## **Final Program**



#### SIAM 2014 Events Mobile App

Scan the QR code to the right with any QR reader and download the TripBuilder<sup>®</sup> EventMobile app to your iPHONE, iPAD, ITOUCH, or ANDROID mobile device. You can also visit *www.tripbuilder.com/siam/2014events* 





Society for Industrial and Applied Mathematics 3600 Market Street, 6th Floor Philadelphia, PA 19104-2688 USA Telephone: +1-215-382-9800 Fax: +1-215- 386-7999 Conference E-mail: meetings@siam.org Conference Web: www.siam.org/meetings/ Membership and Customer Service: (800) 447-7426 (US & Canada) or +1-215-382-9800 (worldwide)

## **General** Information

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#### Organizing Committee Co-chairs

Margot Gerritsen Stanford University, USA

Esmond Ng Lawrence Berkeley National Laboratory, USA

#### **Organizing Committee**

Edmond Chow Georgia Institute of Technology, USA Amr El-Bakry Exxon-Mobil, USA

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Lennaert Van Veen University of Ontario, Canada

Stefan Wild Argonne National Laboratory, USA

**Stephen Wirkus** Arizona State University, USA

#### **SIAM Registration Desk**

The SIAM registration desk is located in the State Room on the 4th Floor. It is open during the following hours:

> Sunday, July 6 7:30 AM - 8:00 PM Monday, July 7 7:15 AM - 4:30 PM Tuesday, July 8 8:00 AM - 4:30 PM Wednesday, July 9 7:30 AM - 4:30 PM Thursday, July 10 8:00 AM - 4:30 PM Friday, July 11 8:00 AM - 4:30 PM

#### **Conference Location**

Technical sessions and all other events will be held at the Palmer House:

17 East Monroe Street Chicago, Illinois, 60603 Direct Hotel Reservation: 1-312-726-7500

The Prizes and Awards luncheon will be held offsite at the Hilton Chicago:

720 South Michigan Avenue Chicago, Illinois, 60605 Direct telephone: 1-312-922-4400

#### Hotel Check-in and Check-out Times

Check-in time is 3:00 PM. Check-out time is 11:00 PM.

#### Childcare

For local child care information, please contact the concierge at the Palmer House for up-to-date recommendations: +1-312-726-7500.

## SIAM Corporate/Institutional Members

SIAM corporate members provide their employees with knowledge about, access to, and contacts in the applied mathematics and computational sciences community through their membership benefits. Corporate membership is more than just a bundle of tangible products and services; it is an expression of support for SIAM and its programs. SIAM is pleased to acknowledge its corporate members and sponsors. In recognition of their support, non-member attendees who are employed by the following organizations are entitled to the SIAM member registration rate.

#### Corporate/Institutional Members

The Aerospace Corporation Air Force Office of Scientific Research AT&T Laboratories - Research Bechtel Marine Propulsion Laboratory The Boeing Company CEA/DAM Department of National Defence (DND/ CSEC) DSTO- Defence Science and Technology Organisation Hewlett-Packard **IBM** Corporation IDA Center for Communications Research, La Jolla IDA Center for Communications Research, Princeton Institute for Computational and **Experimental Research in Mathematics** (ICERM)

Institute for Defense Analyses, Center for Computing Sciences

Lawrence Berkeley National Laboratory Lockheed Martin

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Mathematical Sciences Research Institute

Max-Planck-Institute for Dynamics of Complex Technical Systems

Mentor Graphics

National Institute of Standards and Technology (NIST)

National Security Agency (DIRNSA)

Oak Ridge National Laboratory, managed by UT-Battelle for the Department of Energy

Sandia National Laboratories

Schlumberger-Doll Research

Tech X Corporation

U.S. Army Corps of Engineers, Engineer Research and Development Center United States Department of Energy

List current May 2014.

#### **Funding Agency**

SIAM and the Conference Organizing Committee wish to extend their thanks and appreciation to the U.S. National Science Foundation for its support of the Workshop Celebrating Diversity (WCD).



## Leading the applied mathematics community . . .

Join SIAM and save!

SIAM members save \$130 on full registration for the 2014 SIAM Annual Meeting! Join your peers in supporting the premier professional society for applied mathematicians and computational scientists. SIAM members receive subscriptions to *SIAM Review, SIAM News*, and Unwrapped, and enjoy substantial discounts on SIAM books, journal subscriptions, and conference registrations.

If you are not a SIAM member and paid the Non-Member or Non-Member Mini Speaker/Organizer rate to attend the conference, you can apply the difference between what you paid and what a member would have paid (\$130 for a Non-Member and \$65 for a Non-Member Mini Speaker/ Organizer) towards a SIAM membership. Contact SIAM Customer Service for details or join at the conference registration desk.

If you've already paid the Non-Member registration fee for the conference, we'll deduct the \$130 member discount from your dues – join for 18 months of membership through 2015 for \$83, or join for the rest of 2014 for just \$12.

If you've already paid the Non-Member Mini Speaker/Organizer registration fee for the conference, we'll deduct the \$65 member discount from your dues – join for 18 months of membership through 2015 for \$148, or join for the rest of 2014 for just \$77.

Free Student Memberships are available to students who attend an institution that is an Academic Member of SIAM *www.siam.org/membership/acadlist.htm*, are members of Student Chapters of SIAM, or are nominated by a Regular Member of SIAM.

Join onsite at the registration desk, go to *www.siam.org/joinsiam* to join online or download an application form, or contact SIAM Customer Service

Telephone: +1-215-382-9800 (worldwide); or 800-447-7426 (U.S. and Canada only)

Fax: +1-215-386-7999

E-mail: membership@siam.org Postal mail:

Society for Industrial and Applied Mathematics

3600 Market Street, 6th floor

Philadelphia, PA 19104-2688 USA

#### 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 Grand Ballroom and Red Lacquer Room will have two (2) screens, one (1) data projector and one (1) overhead projector. Cables or adaptors for Apple computers are not supplied, as they vary for each model. Please bring your own cable/adaptor if using an Apple computer.

All other session rooms will have one (1) screen and one (1) data projector. Cables or adaptors for Apple computers are not supplied, as they vary for each model. Please bring your own cable/adaptor if using an Apple computer. Overhead projectors will be provided only when requested.

If you have questions regarding availability of equipment in the meeting room of your presentation, or to request an overhead projector for your session, please see a SIAM staff member at the registration desk.

#### **Internet Access**

Attendees staying within the SIAM room block at the Palmer House will have guest room Internet access at no fee. Additionally, complimentary wireless Internet access is available in the conference meeting space. This service is being provided at no additional cost to attendees.

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



Order your copies @ www.worldscientific.com

#### **Registration Fee Includes**

- · Access to email facilities
- Admission to AN14 technical sessions
- Coffee breaks daily
- Exhibit Hall Admission •
- Poster Session
- Room set-ups and audio/visual equipment
- SIAM Business Meeting (for SIAM members)
- SIAM Events Mobile App
- Welcome Reception

In addition, the following events are available to attendees at no additional cost. The events are subsidized by SIAM and are not covered by the registration fees.

- Career Fair, Graduate Student Reception, and Industry Member Reception
- Community Reception
- Prizes and Awards Luncheon
- Professional Development Evening •

#### Job Postings

Please check with the SIAM registration desk regarding the location of the job postings board or visit http://jobs.siam.org.

#### **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. The books table will close at 4:00 PM on Thursday, July 10.

#### Important Notice to Poster **Presenters**

The poster session is scheduled for Wednesday, July 9 from 12:30-2:00 PM. Poster presenters may set up their poster material on the provided 4' x 8' poster boards in the Exhibit Hall beginning Monday, July 7 at 12:30 PM. All materials must be posted by 12:30 PM on Wednesday, July 9, the official start time of the session. Posters will remain on display through Thursday, July 10. Poster displays must be removed by 3:30 PM. Posters remaining after this time will be discarded. SIAM is not responsible for discarded posters.

#### **Conference Sponsor**

**IBM Research** 

#### Name Badges

A space for emergency contact information is provided on the back of your name badge. Help us help you in the event of an emergency!

#### Comments?

Comments about SIAM meetings are encouraged! Please send to:

Cynthia Phillips, SIAM Vice President for Programs (vpp@siam.org).

