organizer: Lars Grasedyck
RWTH Aachen University, Germany

10:15-10:40 Kolmogorov Widths and Low-Rank Approximation of Parametric Problems
Markus Bachmayr and Albert Cohen, Université Pierre et Marie Curie, France

10:45-11:10 An Adaptive Tensor Method for High-Dimensional Parametric PDEs
Max Pfeffer, Technische Universität Berlin, Germany

11:15-11:40 A Greedy Method with Subspace Point of View for Low-Rank Tensor Approximation in Hierarchical Tucker Format
Loïc Giraldi and Anthony Nouy, Ecole Centrale de Nantes, France

11:45-12:10 Tensor Krylov Methods
Pieter Liejaert, Katholieke Universiteit Leuven, Belgium
Friday, October 30

**MS54**

**Numerical Methods for Markov Chains and Stochastic Models**

10:15 AM-12:15 PM

Room: Techwood - Atlanta Conference Level

Markov chains are a very popular modelling tool, and the research connected to their use is very close to linear algebra in its themes and techniques. Spectral theory, structured linear algebra, connectedness and reducibility properties are frequent topics. This minisymposium summarizes some recent advances in this area.

Organizer: Federico Poloni
University of Pisa, Italy

10:15-10:40 The Computation of the Key Properties of Markov Chains using a Variety of Techniques
Jeffrey J. Hunter, Auckland University of Technology, New Zealand

10:45-11:10 Complex Nonsymmetric Algebraic Riccati Equations Arising in Markov Modulated Fluid Flows
Changli Liu, Sichuan University, China; Jungong Xue, Fundan University, China

11:15-11:40 General Solution of the Poisson Equation for QBDs
Dario Bini, University of Pisa, Italy; Sarah Dendievel and Guy Latouche, Université Libre de Bruxelles, Belgium; Beatrice Meini, University of Pisa, Italy

11:45-12:10 Steady-state Analysis of a Multi-class MAP/PH/c Queue with Acyclic PH Retrivals
Tugrul Dayar and M. Can Orhan, Bilkent University, Turkey

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Friday, October 30

**CP15**

**Linear Algebra Theory: Part I**

10:15 AM-12:15 PM

Room: Vinings - Atlanta Conference Level

Chair: Enide C. Andrade, University of Aveiro, Portugal

10:15-10:30 Ky Fan Theorem Applied to Randić Energy
Enide C. Andrade, University of Aveiro, Portugal; Ivan Gutman, University of Kragujevac, Serbia and State University of Novi Pazar, Serbia; Maria Robbiano and Bernardo Martín, Universidad Católica del Norte, Chile

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Friday, October 30

**CP16**

**Numerical PDEs and Applications: Part I**

10:15 AM-12:15 PM

Room: Marietta - Atlanta Conference Level

Chair: To Be Determined

10:15-10:30 On the Backward Stability of Chebyshev Rootfinding Via Colleague Matrix Eigenvalues
Javier Pérez Álvaro and Vanni Noferini, University of Manchester, United Kingdom

10:35-10:50 Companion Matrices of Hermite-Birkhoff Interpolants
Nikta Shayanfar, Technische Universität Braunschweig, Germany; Amir Amiraslani, University of Hawaii, USA

10:55-11:10 Linear Algebra Provides a Basis for Elasticity Without Stress Or Strain
Humphrey H. Hardy, Piedmont College, USA

11:15-11:30 Fixing Gauge and Rank Deficiency
Daniel Topa, Los Alamos National Laboratory, USA; Pedro Emid, University of New Mexico, USA

11:35-11:50 Iterative Method for Mildly Overdetermined Least-Squares Problems with a Helmholtz Block
Bas Peters, Chen Greif, and Felix J. Herrmann, University of British Columbia, Canada

11:55-12:10 Bounds on Algebraic, Discretization, and Total Numerical Approximation Errors for Linear Diffusion PDEs
Jan Papež, Charles University, Czech Republic; Martin Vohralík, INRIA Paris-Rocquencourt, France
Friday, October 30