#### **Special Events**

Sunday, July 6 5:00-6:00 PM

- Student Orientation Wabash – 3rd Floor
- 6:00-8:00 PM Welcome Reception Empire - Lobby Level

#### Monday, July 7

• 7:15-9:15 PM Career Fair, Graduate Student Reception, and Industry Member Reception Empire - Lobby Level

#### **Tuesday, July 8**

• 12:50-2:15 PM

Prizes and Award Luncheon The Hilton Chicago (720 South Michigan Avenue)

#### • 7:15-8:00 PM

SIAM Business Meeting (for SIAM members)

Grand Ballroom, 4th Floor

Complimentary beer and wine will be served.

#### Wednesday, July 9

- 11:50 AM-12:30 PM Poster Blitz Grand Ballroom – 4th Floor
- 12:30-2:00 PM Poster Session Exhibit Hall



6:15-8:15 PM Community Lecture and Reception Empire - Lobby Level

#### Thursday, July 10

• 6:15-9:15 PM Professional Development Evening Red Lacquer – 4th Floor

(See page 15 for additional details about these Special Events)

#### **Please Note**

SIAM is not responsible for the safety and security of attendees' computers. Do not leave your laptop computers unattended. Please remember to turn off your cell phones, pagers, etc. during sessions.

#### **Recording of Presentations**

Audio and video recording of presentations at SIAM meetings is prohibited without the written permission of the presenter and SIAM.

#### Social Media

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 the 2014 SIAM Annual Meeting is #SIAMAN14.





General Information







## **General Information**

#### The SIAM 2014 Mobile App Powered by TripBuilder<sup>®</sup>

To enhance your conference experience, we're providing a state-of-the-art mobile app to give you important conference information right at your fingertips. With this TripBuilder Event Mobile app, you can:

- Create your own custom schedule
- View Sessions, Speakers, Exhibitors and more
- Take notes and export them to your email
- View Award-Winning TripBuilder Recommendations for the meeting location
- Get instant Alerts about important conference info
- Get instant Alerts about important conference info

#### SIAM 2014 Mobile App

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## Visit the Exhibits

Please talk to company representatives about products and services that are important to you! Enjoy free coffee during coffee breaks. Visit the exhibits during these hours:

> Monday 9:30 AM-4:30 PM Tuesday 9:30 AM-4:30 PM Wednesday 9:30 AM-4:30 PM Thursday 9:30 AM-4:30 PM

#### AMS Booth #109

The American Mathematical Society was founded in 1888 to further the interests of mathematical research and scholarship. The AMS serves over 30,000 individual members worldwide through meetings, programs, and professional services designed to foster communication, collaboration, and public awareness of the mathematical sciences. The AMS publishes books, journals (electronic and print), and MathSciNet-the Mathematical Reviews Database. Our top-tier research publications span the entire spectrum of pure and applied mathematics for professionals, graduate students, and advanced undergraduates. For more information go to www.ams.org.

#### Cambridge University Press Booth #108

Cambridge's publishing in books and journals combines state-of-the-art content with the highest standards of scholarship, writing and production. Visit our stand to browse new titles, available at a 20% discount, and to pick up sample issues of our journals. Visit our website to see everything we do:

www.cambridge.org/us/academic

#### DeGruyter Booth #103

The independent academic publisher De Gruyter can look back at an over 260 year history. Headquartered in Berlin, De Gruyter publishes over 1,300 new titles each year in the humanities, medicine, natural sciences, and law, more than 650 journals, and a broad range of digital media. The Group owns the imprints De Gruyter Akademie Forschung, Birkhäuser, De Gruyter Mouton, De Gruyter Oldenbourg, De Gruyter Open, and De Gruyter Saur. In addition, due to a distribution agreement with the American University Press Harvard University Press (HUP) De Gruyter provides all HUP eBooks. www.degruyter.com

#### Digital Product Simulation Inc. Booth #105

DPS is originally a French company specialized in CAD and CAE integration within CATIA V5 environment. DPS provides services and consulting and also develop its own products through its strong partnership with Dassault Systemes. The US subsidiary, based in the Detroit area has been created in the end of 2011 to address the US market. Due to the development of PLM platforms DPS has developed his activity to the whole simulation lifecycle as well, becoming a distributor of Dymola a software enabling to model and simulate multiphysics complex systems using the Modelica language and acausality.

#### Elsevier Booth # 100

Elsevier publishes world-class mathematics content, from journals and books to online solutions. Find out about our many initiatives for the mathematics community, such as the open archives giving free access to over 165,000 articles via our website: www.elsevier.com/mathematics.

#### International Atomic Energy Agency (IAEA) Booth #107

The IAEA is a science and technology-based organization headquartered in Vienna, Austria that serves as the global focal point for nuclear cooperation and nonproliferation. Brookhaven National Laboratory's (BNL) International Safeguards Project Office recruits for the DOE and the International Atomic Energy Agency (IAEA). The IAEA needs scientists and engineers, electronic and instrumentation specialists, software developers, and experts in information gathering and analysis.

#### MathWorks Booth #102

The MATLAB and Simulink product families are fundamental applied math and computational tools at the world's educational institutions. Adopted by more than 5000 universities and colleges, MathWorks products accelerate the pace of learning, teaching, and research in engineering and science. MathWorks products also help prepare students for careers in industry worldwide, where the tools are widely used for data analysis, mathematical modeling, and algorithm development in collaborative research and new product development. Application areas include data analytics, mechatronics, communication systems, image processing, computational finance, and computational biology. For more information, visit www.mathworks.com/academia.

#### Oxford University Press Booth #104

Oxford University Press is a publisher of some of most respected and prestigious books and journals in the world. Our journals include those of the Institute of Mathematics and its Applications (IMA). Visit our booth or *www.oup.com* for more information.

#### NSF Math Institutes Booth # 200

The NSF supports eight mathematical sciences research institutes. The goals of the institutrs include advancing research, increasing the impact of math in other disciplines, and expanding the talent base of those engaged in math research within the United States. The institutes have proven effective in helping to reach these goals. Come by the NSF Institutes booth to learn about upcoming programs and events.

#### Princeton University Press Booth # 101

New books on display include Beautiful Geometry, by Maor and Jost, The Best Writing on Mathematics 2013, Undiluted Hocus-Pocus( the autobiography of Martin Gardner), Math Bytes by Tim Chartier, and Everyday Calculus by Oscar Fernandez . Adoption copies of textbooks are available including new books for courses in number theory, logic, and computational science. Get a sneak peek at the forthcoming fall titles including Zombie Calculus by Colin Adams and Hidden Markov Processes by M. Vidyasagar.

## Visit the Exhibits

#### SIAM

#### Booth#201-203-205-207-209

Visit the SIAM tabletops to check out our many recently published titles along with a large assortment of other acclaimed SIAM books, all available with generous member and attendee discounts. You'll also find sample issues of SIAM's renowned journals, along with information and applications for anyone interested in becoming a SIAM member. And don't forget to pick up a copy of SIAM News for the road! Be sure to visit SIAM on the Web, too, at *www.siam.org*.

#### Springer Science+ Business Media Booth #106

Come see Springer & Birkhäuser's key applied mathematics titles! Learn about our innovative publishing model, including Open Access. Follow SpringerMath on Twitter or like our Facebook page to receive the latest updates.

#### **Tabletop Displays**

- Academy of Mathematics and Systems Science
- Association of Women in Mathematics (AWM)
- Kadon Enterprises, Inc.

This exhibitor list is current at press time.

## Visit the Exhibits!

The Palmer House, Chicago, Illinois, USA

## 2014 SIAM ANNUAL MEETING

JULY 7-11, 2014 THE PALMER HOUSE CHICAGO, ILLINOIS, USA

#### **Exhibit Hours**

Monday, July 7 9:30 AM-4:30 PM

Tuesday, July 8 9:30 AM-4:30 PM

Wednesday, July 9 9:30 AM-4:30 PM

Thursday, July 10 9:30 AM-4:30 PM



Booth Exhibitors	Booth #
AMS	
Cambridge University Press	
DeGruyter	103
Digital Product Simulation Inc.	105
Elsevier	100
International Atomic Energy Agency	
MathWorks	102
NSF Math Institutes	200
Oxford University Press	
Princeton University Press	
SIAM	203-205-207-209
Springer	106

#### **Tabletop Exhibitors**

Academy of Mathematics and Systems Science Association for Women in Mathematics (AWM) Kadon Enterprises

Coffee breaks will be served only in the exhibit hall.