CP17

Optimization
10:15 AM-12:15 PM
Room: University - Atlanta Conference Level
Chair: Hyun-Min Kim, Pusan National University, Busan (Pusan), Republic of Korea

10:15-10:30 Matrix-Free Krylov Subspace Methods for Solving a Riemannian Newton Equation
Kensuke Aihara and Hiroyuki Sato, Tokyo University of Science, Japan

10:35-10:50 Approximating the Cardinality of a Vector to Handle Cardinality Constraints in Optimization
Agnes Bialecki, EDF, France; Laurent El Ghaoui, University of California, Berkeley, USA; Riadh Zorgati, EDF, France

10:55-11:10 Primal and Dual Algorithms for the Ball Covering Problem
Akshay Gupte and Lin Dearing, Clemson University, USA

11:15-11:30 Finding the Nearest Valid Covariance Matrix: a Fx Market Case
Aleksei Minabutdinov, National Research University Higher School of Economics, Russia

11:35-11:50 Convergence of Newton Iterations for Order-Convex Matrix Functions
Sang-Hyup Seo, Pusan National University, Busan (Pusan), Republic of Korea; Jong-Hyeon Seo, Daegu Gyeongbuk Institute of Science and Technology, Korea; Hyun-Min Kim, Pusan National University, Busan (Pusan), Republic of Korea

11:55-12:10 Modulus-Type Inner Outer Iterative Methods for Nonnegative Constrained Least Squares Problems
Ning Zheng, The Graduate University for Advanced Studies, Sokenkai, Japan; Ken Hayami, National Institute of Informatics, Japan; Junfeng Yin, Tongji University, China

Lunch Break
12:15 PM-1:45 PM
Attendees on their own

Friday, October 30

MS55
Recent Advances in Numerical Linear Algebra for Inverse Problems - Part II of II
1:45 PM-3:45 PM
Room: International Ballroom North - Lower Level 1
For Part 1 see MS49

Being able to compute reliable solutions to inverse problems is integral in many scientific applications. However, inverse problems are typically large-scale and ill-posed, presenting significant mathematical and computational challenges. Numerical linear algebra has been and continues to be essential in the development of robust and scalable algorithms to tackle these challenges. This minisymposium will highlight state-of-the-art research on numerical linear algebra for solving inverse problems from a wide range of applications including image deblurring, tomographic reconstruction, and hyperspectral imaging.

Organizer: Julianne Chung
Virginia Tech, USA
Organizer: Marco Donatelli
University of Insubria, Como, Italy

1:45-2:10 SVD Approximations for Large Scale Imaging Problems
James G. Nagy, Emory University, USA

2:15-2:40 Structure Preserving Reblurring Preconditioners for Image Deblurring
Pietro Dell’Acqua, University of Genova, Italy; Marco Donatelli, University of Insubria, Como, Italy; Claudio Estatico, University of Genoa, Italy; Mariarosa Mazza, University of Insubria, Como, Italy

2:45-3:10 Recovering Sparsity in a Krylov Subspace Framework
Silvia Gazzola, University of Padova, Italy; James G. Nagy, Emory University, USA; Paolo Novati, University of Trieste, Italy

3:15-3:40 Arnoldi Methods for Image Deblurring with Anti-Reflective Boundary Conditions
Marco Donatelli, University of Insubria, Como, Italy; David Martin and Lothar Reichel, Kent State University, USA

MS56
Innovative Methods for Eigenvalue Solutions - Part II of II
1:45 PM-3:45 PM
Room: International Ballroom South - Lower Level 1
For Part 1 see MS50

This minisymposium is concerned with innovative methods for eigenvalue solutions. Modern large-scale scientific computing and engineering simulations pose significant challenges to classical eigensolvers. New efficient and reliable methods are desired. In recent years, there are quite some exciting developments, such as those based on contour integrals, domain decompositions, stochastic methods, SS methods, structured techniques, etc. The minisymposium intends to discuss a wide spectrum of innovative eigensolvers, their analysis, and the related practical applications.

Organizer: Raymond H. Chan
Chinese University of Hong Kong, Hong Kong

Organizer: Jianlin Xia
Purdue University, USA

1:45-2:10 The Use of Stochastic Collocation Methods to Understand Pseudo-Spectra in Linear Stability Analysis
Howard C. Elman, University of Maryland, College Park, USA; David Silvester, University of Manchester, United Kingdom

2:15-2:40 Large-Scale Eigenvalue Calculations in Scientific Problems
Esmond G. Ng, Lawrence Berkeley National Laboratory, USA

2:45-3:10 Accurate Computations of Eigenvalues of Diagonally Dominant Matrices with Applications to Differential Operators
Qiang Ye, University of Kentucky, USA

3:15-3:40 Convergence of the Truncated Lanczos Approach for the Trust-Region Subproblem
Leihong Zhang, Shanghai University of Finance and Economics, China; Ren-Cang Li, University of Texas at Arlington, USA
Friday, October 30

**MS57**

**Preconditioning Techniques For Non-Symmetric or Symmetric Indefinite Matrices - Part II of II**

1:45 PM-3:45 PM

Room: Piedmont - Atlanta Conference Level

For Part 1 see MS51

It is well-known that preconditioning is the key factor for the efficient solution of large sparse linear systems and eigenproblems. While for Symmetric Positive Definite matrices a number of robust and efficient algorithms are available for both sequential and parallel computations, the same does not hold true for Non-Symmetric and/or Symmetric Indefinite problems. The most frequent occurrence is the lack of robustness, with unstable numerical behaviors in both the preconditioner computation and application. This minisymposium aims at presenting the most recent advances on this topic, gathering worldwide experts to share experiences, challenges and new ideas.

Organizer: Massimiliano Ferronato
University of Padova, Italy

Organizer: Carlo Janna
University of Padova, Italy

Organizer: Miroslav Tuma
Czech Republic Academy of Science, Czech Republic

1:45-2:10 Preconditioned Iterative Methods for Solving Indefinite Linear Systems
Miroslav Tuma, Czech Republic Academy of Science, Czech Republic; Jennifer Scott, Rutherford Appleton Laboratory, United Kingdom

2:15-2:40 An Algebraic Multigrid Method for Nonsymmetric Linear Systems
Daniel Osei-Kuffuor, Lu Wang, and Robert Falgout, Lawrence Livermore National Laboratory, USA

2:45-3:10 Aggressive Accelerator-Enabled Local Smoothing Via Incomplete Factorization, with Applications to Preconditioning of Stokes Problems with Heterogeneous Viscosity Structure
Patrick Sanan, Università della Svizzera Italiana, Switzerland; Karl Rupp, Vienna University of Technology, Austria; Olaf Schenk, Università della Svizzera Italiana, Switzerland

3:15-3:40 Low-Rank Approximation Preconditioners for Symmetric and Nonsymmetric Systems
Ruipeng Li and Yousef Saad, University of Minnesota, USA

**Friday, October 30**

**MS58**

**Approaches to Reducing Communication in Krylov Subspace Methods**

1:45 PM-3:45 PM

Room: Spring - Atlanta Conference Level

Communication - the movement of data between levels of memory hierarchy or between processors over a network - is the most expensive operation in terms of both time and energy at all scales of computing. Achieving scalable performance in terms of time and energy thus requires a dramatic shift in the field of algorithmic design. Solvers for sparse linear algebra problems, ubiquitous throughout scientific codes, are often the bottlenecks in application performance due to a low computation/communication ratio. This minisymposium includes four presentations detailing advances in reducing data movement costs in Krylov subspace methods.