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## Association for Women in Mathematics (AWM) Workshop

Monday, July 7 - Wednesday, July 9, 2014

Association for Women in Mathematics (AWM) Workshop for Women Graduate Students and Recent PhDs

Held in conjunction with the 2014 SIAM Annual Meeting

The Association for Women in Mathematics (AWM) plans a workshop from Monday morning through Wednesday, July 9, 2014. AWM and SIAM welcome your participation.

There is NO additional registration fee for this AWM workshop. The minisymposia, poster session and award lecture are open to all SIAM meeting attendees.

AWM is grateful to SIAM and their Conference Department for their efforts on behalf of the workshop and all AWM activities. AWM also wishes to express its gratitude to the U.S. National Science Foundation and the U.S. Department of Energy for their support of the AWM workshop.

Monday, July 7

MS5 AWM Workshop - Career Panel: Women and Challenges in Mathematics, Science, and Engineering I

SP1 AWM-SIAM Sonia Kovalevsky Lecture: The Evolution of Complex Interactions in Non-Linear Kinetic Systems Irene M. Gamba, University of Texas, Austin, USA

MS19 AWM Workshop - Career Panel: Women and Challenges in Mathematics, Science, and Engineering II

Tuesday, July 8

MS33 AWM Meeting - Workshop: Research Talks by Recent Ph.D.s I MS49 AWM Meeting - Workshop: Research Talks by Recent Ph.D.s II

Wednesday, July 9

Poster Session

## Workshop Celebrating Diversity (WCD)

Organizers:

Susan E. Minkoff, University of Texas at Dallas, USA Cristina Villalobos, University of Texas - Pan American, USA Stephen A. Wirkus, Massachusetts Institute of Technology, USA

This annual event provides a chance for students to listen to technical talks presented by minority graduate students. The workshop is intended to accomplish several goals:

- To send a clear, explicit message of enthusiastic welcome and support from SIAM to members of under-represented groups. The workshop is deliberately held as part of a regular SIAM meeting so that the participants can combine the experiences of attending a regular scientific meeting and a special occasion dedicated to them.
- To bring together a mixture of people from different levels of age and professional experience, ranging from undergraduate students to senior scientists.
- To provide an opportunity for minority graduate students to present their research.
- To provide an informal, comfortable setting (a lunch) where all the students can meet applied and computational mathematicians with a wide variety of jobs in academia, national laboratories, industry, and government.

SIAM and the Conference Organizing Committee wish to extend their thanks and appreciation to the U.S. National Science Foundation for its support of the Workshop Celebrating Diversity.

There is no additional registration fee to attend WCD sessions. The minisymposia are open to all SIAM Meeting attendees.

#### Workshop Celebrating Diversity Sessions

#### Tuesday, July 8

MS32 Mathematical Modeling of Health Problems MS48 Applications in Human Performance, Counterterrorism, and Risk Analysis

#### Wednesday, July 9

MS63 Dynamical Models in Applied Mathematics MS79 Theoretical and Numerical Results in Dynamical Systems

#### Thursday, July 10

MS95 Analysis and Applications of Optimization MS109 Modeling and Algorithm Development for Mathematical Geosciences



## **Student Days**

#### Students - Activities just for you at the 2014 SIAM Annual Meeting in Chicago, Illinois, USA

Student Days at the 2014 SIAM Annual Meeting is a day for students and about students. Organizers have got it all covered this year, with activities and sessions where students can meet with both peers and professionals in their field, participate in a career fair, attend an information session on hot areas for jobs and research, and network with SIAM Student Chapters from all over the world.

#### Goals

Organized by the SIAM Education Committee (Chaired by Peter Turner, Clarkson University), Student Days are designed to encourage student participation in SIAM, to help students learn more about applied mathematics and computational science as both fields of study and as careers, and to provide a forum for emerging mathematicians to learn about their field from the professionals who know the answers. Organizers also hope to encourage those in the learning community to establish new student chapters of SIAM and to promote interaction between students and SIAM leadership.

#### **Events and Happenings**

Student Days sessions include presentations by student chapter representatives and the winners of the SIAM Award in the Mathematical Contest in Modeling (MCM) and the SIAM Student Paper Prizes. In addition, students can attend plenary sessions from the SIAM Annual Meeting (AN14). Other activities that will enhance the meeting for students include a special orientation prior to Sunday's welcome reception, a student lounge, and a session for students with selected conference invited speakers. Other activities that will be of interest to students include the industrial panel and career fair on Monday, the poster blitz and poster session on Wednesday, the community lecture on Wednesday, and the book giveaway and professional development activities on Thursday.

#### Meeting with Leaders and Influencing SIAM

(by invitation only)

Student Days 2014 will also feature the Student Chapter Meeting with SIAM Leadership. This meeting gives faculty advisors and student chapter representatives the opportunity to meet with key decision makers to discuss ideas for improving student chapters and ways that SIAM can meet the needs of current and future student members all over the world. Each chapter selects one student member to attend the event as its chapter representative.

#### Finding Jobs for You

Monday, July 7, features events to help you find a job and develop your career. An industry panel organized by SIAM Vice President for Industry, Thomas Grandine, will offer insights into what it's like to work in industry. The panel will be followed by a Career Fair and a reception for industry representatives and graduate students. The Career Fair provides students the opportunity to interact with prospective employers from government and industry who are specifically interested in SIAM's unique community. Find out what prospective employers are looking for and what each has to offer. A Career Fair student guide will be available online in the spring. Professional development evening is Thursday, July 10. In addition to a panel discussion, there will be an opportunity to network with professionals in the field.

## Student Days Schedule

...and other Activities of Interest to Students

Sunday, July 6, 2014

5:00 PM - 6:00 PMStudent Orientation6:00 PM - 8:00 PMWelcome Reception

Workshops

	Monday, July 7, 2014
9:30 AM - 4:30 PM	Visit the student lounge in the Exhibit Hall
10:30 AM - 12:30 PM	Undergraduate Presentations (MS9)
4:00 - 6:00 PM	Undergraduate Presentations (MS23)
6:15 - 7:15 PM	Industry Panel
7:15 - 9:15 PM	Career Fair, Graduate Student Reception

Tuesday, July 8, 2014		
7:00 - 8:15 AM	Student Chapter meeting with SIAM Leadership (by invitation only)	
8:30 - 10:30 AM	SIAM Student Chapter Presentations (MS37)	
9:30 AM - 4:30 PM	Visit the student lounge in the Exhibit Hall	
10:30 - 11:00 AM	Coffee break	
11:00 - 11:45 PM	AN14 invited speakers	
12:50 - 2:15 PM	Prizes and Awards Luncheon (at the Hilton Chicago, 720 South Michigan Avenue)	
2:30 - 3:30 PM	John von Neumann Lecture	

## Student Days

3:30 - 4:00 PM	Coffee break
4:00 - 6:00 PM	Students informal meeting with Invited Speakers (MS53)
6:15 - 7:00 PM	Funding Agency Panel

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Wednesday, July 9, 2014		
8:30 - 10:30 AM	SIAM Student Chapter Presentations (MS68)	
9:30 - 4:30 PM	Visit the student lounge in the Exhibit Hall	
10:30 - 11:00 AM	Coffee break	
11:00 - 11:45 AM	AN14 Invited Speakers	
11:50 AM - 12:30 PM	Poster Blitz	
12:30 - 2:00 PM	Poster Session	
12:30 - 2:00 PM	Lunch break (attendees on their own)	
2:00 - 2:45 PM	AN14 Invited speaker	
3:00 - 3:30 PM	Reid Prize Lecture	
3:30 - 4:00 PM	Coffee break	
4:00 - 5:00 PM	2014 SIAM/MCM Award winners presentations (MS84)	
5:00 - 6:00 PM	2014 SIAM Student Paper Prize winners presentations (MS90)	
6:15 - 7:15 PM	I.E. Block Community Lecture	
7:15 - 8:15 PM	Community Reception	

Thursday, July 10, 2014

SIAM Book Giveaway - Exhibit Hall STUDENTS ONLY 4:00 - 4:30 PM **Professional Development Evening** 6:15 - 9:15 PM