Organizer: Erin C. Carson
New York University, USA

Organizer: Laura Grigori
INRIA, France

1:45-2:10 The s-Step Lanczos Method and its Behavior in Finite Precision
Erin C. Carson, New York University, USA; James W. Demmel, University of California, Berkeley, USA

2:15-2:40 Enlarged Krylov Subspace Methods for Reducing Communication
Sophie M. Moufawad, IFP Energies nouvelles, France; Laura Grigori, INRIA, France; Frederic Nataf, Laboratoire Jacques-Louis Lions, France

2:45-3:10 Preconditioning Communication-Avoiding Krylov Methods
Siva Rajamanickam, Sandia National Laboratories, USA; Ichitaro Yamazaki, University of Tennessee, Knoxville, USA; Andrey Prokopenko, Erik G. Boman, and Michael Heroux, Sandia National Laboratories, USA; Jack J. Dongarra, University of Tennessee, Knoxville, USA

continued on next page
The study of structured matrices has led to many efficient linear algebra subroutines that make large-scale problems feasible. This minisymposium introduces recent advances in fast algorithms for computing data-sparse approximations of structured matrices based on randomization techniques, hierarchical matrix structure, FMM, etc. These data-sparse approximations give linear or quasi-linear time methods for eigendecomposition, matrix factorization, and multiplication with applications in fast solvers for high dimensional PDE's, integral transforms (e.g., Fourier integral operators) and special function transforms.

Organizer: Haizhao Yang  
Duke University, USA

Organizer: James Vogel  
Purdue University, USA

1:45-2:10 Butterfly Factorizations
Yingzhou Li, Stanford University, USA; Haizhao Yang, Duke University, USA; Eileen R. Martin, Kenneth L. Ho, and Lexing Ying, Stanford University, USA

2:15-2:40 Approximation of Real Eigenvalues of Some Structured Nonsymmetric Matrices
Victor Pan, City University of New York, USA

2:45-3:10 Rank-Structured PDE Solvers
David Bindel, Cornell University, USA

3:15-3:40 Linear Time Eigendecomposition and SVD Algorithms
James Vogel and Jianlin Xia, Purdue University, USA
**Friday, October 30**

**CP18**

**Linear Algebra Theory: Part II**

1:45 PM-3:05 PM  
Room: Vinings - Atlanta Conference Level  
Chair: Peter Semrl, University of Ljubljana, Slovenia

1:45-2:00 **Coherency Preservers**  
Peter Semrl, University of Ljubljana, Slovenia

2:05-2:20 **A Connection Between Comrade Matrices and Reachability Matrices**  
Maryam Shams Solary, Payam Noor  
University, Iran

2:25-2:40 **Maximal Lower Bounds in Loewner Order**  
Nikolas Stott, INRIA, France; Xavier Allamigeon and Stéphane Gaubert, INRIA and CMAP, Ecole Polytechnique, France

2:45-3:00 **Tropical Bounds for the Eigenvalues of Block Structured Matrices**  
Marianne Akian, Stephane Gaubert, and Andrea Marchesini, INRIA and CMAP, Ecole Polytechnique, France

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**Friday, October 30**

**CP19**

**Numerical PDEs and Applications: Part II**

1:45 PM-3:45 PM  
Room: Marietta - Atlanta Conference Level  
Chair: To Be Determined

1:45-2:00 **Coupled Preconditioners for the Incompressible Navier-Stokes Equations**  
Xin He and Kees Vuik, Delft University of Technology, Netherlands

2:05-2:20 **On Some Algebraic Issues of Domain Decomposition Approaches**  
Valery P. Il’in, Russian Academy of Sciences, Russia

2:25-2:40 **Robust Incomplete Factorization Preconditioner with Mixed-Precision for Parallel Finite Element Analysis**  
Naoki Morita, Gaku Hashimoto, and Hiroshi Okuda, University of Tokyo, Japan

2:45-3:00 **Efficient Simulation of Fluid-Structure Interactions Using Fast Multipole Method**  
Minghao W. Rostami and Sarah D. Olson, Worcester Polytechnic Institute, USA

3:05-3:20 **Block Preconditioners for An Incompressible Magnetohydrodynamics Problem**  
Michael P. Wathen, Chen Greif, and Dominik Schotzau, University of British Columbia, Canada

3:25-3:40 **The WR-HSS Method and Its Subspace Acceleration for the Unsteady Elliptic Problem**  
XI Yang, Nanjing University of Aeronautics and Astronautics, China
SIAM CONFERENCE ON APPLIED LINEAR ALGEBRA

OCTOBER 26-30, 2015

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Kilmer, Misha E., MS35, 10:15 Thu
Kilmer, Misha E., MS42, 3:00 Thu
Kilmer, Misha E., MS49, 10:15 Fri
Kim, Yeonji, PP1, 3:00 Wed
Kintscher, Nils, CP3, 3:40 Mon
Klein, Philip, MS11, 3:30 Mon
Kloster, Kyle, MS6, 11:15 Mon
Klyuchuk, Tetiana, PP1, 3:00 Wed
Klyuchuk, Christine, CP5, 11:35 Tue
Klyuchuk, Christine, MS28, 10:15 Wed
Knepper, Sarah, CP7, 4:40 Tue
Knight, Nicholas, MS18, 10:15 Tue
Knight, Nicholas, MS18, 10:15 Tue
Knight, Nicholas, MS25, 3:00 Tue
Knight, Philip, MS30, 11:45 Wed
Knyazev, Andrew, MS37, 10:15 Thu

Italicized names indicate session organizers.
Koanantakool, Penporn, MS18, 11:45 Tue
Kolda, Tamara G., MS35, 10:15 Thu
Kolda, Tamara G., MS42, 3:00 Thu
Kolda, Tamara G., MS42, 3:30 Thu
Koskela, Antti, MS8, 4:00 Mon
Kostic, Vladimir, CP6, 11:55 Tue
Koyuncu, Selcuk, CP11, 10:55 Thu
Kraemer, Sebastian, MS59, 2:15 Fri

Nakatsukasa, Yuji, MS33, 10:15 Wed
Nakatsukasa, Yuji, MS33, 11:15 Wed
Navasca, Carmeliza, MS17, 10:15 Tue
Navasca, Carmeliza, MS24, 3:00 Tue
Ng, Esmond G., MS56, 2:15 Fri
Nie, Jiawang, MS17, 10:45 Tue
Noferini, Vanni, MS3, 10:15 Mon
Noferini, Vanni, MS10, 3:00 Mon
Noferini, Vanni, MS33, 11:45 Wed
Nouy, Anthony, MS32, 11:45 Wed

O’Connell, Meghan, CP1, 11:35 Mon
Olshanskii, Maxim, CP14, 4:40 Thu
Orban, Dominique, MS15, 11:15 Tue
O’Rourke, Sean, MS34, 10:15 Wed
O’Rourke, Sean, MS34, 10:15 Wed
Osei-Kuffuor, Daniel, MS57, 2:15 Fri
Overton, Michael L., IP1, 8:15 Mon

Palitta, Davide, PP1, 3:00 Wed
Palmowski, Kevin, CP5, 11:55 Tue
Pan, Jianyu, MS29, 3:30 Tue
Pan, Victor, MS60, 2:15 Fri
Papadimitriou, Dimitri, CP1, 11:55 Mon
Papež, Jan, CP16, 11:35 Fri
Parks, Haesun, IP12, 9:00 Fri
Patel, Aftab, MS48, 4:30 Thu
Pearson, John, PP1, 3:00 Wed
Pearson, John W., MS36, 10:15 Thu
Pearson, Kelly, MS47, 3:30 Thu
Pérez Álvaro, Javier, CP16, 10:15 Fri
Perovic, Vasilije, CP8, 3:40 Tue
Peters, Bas, CP16, 11:35 Fri
Pfeffer, Max, MS53, 10:45 Fri
Plemmons, Robert, MS49, 11:45 Fri
Polizzi, Eric, MS26, 4:30 Tue
Poloni, Federico, MS16, 11:15 Tue
Poloni, Federico, MS54, 10:15 Fri