## **Special Events**

Sunday, July 6		
<b>5:00 - 6:00 PM</b> Wabash-3rd Floor	<b>Student Orientation</b> This event on the Annual Meeting calendar is intended to enhance students' experience at the meeting by providing an introduction to some of the meeting organizers, to Chicago, and to the program. There are several new events and facilities to help students get the fullest benefit from the meeting. A few very short presentations will be followed by an opportunity to network with both fellow students and other attendees prior to the general welcome reception.	
<b>6:00 - 8:00 PM</b> Empire – Lobby Level	Welcome Reception The welcome reception is open to all attendees and their guests. Light hors d'oeuvres will be served. One "free drink" ticket is Included with each registration. A cash bar will be available for those who wish to purchase additional beverages.	
	Monday, July 7	
<b>6:15 - 7:15 PM</b> Grand Ballroom – 4 <sup>th</sup> Floor	Industry Panel: Motivating Industrial Participation and Collaboration	
<b>6:15 - 7:15 PM</b> Red Lacquer – 4 <sup>th</sup> Floor	Panel: Thinking of Writing a Book?	
<b>7:15 - 9:15 PM</b> Empire – Lobby Level	Career Fair, Graduate Student Reception and Industry Reception The SIAM Applied Mathematics and Computational Science Career Fair is an informational and interactive event at which employers and prospective employees can discuss careers. It is a great opportunity for prospective employees to meet government and industry representatives and discuss what they are looking for and what each employer has to offer. Complimentary light hors d'oeuvres, beer and wine will be served.	
	Career Fair :     Argonne National Laboratory     Boeing Company     MathWorks     School of Mathematics, Peking University	
	Organizations will be added to the growing list of Career Fair exhibitors as they confirm. For the most current list, visit http://www.siam.org/meetings/AN14/career/php	
	<ul> <li>Graduate Student Reception*</li> </ul>	
	Graduate students and new PhDs are especially urged to attend this event.	
	<ul> <li>Industry Member Reception*</li> </ul>	
	This reception is scheduled as a networking opportunity for attendees from industry.	
	* These three events are designed to be interactive.	

## **Special Events**

Tuesday, July 8

## 12:50 - 2:15 PM Prizes and Awards Luncheon The Hilton Chicago, 720 South Michigan Avenue This luncheon, being held at the Hilton Chicago, 720 South Michigan

Avenue, will recognize and honor this year's award recipients. The luncheon is open to all meeting attendees and is included in the registration fee, however, a reservation is required in advance. If you do not have a ticket, please see a SIAM representative at the registration desk. Tickets can be obtained through noon on Monday. See page 22 for the list of prizes and awards being presented.

#### 7:15 - 8:00 PM SIAM Business Meeting (open to SIAM members; complimentary beer and wine will be served) Grand Ballroom – 4<sup>th</sup> Floor

Wednesday, July 9

#### **Poster Blitz** 11:50 - 12:30 PM

Grand Ballroom – 4<sup>th</sup> Floor

Exhibit Hall

#### 12:30 - 2:00 PM **Poster Session**

New this year is the Poster Blitz followed immediately by an afternoon Poster Session! The Poster Blitz is comprised of brief 1-2 minute oral presentations by participating poster presenters. During the Poster Session presenters are present to discuss their posters. It is an informal setting, allowing presenters to discuss their research with individual attendees.

#### 6:15 - 8:15 PM I. E. Block Community Lecture and Reception

Lecture – Grand Ballroom – 4<sup>th</sup> Floor, Reception – Empire – Lobby Level

This event is open to all attendees, their guests and the local community.

Sep Kamvar, Massachusetts Institute of Technology, will deliver the community lecture from 6:15 to 7:15 PM, followed by the Community Reception from 7:15 to 8:15 PM. Complimentary light hors d'oeuvres, beer and wine will be served.

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Monday, July 7

#### 8:30 – 9:15 AM

IP1 Age of Networks Jennifer Tour Chayes, Microsoft Research, USA Grand Ballroom – 4<sup>th</sup> Floor

#### 9:20 - 10:05 AM

IC1 Equilibrium Analysis of Large Populations Dynamics Rene Carmona, Princeton University, USA Grand Ballroom – 4<sup>th</sup> Floor

#### 9:20 - 10:05 AM

IC2 Solving Stochastic Inverse Problems Using Sigma-Algebras on Contour Maps Donald Estep, Colorado State University, USA Red Lacquer – 4<sup>th</sup> Floor

#### 2:00 – 2:45 PM

SP1 AWM-SIAM Sonia Kovalevsky Lecture
The Evolution of Complex Interactions in Non-Linear Kinetic Systems
Irene M. Gamba, University of Texas at Austin, USA
Grand Ballroom – 4<sup>th</sup> Floor

#### 2:50 – 3:35 PM

IP2 Big Data, Sparse Information: Bayesian Inference for Large-scale Models, with Application to Inverse Modeling of Antarctic Ice Sheet Dynamics
 Omar Ghattas, University of Texas at Austin, USA
 Grand Ballroom – 4<sup>th</sup> Floor

Tuesday, July 8

#### 11:00 AM - 11:45 AM

IC3 Computational Biology in the 21st Century: Making Sense out of Massive Data Bonnie Berger, Massachusetts Institute of Technology, USA Grand Ballroom – 4<sup>th</sup> Floor

#### 11:00 AM - 11:45 AM

IC4 The Evolution of Combinatorial Solvers for Laplacian Linear Systems Sivan A. Toledo, Tel Aviv University, Israel Red Lacquer – 4<sup>th</sup> Floor

#### 11:50 AM - 12:35 PM

IP3 Pattern Recognition with Weakly Coupled Oscillatory Networks Katharina Krischer, Technical University of Munich, Germany Grand Ballroom – 4<sup>th</sup> Floor

#### 2:30 PM - 3:30 PM

SP2 Fast, Accurate Tools for Physical Modeling in Complex Geometry
Leslie Greengard, Simons Foundation and Courant Institute of Mathematical Sciences, New York University, USA
Grand Ballroom – 4<sup>th</sup> Floor

Wednesday, July 9

#### 11:00 AM - 11:45 AM

IC5 Optimization Algorithms for Machine Learning Jorge Nocedal, Northwestern University, USA Grand Ballroom – 4<sup>th</sup> Floor

#### 11:00 AM - 1:45 AM

IC6 The Mathematical Problems of Isotropic-Nematic Interface Pingwen Zhang, Peking University, China Red Lacquer – 4<sup>th</sup> Floor

#### 2:00 PM - 2:45 PM

IP4 Scientific Computing in Movies and Virtual Surgery Joseph Teran, University of California, Los Angeles, USA Grand Ballroom – 4<sup>th</sup> Floor

#### 3:00 PM - 3:30 PM

 SP3 W. T. and Idalia Reid Prize in Mathematics Lecture On the Master Equation in Mean Field Theory
 Alain Bensoussan, The University of Texas at Dallas and City University of Hong Kong, Hong Kong Grand Ballroom – 4<sup>th</sup> Floor

#### 6:15 PM - 7:45 PM

SP4 I. E. Block Community Lecture
 Search and Discovery in Human Networks
 Sep Kamvar, Massachusetts Institute of Technology, USA
 Grand Ballroom - 4th Floor

Thursday, July 10

11:00 AM – 11:45 AM

IP5 Big Data Visual Analysis
 Christopher Johnson, University of Utah, USA
 Grand Ballroom – 4<sup>th</sup> Floor

11:50 AM - 12:35 PM

IP6 Virtual Electrophysiology Laboratory
Natalia A. Trayanova, Johns Hopkins University, USA
Grand Ballroom – 4<sup>th</sup> Floor

#### 2:00 PM - 2:45 PM

IP7 Unilever, Science and eScience: The Challenges Ahead Massimo Noro, Unilever, United Kingdom Grand Ballroom – 4<sup>th</sup> Floor

#### 3:00 PM - 3:30 PM

SP5 Julian Cole Lecture: Growth, Patterning, and Control in Nonequilibrium Systems John Lowengrub, University of California, Irvine, USA Grand Ballroom – 4th Floor

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Friday, July 11

11:00 AM – 11:45 AM IC7 The Statistics Behind the Discovery of the Higgs Boson Kyle Cranmer, New York University, USA Grand Ballroom – 4<sup>th</sup> Floor

11:00 AM – 11:45 AM IC8 Random Braids Jean-Luc Thiffeault, University of Wisconsin, Madison, USA Red Lacquer – 4<sup>th</sup> Floor

#### 11:50 AM - 12:35 PM

IP8 Evolutionary or Revolutionary? Applied Mathematics for Exascale Computing Jeffrey A. Hittinger, Lawrence Livermore National Laboratory, USA Grand Ballroom – 4<sup>th</sup> Floor

2:00 PM - 2:45 PM

IP9 Physics-based Animation Sound: Progress and Challenges Doug L. James, Cornell University, USA Grand Ballroom – 4<sup>th</sup> Floor

#### 3:00 PM - 3:30 PM

 SP6 Theodore Von Karman Prize Lecture Materials from Mathematics
 Richard James, University of Minnesota, USA Grand Ballroom – 4<sup>th</sup> Floor 21

## Prizes and Awards Luncheon

The Prizes and Awards Luncheon will be held in the Grand Ballroom of the Hilton Chicago, 720 South Michigan Avenue. The luncheon begins at 12:50 PM and the awards ceremony shortly thereafter. Please be sure to bring the ticket provided in your registration packet.