Italicized names indicate session organizers
S

Saad, Yousef, MS19, 10:15 Tue
Saad, Yousef, MS26, 3:00 Tue
Saad, Yousef, MS39, 10:15 Thu
Saad, Yousef, MS37, 10:45 Thu
Sadayappan, Saday, MS25, 4:00 Tue
Sadok, Hassane, MS21, 3:00 Tue
Sakurai, Tetsuya, MS50, 10:45 Fri
Sanan, Patrick, MS57, 2:45 Fri
Sao, Piyush, MS48, 4:00 Thu
Saunders, Michael A., MS43, 3:30 Thu
Schaer, Christian E., CP13, 4:00 Thu
Schwartz, Oded, MS18, 10:15 Tue
Schwartz, Oded, MS25, 3:00 Tue
Schweitzer, Marcel, MS1, 10:15 Mon
Scott, Jennifer, MS43, 3:00 Thu
Scott, Jennifer, MS43, 3:00 Thu
Scquizzato, Michele, MS18, 10:45 Tue
Sellers, Kimberly F., MS35, 11:15 Thu
Semrl, Peter, CP18, 1:45 Fri
Seo, Sang-Hyup, CP17, 11:35 Fri
Serre, François, PP1, 3:00 Wed
Shader, Bryan L., MS20, 11:45 Tue
Shams Solary, Maryam, CP18, 2:05 Fri
Shao, Meiyue, MS37, 10:15 Thu
Shao, Meiyue, MS44, 3:00 Thu
Shao, Meiyue, MS44, 4:30 Thu
Shayanfar, Nikta, CP16, 10:35 Fri
Simhadri, Harsha Vardhan, MS25, 3:30 Thu
Simoncini, Valeria, MS32, 10:15 Wed
Simson, Oliva, MS28, 11:45 Wed
Singer, Sanja, CP4, 4:40 Mon
Sokolovic, Sonja, CP3, 4:00 Mon
Solomonik, Edgar, MS18, 11:15 Tue
Soltanolkotabi, Mahdi, MS7, 4:00 Mon
Soodhalter, Kirk M., MS2, 10:15 Mon
Soodhalter, Kirk M., MS2, 10:15 Mon
Soodhalter, Kirk M., MS9, 3:00 Mon
Sosa, Freddy E., CP8, 4:40 Thu
Sosonkina, Masha, MS48, 3:00 Thu

R

Rai, Prashant, MS59, 1:45 Fri
Rajamanickam, Siva, MS48, 3:00 Thu
Rajamanickam, Siva, MS58, 2:45 Fri
Ramage, Alison, MS15, 10:15 Tue
Ramage, Alison, MS22, 3:00 Tue
Ramage, Alison, MS22, 3:00 Tue
Ramlau, Ronny, MS14, 10:15 Tue
Ramlau, Ronny, MS14, 11:15 Tue
Ramlau, Ronny, MS21, 3:00 Tue
Rao, Anup, MS34, 11:15 Wed
Rees, Tyrome, MS36, 10:15 Thu
Rees, Tyrome, MS36, 10:15 Thu
Reichel, Lothar, MS14, 10:15 Tue
Reichel, Lothar, MS21, 3:00 Tue
Reichel, Lothar, MS55, 3:15 Fri
Relton, Samuel, MS1, 10:15 Mon
Relton, Samuel, MS8, 3:00 Mon
Relton, Samuel, CP9, 11:45 Wed
Remis, Rob, MS9, 3:30 Mon
Ren, Zhiru, MS23, 4:00 Tue
Renault, Rosemary A., MS14, 10:45 Tue
Ridzal, Denis, MS36, 11:45 Thu
Rittich, Hannah, CP11, 11:55 Thu
Robertson, Amber S., PP1, 3:00 Wed
Robol, Leonardo, MS3, 11:45 Mon
Rodriguez, Giuseppe, MS14, 11:45 Tue
Roehrig-Zoellner, Melven, CP4, 4:00 Mon
Roman, Jose E., MS37, 11:15 Thu
Romero Alcalde, Eloy, CP4, 4:20 Mon
Rostami, Minghao W., MS29, 10:45 Wed
Rostami, Minghao W., CP19, 2:45 Fri
Rottmann, Matthias, CP3, 4:20 Mon
Rouet, Francois-Henry, MS39, 11:45 Thu
Rozloznik, Miro, CP10, 11:15 Wed
Ruthotto, Lars, MS49, 11:15 Fri