If you do not have a ticket but wish to attend the luncheon, be sure to see a SIAM staff member at the registration desk no later than noon on Monday, July 7.

The following Prizes, Awards and Fellows will be recognized:

#### I. E. Block Community Lecture

Sep Kamvar, Massachusetts Institute of Technology, USA

#### John von Neumann Lecture

Leslie F. Greengard, Simons Foundation and Courant Institute of Mathematical Sciences, New York University, USA

#### AWM-SIAM Sonia Kovalevsky Lecture

Irene M. Gamba, University of Texas at Austin, USA

#### Julian Cole Lectureship

John Lowengrub, University of California at Irvine, USA

#### Richard C. DiPrima Prize

Thomas D. Trogdon, Courant Institute of Mathematical Sciences, New York University, USA

#### George Pólya Prize

Adam W. Marcus, Yale University, USA and Crisply, LLC, USA Daniel A. Spielman, Yale University, USA Nikhil Srivastava, Microsoft Research, India

#### W. T. and Idalia Reid Prize in Mathematics Lecture

Alain Bensoussan, University of Texas at Dallas, USA and City University of Hong Kong, Hong Kong

## **Prizes and Awards Luncheon**

#### Theodore von Karman Prize

Weinan E, Princeton University and Richard D. James, University of Minnesota, USA

#### SIAM Award in the MCM

Problem A, the Continuous Problem Zhejiang University, P. R. China Students: **Yuan Gong, Shu Liu, Yandi Shen** Faculty Advisor: Jianxin Zhu

Problem B, the Discrete Problem Southwest University for Nationalities, P.R. China Students: **Yiping Liu, Yongyi Xie, Yao Zhang** Faculty Advisor: Professor Gaoping Li

#### **SIAM Student Paper Prizes**

Sean P. Cornelius, Northwestern University, USA Carlos Fernandez-Granda, Stanford University, USA Iain Smears, Oxford University, United Kingdom

#### SIAM Prize for Distinguished Service to the Profession

Arieh Iserles, University of Cambridge, United Kingdom

#### **SIAM Outstanding Paper Prizes**

Andrea L. Bertozzi, UCLA, and Arjuna Flenner, Naval Air Weapons Center Diffuse Interface Models on Graphs for Classification of High Dimensional Data

**Emmanuel J. Candès**, Stanford University; **Yonina C. Eldar**, Technion, Israel; **Thomas Strohmer**, University of California, Davis; and **Vladislav Voroninski**, Massachusetts Institute of Technology Phase Retrieval via Matrix Completion

Yurii Nesterov, Université catholique de Louvain, Belgium Efficiency of Coordinate Descent Methods on Huge-Scale Optimization Problems

## **Prizes and Awards Luncheon**

The Class of 2014 Fellows will be recognized during the Prizes and Awards Luncheon.

Mark Ainsworth, Brown University John S. Baras, University of Maryland, College Park Lorenz T. Biegler, Carnegie Mellon University Ake Bjorck, Linkoping University, Emeritus Alfred M. Bruckstein, Technion - Israel Institute of Technology Suncica Canic, University of Houston Inderjit S. Dhillon, The University of Texas at Austin Vladimir L. Druskin, Schlumberger-Doll Research Leah Edelstein-Keshet, University of British Columbia Donald Estep, Colorado State University Bengt Fornberg, University of Colorado Boulder Omar Ghattas, The University of Texas at Austin Philip E. Gill, University of California, San Diego Solomon W. Golomb, University of Southern California Jan S. Hesthaven, Ecole Polytechnique Federale de Lausanne Dorit S. Hochbaum, University of California, Berkeley Masakazu Kojima, Tokyo Institute of Technology and JST CREST Jeffrey C. Lagarias, University of Michigan Jean B. Lasserre, Centre National de la Recherche Scientifique and Institute of Mathematics, University of Toulouse Tai-Ping Liu, Academia Sinica Mitchell B. Luskin, University of Minnesota Nancy K. Nichols, University of Reading Peter J. Olver, University of Minnesota Yuriko Yamamuro Renardy, Virginia Polytechnic Institute and State University L. Ridgway Scott, University of Chicago Mikhail Shashkov, Los Alamos National Laboratory, X-Computational Physics Division Christine A. Shoemaker, Cornell University Valeria Simoncini, Universita di Bologna Zdenek Strakos, Charles University in Prague Bernd Sturmfels, University of California, Berkeley Jorge X. Velasco-Hernandez, Instituto de Matematicas UNAM Michael S. Vogelius, Rutgers, The State University of New Jersey

## Nominate a SIAM Fellow Class of 2015 nominations now open

## fellows.siam.org/information

Do you have colleagues who have made distinguished contributions to the disciplines of applied mathematics and computational science? You can nominate up to two of them to be considered for the SIAM Fellows Class of 2015. The SIAM Fellows Program honors exceptionally talented people in our community and makes their accomplishments visible to a wider audience. Up to 31 SIAM members will be selected for this honor in 2015. Support your profession by helping SIAM identify members who have made the most significant contributions to our field.

#### Criteria for selection as a SIAM Fellow

- Research excellence or
- Excellence in industrial work (that might or might not involve traditional research) or
- · Excellence in educational activities that reach a broad audience or
- Other forms of excellence directly related to the goals of SIAM

#### To make a nomination go to nominatefellows.siam.org.

Only nominations completed by November 3, 2014, will be considered for 2015 Fellowships.

The list of newly announced 2014 SIAM Fellows can be found at *fellows.siam.org*.



SIAM SOCIETY for INDUSTRIAL and APPLIED MATHEMATICS 5/14



## June 15-June 26, 2015 Delphi, Greece

## **RandNLA:** Randomization in Numerical Linear Algebra



The sixth Gene Golub SIAM Summer School will take place at the European Cultural Centre of Delphi (ECCD), located in Delphi, Greece.

The goal of *RandNLA* is to design better algorithms for numerical linear algebra problems by using randomization, e.g., random sampling and random projections. It is a topic that has received a great deal of interdisciplinary interest in recent years, with contributions coming from numerical linear algebra, theoretical computer science, scientific computing, statistics, optimization, data analysis, and machine learning, as well as application areas such as genetics, physics, astronomy, and internet modeling.

The summer school is designed to bring graduate students up to date on the state of

the art in the theory, numerical aspects, and data analysis applications of *RandNLA*. Since *RandNLA* is quite interdisciplinary, students will be selected from a wide range of backgrounds. Thus the courses are designed to provide students with an overview of *RandNLA* and also an understanding of the complementary strengths and weaknesses that different traditional research areas bring to this new research area.

The school will include four classes, three tutorials, and several associated project working group sessions. The topics include:

- Interdisciplinary Overview of RandNLA
- Numerical Analysis Perspectives on RandNLA
- Theoretical Computer Science Perspectives on RandNLA
- RandNLA in Applied Mathematics
- Solving Symmetric Diagonally-Dominant Systems in Input Sparsity Time
- Matrix Concentration Bounds and Graph Sparsification
- Industrial Uses of RandNLA

The Summer school is being organized by

- Petros Drineas, Rensselaer Polytechnic Institute, USA
- Efstratios Gallopoulos, University of Patras, Greece
- Ilse Ipsen, North Carolina State University, USA
- Michael W. Mahoney, University of California at Berkeley, USA

Applicants selected to participate pay no registration. Funding for local accommodations and meal expenses will be available for all participants. Limited travel funds are also available.