Sousedik, Bedrich, MS32, 11:15 Wed
Stanhope, Shelby, PP1, 3:00 Wed
Stathopoulos, Andreas, MS37, 11:45 Thu
Steinlechner, Michael, MS59, 2:45 Fri
Stillfjord, Tony, MS52, 11:15 Fri
Stöckel, Morten, MS5, 11:45 Mon
Stott, Nikolas, CP18, 2:25 Fri
Strakos, Zdenek, MS4, 10:15 Mon
Strang, Gil, MS4, 10:45 Mon
Strang, Gilbert, MS11, 3:00 Mon
Srebel, Artur, CP3, 4:40 Mon
Strong, David M., MS4, 10:15 Mon
Strong, David M., MS4, 10:15 Mon
Sugihara, Kota, CP14, 4:20 Thu
Suryanarayana, Phanish, MS26, 4:00 Tue
Sutton, Brian D., PP1, 3:00 Wed
Szyld, Daniel B., MS22, 4:30 Thu

T

Tang, Peter, MS50, 11:15 Fri
Tichy, Petr, PP1, 3:00 Wed
Tisseur, Françoise, MS30, 10:45 Wed
Toledo, Sivan A., MS1, 11:45 Mon
Tomov, Stanimire, CP12, 11:55 Thu
Topa, Daniel, CP16, 10:15 Mon
Tsatsomeros, Michael, MS20, 10:45 Tue
Tudisco, Francesco, MS6, 10:15 Mon
Tudisco, Francesco, MS6, 10:15 Mon
Tuma, Miroslav, MS43, 3:00 Thu
Tuma, Miroslav, MS51, 10:15 Fri
Tuma, Miroslav, MS57, 1:45 Fri
Tuma, Miroslav, MS57, 1:45 Fri
Tyryshnikov, Eugene, IP11, 8:15 Fri

Van Beeumen, Roel, CP9, 11:55 Wed
van de Geijn, Robert A., MS11, 3:00 Mon
Van Dooren, Paul M., MS10, 3:30 Mon
van Gijzen, Martin B., MS2, 10:15 Mon
van Gijzen, Martin B., MS9, 3:00 Mon
van Gijzen, Martin B., PP1, 3:00 Wed
Van Loan, Charles, PP1, 3:00 Wed
Vandebril, Raf, MS16, 10:15 Tue
Vandebril, Raf, CP13, 4:20 Thu
Vandereycken, Bart, MS16, 11:45 Tue
Vasudevan, Varun, PP1, 3:00 Wed
Vecharynski, Eugene, MS37, 10:15 Thu
Vecharynski, Eugene, MS44, 3:00 Thu
Vecharynski, Eugene, MS44, 3:00 Thu
Vempala, Santosh, MS34, 11:45 Wed
Vogel, James, MS60, 1:45 Fri
Vogel, James, MS60, 3:15 Fri
Vu, Van, MS34, 10:15 Wed
Vybiral, Jan, MS13, 3:30 Mon

W
Wagner, Roland, MS21, 3:30 Tue
Wang, Ben-Hao, MS31, 10:15 Wed
Wang, Ke, MS34, 10:45 Wed
Wang, Weichung, MS35, 10:45 Thu
Wang, Zeng-Qi, MS23, 3:00 Tue
Wang, Zhengsheng, PP1, 3:00 Wed
Wathen, Michael P., CP19, 3:05 Fri
Willett, Rebecca, MS7, 4:30 Mon
Wilson, Ulrica, MS20, 10:15 Tue
Wilson, Ulrica, MS27, 3:00 Tue
Wilson, Ulrica, MS27, 3:00 Tue
Woerdeman, Hugo J., MS4, 11:15 Mon
Wong, Elizabeth, MS31, 10:45 Wed
Wright, Margaret H., MS42, 4:30 Thu
Wu, Lingfei, CP13, 4:40 Thu
Wu, Sheng-Jhih, MS40, 11:45 Thu

X
Xi, Yuanzhe, MS39, 10:15 Thu
Xi, Yuanzhe, MS39, 10:15 Thu
Xia, Jianlin, MS41, 10:15 Thu
Xia, Jianlin, MS46, 3:00 Thu
Xia, Jianlin, MS46, 4:00 Thu
Xia, Jianlin, MS50, 10:15 Fri
Xia, Jianlin, MS56, 1:45 Fri
Xiao, Mingqing, MS52, 10:45 Fri
Xu, Yangyang, MS17, 11:15 Tue
Xue, Fei, MS44, 3:30 Thu
Xue, Jungong, MS54, 10:45 Fri

Y
Yamamoto, Yusaku, CP10, 11:35 Wed
Yamazaki, Ichitaro, CP10, 11:55 Wed
Yang, Chao, MS19, 10:15 Tue
Yang, Chao, MS26, 3:00 Tue
Yang, Chao, PP1, 3:00 Wed
Yang, Haizhao, MS60, 1:45 Fri
Yang, Haizhao, MS60, 1:45 Fri
Yang, XI, CP19, 3:25 Fri
Yang, Zhao, CP6, 10:15 Tue
Ye, Ke, MS24, 3:00 Tue
Ye, Qiang, MS56, 2:45 Fri
Ye, Xin, CP11, 10:15 Thu
Yeredor, Arie, MS24, 4:00 Tue
Yin, Guojian, MS50, 11:45 Fri
Yokota, Rio, MS45, 4:00 Thu

Z
Zhang, Guo-Feng, MS23, 4:30 Thu
Zhang, Jiani, MS21, 4:00 Tue
Zhang, Leihong, MS56, 3:15 Fri
Zheng, Ning, CP17, 11:55 Fri
Zorin, Denis, MS38, 11:15 Thu
Zwaan, Ian, MS21, 4:30 Tue

Italicized names indicate session organizers
LA15 Conference Budget

Conference Budget
SIAM Conference on Applied Linear Algebra
October 26 - 30, 2015
Atlanta, Georgia

Expected Paid Attendance 300

Revenue
Registration Income $115,050
Total $115,050

Expenses
Printing $2,500.00
Organizing Committee $3,600.00
Invited Speakers $15,000.00
Food and Beverage $35,900.00
AV Equipment and Telecommunication $18,700.00
Advertising $5,200.00
Conference Labor (including benefits) $56,529.00
Other (supplies, staff travel, freight, misc.) $8,700.00
Administrative $17,286.00
Accounting/Distribution & Shipping $9,217.00
Information Systems $16,619.00
Customer Service $6,277.00
Marketing $9,860.00
Office Space (Building) $6,236.00
Other SIAM Services $6,587.00
Total $218,211

Net Conference Expense ($103,161)

Support Provided by SIAM $103,161
 $0

Estimated Support for Travel Awards not included above:

Early Career and Students 31 $22,000