#### Application deadline: February 1, 2015

As information is available on the courses and on how to apply, it will be posted at: www.siam.org/students/g2s3/index.php

Sponsored by SIAM through an endowment from the estate of Gene Golub. For more information about prior summer schools and Professor Gene Golub go to www.siam.org/students/g2s3/.



Society for Industrial and Applied Mathematics

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# Wanted: Challenge Problems

Problem Ideas Being Sought for High School Math Modeling Competition

## Moody's Mega Math Challenge \$125,000 IN SCHOLARSHIP PRIZES!

Moody's Mega Math (M<sup>3</sup>) Challenge is an Internet-based, applied mathematics contest for high school juniors and seniors. M<sup>3</sup> takes place each year in March. Teams of 3-5 students are given 14 hours to solve an open-ended, math modeling problem related to a real-world issue. Winners receive college scholarships totaling \$125,000. Registration and participation are free.

The goal of the Challenge is to motivate students to study and pursue careers in STEM disciplines, especially applied mathematics, computational science, economics, and finance. The problem is revealed to the students only after they login on their selected Challenge day. Solutions are judged by professional mathematicians on the approach and methods used and the creativity displayed in problem solving and mathematical modeling.

Coming up with great problem ideas year after year is not easy, and that's where we're hoping you can help.

#### **Required problem characteristics**

- Accessibility to 11th and 12th graders
- · Suitability for solution in 14 hours
- Possibility for significant mathematical modeling
- + Topic of current interest involving interdisciplinary problem solving and critical thinking skills (e.g., humanitarian or environmental concerns, social media or online community challenges economic or financial problems)
- Availability of enough data for a variety of approaches and depth of solutions ٠ (but no easy answers found on the web
- Problem is broken into a few pieces
- References are identified that will be helpful for getting students started а.
- Please submit problem statement idea in the format of previous Challenge • problems

#### **Problem structure**

Within the problem statement, there should be three questions for teams to answer:

- Question One: The warm up Every serious team can answer.
- · Question Two: The guts Framed so that every team can have some success and many teams can cover it well.
- · Question Three: The discriminator Many teams can do something, while only a few will have striking results.

#### Honoraria

- \$150 for problems found suitable to add to the M<sup>3</sup> problem reserve "bank"
- \$300 for problems posted on the website as sample modeling problems
- \$1,000 for problems selected from the reserve bank to be used as "the" Challenge problem

View previous problem statements at http://m3challenge.siam.org/problem/.

#### To submit new ideas or get additional information, contact:

Michelle Montgomery Project Director, Moody's Mega Math Challenge SIAM - Society for Industrial and Applied Mathematics 3600 Market Street, 6th Floor, Philadelphia, PA 19104 USA

Montgomery@siam.org M3Challenge@siam.org http://m3challenge.siam.org

THE MOODY'S FOUNDATION http://m3challenge.siam.org

Society for Industrial and Applied Mathematics





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## AN14 Program

## 2014 SIAM ANNUAL MEETING (AN14)



Slow manifolds, adapted from Desroches, Guckenheimer, Krauskopf, Kuehn, Osinga and Wechselberger, "Mixed-mode oscillations with multiple time scales," SIAM Review 54(2) (2012) 211-288

## Sunday, July 6

Registration 7:30 AM-8:00 PM Room:State - 4th Floor

SIAM Workshop on Network Science (July 6-7, 2014 -separate fees apply) 8:00 AM-5:00 PM Room:Monroe - 6th Floor

SIAM Workshop on Exascale Applied Mathematics Challenges and Opportunities (July 6, 2014 -separate fees apply) 8:00 AM-5:00 PM Room:Adams - 6th Floor Sunday, July 6 **Student Orientation**  *5:00 PM-6:00 PM Room:Wabash - 3rd Floor* 

Welcome Reception 6:00 PM-8:00 PM Room:Empire - Lobby Level

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## Monday, July 7

Committee on Committees and Appointments Breakfast Meeting 7:00 AM-8:30 AM

Room:Buckingham - 5th Floor

Registration 7:15 AM-4:30 PM Room:State - 4th Floor

**Opening Remarks** 8:15 AM-8:30 AM Room:Grand Ballroom - 4th Floor

## IP1 Age of Networks

8:30 AM-9:15 AM

Room:Grand Ballroom - 4th Floor

Chair: David F. Gleich, Purdue University, USA

Networks are becoming increasingly relevant in a host of domains. In the tech industry, we see the Internet, the WWW, and many online social networks. In economics, we are experiencing both the positive and negative effects of a global networked economy. In biomedical applications, the structure of gene regulatory networks is relevant for the treatment of many human diseases. In this talk, I describe quite generally models we are using to describe these networks, processes we are studying on the networks, algorithms we have devised for the networks, and finally, methods we are developing to indirectly infer network structure from measured data. I then focus on a couple of specific applications, including one to cancer genomics.

Jennifer Tour Chayes

Microsoft Research, USA

#### Monday, July 7

### IC1

#### Equilibrium Analysis of Large Populations Dynamics

9:20 AM-10:05 AM

Room:Grand Ballroom - 4th Floor

Chair: Chen Greif, University of British Columbia, Canada

The first part of the talk will review several applications, including bird flocking, information percolation in social networks, valuation of exhaustible resources, high frequency market making, emissions regulation, ..., for which models of large populations dynamics can be brought to bear. These models will be framed in the context of the theory of mean field games. The second part of the talk will present recent equilibrium existence results, and discuss some of the nagging computational challenges raised by the need for reasonable numerical approximations to these equilibria.

Rene Carmona Princeton University, USA

#### Monday, July 7

## IC2

#### Solving Stochastic Inverse Problems Using Sigma-Algebras on Contour Maps

9:20 AM-10:05 AM

Room:Red Lacquer - 4th Floor

Chair: Edmond Chow, Georgia Institute of Technology, USA

We describe recent work on the formulation and numerical solution of stochastic inverse problems for determining parameters in differential equations with stochastic data on output quantities. The new approach involves approximating the generalized contour maps representing set-valued inverse solutions, using the approximate contour maps to define a geometric structure on events in the sigma-algebra for the probability space on the parameter domain, and exploiting the structure to define and approximate probability distributions in the space. We will present various examples, including high-dimensional problems involving spatially varying parameter fields in storm surge models.

Donald Estep Colorado State University, USA

Coffee Break 10:00 AM-10:30 AM Room: Exhibit Hall



#### MT1 Communicating Math to Journalists

10:30 AM-12:30 PM

Room:Salon 1 - 3rd Floor

#### Organizer: Rachel Levy, Harvey Mudd College, USA

Join video journalist Flora Lichtman, whose work has appeared on NPR, the New York Times and Popular Science, and Grandma got STEM blogger Rachel Levy (Harvey Mudd College) for a minitutorial designed to help you disseminate your research to news outlets. In the minitutorial you will learn how to develop productive collaborations with reporters, and see examples of ways reporters can help make your technical communication clearer. You will practice how to craft a message, how to avoid miscommunication, and how to develop a press kit.

Rachel Levy, *Harvey Mudd College, USA* Flora Lichtman, *NPR, USA* 

#### Monday, July 7

#### MS1 Leader Selection in Multiagent Systems Under Disturbances

10:30 AM-12:30 PM

Room: Grand Ballroom - 4th Floor

Selecting a number of agents and controlling them to effectively reject noise in multi-agent systems is known as the leader selection problem. This combinatorial problem has recently received significant attention due to its various applications ranging from vehicular formations to network security. A diverse set of theoretical and computational results have been obtained using tools from convex optimization, submodular optimization, game theory, and information centrality theory. In this minisymposium, we briefly survey recent developments and discuss their advantages and shortcomings. The talks are selected to target audience with backgrounds in dynamical systems, optimization, and complex networks.

#### Organizer: Fu Lin

Argonne National Laboratory, USA

10:30-10:55 Leader Selection in Noisy Multi-agent Systems: A Resistance Distance Approach

Fu Lin, Argonne National Laboratory, USA

11:00-11:25 On Leader Selection for Performance and Controllability Andrew Clark, University of Washington, USA

#### 11:30-11:55 Network Adaption for Leader-Follower Networks

Airlie Chapman and Mehran Mesbahi, University of Washington, USA

#### 12:00-12:25 Joint Centrality and Optimal Leader Selection in Noisy Networks

*Katherine Fitch* and Naomi E. Leonard, Princeton University, USA

#### Monday, July 7

#### MS2 Optimization and Learning for Large-Scale Data Analysis

10:30 AM-12:30 PM

Room:Red Lacquer - 4th Floor

This minisymposium will survey new methods and frameworks that stretch the limits of what types of analysis are possible for large-scale data. Covering topics from large-scale object-feature-array factorization and learning to optimization-based methods for loss/risk minimization, this symposium will highlight work on the analysis of the underlying numerical methods as well as implementation of these methods on highperformance computing environments.

#### **Organizer: Stefan Wild**

Argonne National Laboratory, USA

#### 10:30-10:55 Bayesian Estimation for Mixtures of Linear Subspaces with Variable Dimension

Brian St. Thomas and Sayan Mukherjee, Duke University, USA; Lek-Heng Lim, University of Chicago, USA

#### 11:00-11:25 Efficient Quasi-Newton Proximal Method for Large Scale Sparse Optimization

Xiaocheng Tang, Lehigh University, USA

#### 11:30-11:55 Distributed Coordinate Descent Method for Learning with Big Data

*Martin Takac* and Peter Richtarik, University of Edinburgh, United Kingdom

#### 12:00-12:25 Nomad: Non-Locking, Stochastic Multi-Machine Algorithm for Asynchronous and Decentralized Matrix Factorization

S V N Vishwanathan, Purdue University, USA

#### MS3 Numerical Analysis for (Multi) Linear Algebra Graph Mining

10:30 AM-12:00 PM

#### Room: Crystal - 3rd Floor

Modern relational datasets have rich topology and network scientists seek topological understanding. Recent research efforts propose linear algebra and tensor analysis techniques for classifying, ranking, and clustering data entities. The majority of the focus has been on choosing what to calculate and how to do it efficiently. It is frequently the case that: (i) poorly converged algebraic solutions often yield decent data mining results and (ii) highly accurate algebraic solutions are sometimes insufficient. We present examples regarding mapping numerical convergence tolerances to the eventual data mining decisions made with the algorithms and develop theory to understand (i) and (ii).

#### Organizer: Geoffrey D. Sanders

Lawrence Livermore National Laboratory, USA

#### **Organizer: Alexander Breuer**

Technische Universität München, Germany

#### **Organizer: Tobias Jones** *University of Colorado Boulder, USA*

10:30-10:55 Numerical Analysis of

#### **Spectral Clustering Algorithms (SCAs)** *Geoffrey D. Sanders* and Lance Ward,

Lawrence Livermore National Laboratory, USA; Tobias Jones, University of Colorado Boulder, USA

#### 11:00-11:25 Algebraic Distance on Graphs with Applications to Large-Scale Optimization and Data Analysis

Jie Chen, Argonne National Laboratory, USA; *Ilya Safro*, Clemson University, USA

#### 11:30-11:55 Krylov Subspaces for Approximation of the Spectral Embedding

Alexander Breuer, U.S. Army Research Laboratory, USA

#### Monday, July 7

#### MS4 Numerical Methods for the Ocean and Atmosphere -Part I of II

10:30 AM-12:30 PM

#### *Room:Salon 3 - 3rd Floor* For Part 2 see MS17 Organized by SIAG/GS

This minisymposium describes some recent progress in the numerical solution of partial differential equations, as applied to oceanic and atmospheric flows. Topics addressed by the speakers include adaptive grids, multiple time scales, multi-layer models, and spatial discretization schemes including discontinuous Galerkin, finite volume, and spectral element methods.

#### **Organizer: Robert L. Higdon** *Oregon State University, USA*

10:30-10:55 A Unified Discontinuous Galerkin Approach for Solving the Two- and Three-Dimensional Shallow Water Equations

*Ethan Kubatko*, The Ohio State University, USA

11:00-11:25 Analysis of Adaptive Mesh Refinement for Imex Discontinuous Galerkin Solutions of the Compressible Euler Equations with Application to Atmospheric Simulations

Michal A. Kopera and Francis X. Giraldo, Naval Postgraduate School, USA

#### 11:30-11:55 A Discontinuous Galerkin Non-Hydrostatic Model with An Operator-Split Semi-Implicit Time Stepping Scheme

Ram Nair, National Center for Atmospheric Research, USA; Lei Bao, University of Colorado Boulder, USA

#### 12:00-12:25 Pressure Forcing and Time Splitting for Discontinuous Galerkin Approximations to Layered Ocean Models

Robert L. Higdon, Oregon State University, USA

#### Monday, July 7

## MS5

#### AWM Workshop - Career Panel: Women and Challenges in Mathematics, Science, and Engineering I

10:30 AM-12:30 PM

Room:Salon 2 - 3rd Floor

#### For Part 2 see MS19

Increasingly, women are earning advanced degrees in mathematics, science, and engineering and are entering the workforce. Yet these women still face a variety of challenges – from lower salaries to juggling a family with a career. We will share experiences, ideas, and strategies that can help women develop and advance their careers and increase their contribution to science and technology. Topics include:

- Analyzing success factors and barriers
- Enhancing networking and leadership
- Promoting capability and skills
- Learning career paths in universities, national laboratories, and industries
- Advancing to senior levels with increasing visibility
- Mentoring and sponsoring women
- Balancing between family and career

#### Organizer: MiSun Min

Argonne National Laboratory, USA

**Organizer: Xueying Wang** 

Washington State University, USA 10:30-10:50 Beating the Imposter Syndrome

Margot Gerritsen, Stanford University, USA

#### 10:55-11:15 My Intertwined Paths: Career and Family

Lois Curfman McInnes, Argonne National Laboratory, USA

## 11:20-11:40 From Law of Large Numbers...

*Fengyan Li*, Rensselaer Polytechnic Institute, USA

#### 11:45-12:05 On the Importance of Good Mentoring and having an Engaging Community

Mary Silber, Northwestern University, USA

#### 12:10-12:30 On the Road Again: My Experience as an Early-career Mathematician

Anne Shiu, University of Chicago, USA

#### MS6 Fast Solvers for PDE-Constrained Optimization

10:30 AM-12:30 PM

Room:Salon 7 - 3rd Floor

#### Organized by SIAG/ALA

The solution of optimization problems with constraints given by partial differential equations is an important and challenging problem for numerical analysts, as well as applied scientists across many disciplines. At the heart of the optimization procedure lies the solution of linear systems that are often large, sparse and structured. Our minisymposium aims to highlight recent developments of strategies for solving these systems, including preconditioned iterative methods and stateof-the-art multilevel techniques, as well as high performance computing approaches. The aim of these methods is to provide a robust and flexible framework for solving PDEconstrained optimization problems arising in a range of scientific applications.

Organizer: John W. Pearson

University of Edinburgh, United Kingdom

#### **Organizer: Martin Stoll**

Max Planck Institute, Magdeburg, Germany

10:30-10:55 Fast Iterative Solvers for Reaction-Diffusion Control Problems from Biological and Chemical Processes

John W. Pearson, University of Edinburgh, United Kingdom; Martin Stoll, Max Planck Institute, Magdeburg, Germany

#### 11:00-11:25 Parallel Preconditioning for All-at-Once Solution of Time-Dependent Navier-Stokes Optimization Problems

Andrew Barker, Max Planck Institute, Magdeburg, Germany

#### 11:30-11:55 A Block Diagonal Preconditioner for All-at-Once Solution of Time-Dependent PDE-Constrained Optimization Problems

*Eleanor McDonald* and Andrew J. Wathen, University of Oxford, United Kingdom

#### 12:00-12:25 All-at-Once Multigrid Methods for Optimal Control Problems *Stefan Takacs*, Technische Universitat

Chemnitz, Germany

#### Monday, July 7

#### MS7 Recent Progress on Computation and

Systems - Part I of III 10:30 AM-12:30 PM

Room:Wilson - 3rd Floor

#### For Part 2 see MS21

Time varying systems are common in many science and engineering fields. There are many open challenges in computation and application of time varying systems. In this minisymposium we will present recent progress in three aspects in this area: Algorithm Development (session 1); Stochastic Simulation (session 2); Application (session 3).

**Application of Time Varying** 

Organizer: Yang Cao Virginia Tech, USA

Organizer: Shengtai Li

Los Alamos National Laboratory, USA

#### Organizer: Soumyendu Raha Indian Institute of Science, Bangalore, India

10:30-10:55 Time Varying RBFs for Wave-Like Solutions of Pdes

C.W. Gear, Arta Jamshidi, and Yannis Kevrekidis, Princeton University, USA

#### 11:00-11:25 Algorithms That Satisfy a Stopping Criterion, Probably

Uri M. Ascher and Farbod Roosta-Khorasani, University of British Columbia, Canada

#### 11:30-11:55 On High Index Differential-Algebraic Equations Soumyendu Raha, Indian Institute of Science,

Bangalore, India

## 12:00-12:25 Sensitivity Analysis of Stochastic Chemical Kinetics

Muruhan Rathinam and Ting Wang, University of Maryland, Baltimore County, USA

#### Monday, July 7

### MS8

#### Locomotion in Terrestrial and Granular Environments

10:30 AM-12:30 PM

#### Room:Kimball - 3rd Floor

This minisymposium will survey recent developments in the dynamics and mechanics of animal locomotion in terrestrial environments. Contact forces including friction play an important role in determining efficient and stable kinematics. We consider both legged and limbless organisms, and study strategies which lead to efficient locomotion and robustness in the presence of noise.

#### Organizer: Silas Alben

University of Michigan, USA

#### 10:30-10:55 Optimizing Snake Locomotion in the Plane

Silas Alben, University of Michigan, USA; Matt Osborne, University of Toledo, USA; Xiaolin Wang, Georgia Institute of Technology, USA

#### 11:00-11:25 Lessons from Animal Locomotion: Extending Floquet Theory to Hybrid Limit Cycle Oscillators Shai Revzen, University of Michigan, USA

11:30-11:55 From Animal to Robot and Back: Sidewinding on Granular Media *Howie Choset*, Chaohui Gong, and Matthew

Travers, Carnegie Mellon University, USA

#### 12:00-12:25 Chaotic Scattering during Legged Locomotion on Granular Media

*Tingnan Zhang*, Georgia Institute of Technology, USA; Chen Li, University of California, Berkeley, USA; Predrag Cvitanovic and Daniel Goldman, Georgia Institute of Technology, USA

#### MS9

#### Student Days: Undergraduate Sessions

10:30 AM-12:00 PM

Room:Salon 6 - 3rd Floor

For Part 2 see MS23 Organized by the SIAM Education Committee

Undergraduate Research in Applied and Computational Mathematics.

Organizer: Peter R. Turner Clarkson University, USA

#### 10:30-10:55 Billiard Motion of Microorganisms in Confined Domains

Colin Wahl and *Joseph Lukasik*, University of Wisconsin, Madison, USA

#### 11:00-11:25 A Bioinformatic

Approach to Cancer Research Nicolas Limogiannis, Wofford College, USA

11:30-11:55 An Initial Modeling of Fractal Nets for the Sierpinski Gasket Barrett Leslie, Illinois Institute of Technology, USA

#### Monday, July 7

## MS10

#### Multiscale Modeling and Simulation of Cardiac Excitation-Contraction Coupling

10:30 AM-12:30 PM

Room:Salon 10 - 3rd Floor

#### For Part 2 see MS24

ECC denotes translation of a membrane potential depolarization into a contraction in cardiac muscle cells. It is a multiscale process since it involves membrane potential dynamics on the length scale of the cell, reaction-diffusion processes with random source terms on length scales from the cell (~100µm) down to specialized subvolumes (diadic clefts, 0.2µm) and time scales from fractions of milliseconds to hundreds of seconds. The interesting mathematical questions concern numerical techniques to deal with the multi-scale character of the problem, methods to determine the deterministic limit of the stochastic reaction-diffusion process and model simplification techniques. The minisymposium will discuss them.

#### Organizer: Martin Falcke MDC for Molecular Medicine, Germany

mb e jor morecular medicine, Germany

#### Organizer: Nagaiah Chamakuri Austrian Academy of Sciences, Austria

10:30-10:55 Cellular Mechanisms of Calcium-Mediated Triggered Activity in Cardiac Myocytes

Alain Karma and Zhen Song, Northeastern University, USA

#### 11:00-11:25 Modeling the Molecular Basis of Calcium Entrained Arrhythmia

Aman Ullah and Tuan Hoang-Trong, George Mason University, USA; Geoge Williams and William Lederer, University of Maryland, Baltimore, USA; *Mohsin S. Jafri*, George Mason University, USA

#### 11:30-11:55 Alternans As An Order-Disorder Transition in Heart Cells

Yohannes Shiferaw, California State University, Northridge, USA

#### 12:00-12:25 Multiscale Modeling and Numerical Simulation of Calcium Cycling in Cardiac Myocyte

Nagaiah Chamakuri, Austrian Academy of Sciences, Austria

#### Monday, July 7

#### MS11 Tensor Analysis, Computation and

Application - Part I of III 10:30 AM-12:30 PM

Room:Salon 5 - 3rd Floor

#### For Part 2 see MS25

Multilinear algebra and tensor computations have made some great strides in advancing applied and computational mathematics as well as engineering and science fields. Here we present several talks which report on state-of-the-art methods in tensor decompositions (canonical polyadic, tucker and spectral), answer the questions of tensor complexity and include applications in object recognition, data compression and pollution sources identification.

#### Organizer: Carmeliza Navasca University of Alabama at Birmingham, USA

#### 10:30-10:55 Canonical Polyadic Decomposition for Symmetric Tensor

*Carmeliza Navasca*, University of Alabama at Birmingham, USA; Na Li, MathWorks, USA

#### 11:00-11:25 Dynamical Systems Analysis of Swamps in ALS

Martin J. Mohlenkamp, Ohio University, USA

#### 11:30-11:55 Computing Eigenvalues and Eigenvectors of Symmetric Tensors: A Survey

Lixing Han, University of Michigan-Flint, USA

#### 12:00-12:25 Towards Better Computation-statistics Trade-off in Tensor Decomposition

*Ryota Tomioko*, Toyota Technological Institute at Chicago, USA

### MS12 From Cilia Hydrodynamics To Biological Functions

10:30 AM-12:30 PM

Room:Indiana - 3rd Floor

Cilia are micro-scale hair-like structures that cover many eukaryotic cells, from singlecelled protozoa to mammalian epithelial surfaces. Often, carpets of motile cilia are arranged and coordinated such that their motion transports and mixes fluid near the surface, performing a broad array of functions, including food capture, acquisition of microbial partners, mucus clearance, left-right asymmetry determination during embryonic development, and transport of egg cells in the Fallopian tubes. In addition to their role in biological systems, cilia also provide an attractive paradigm for fluid manipulation in microfluidic devices. In this session, we will present recent works on biological and artificial cilia, and discuss their transport and mixing functions.

#### Organizer: Janna C. Nawroth Harvard University, USA

#### Organizer: Eva Kanso

University of Southern California, USA

#### 10:30-10:55 The Capture of Symbiotic Bacteria from the Environment by Host Ciliated Epithelia

Margaret McFall-Ngai, University of Wisconsin, Madison, USA

#### 11:00-11:25 A Cilia-Driven Hydrodynamic Sieve for Selective Particle Capture

Janna C. Nawroth, Harvard University, USA

#### 11:30-11:55 Cilia Generated Flows: Insights from Cell Cultures and Engineered Arrays

*Richard Superfine*, University of North Carolina, USA

#### 12:00-12:25 Mixing and Transport by Ciliary Flows: A Numerical Study

*Eva Kanso*, University of Southern California, USA

#### Monday, July 7

### MS13 Applied Mathematics in Industry - Part I of II

10:30 AM-12:30 PM

#### Room:Salon 12 - 3rd Floor For Part 2 see MS18

Organized by the SIAM Industry Committee

This minisymposium will highlight the work performed by SIAM's industrial members. The presentations may focus on any aspect of mathematics being performed or used within industry and can focus on production, theory, experiment, or development. The talks will target the general audience. They are intended to be of interest to the general SIAM member wishing to learn more about industrial mathematics and to postdocs and graduate students considering a career in industry.

#### Organizer: Michael Miksis Northwestern University, USA

#### 10:30-10:55 Estimating Shape and

Motion Information from Radar Data Matthew Ferrara and Gregory Arnold, Matrix Research, Inc., USA; Mark Stuff, Michigan Tech Research Institute, USA; Jason T. Parker, Air Force Research Laboratory, USA

#### 11:00-11:25 Frictional and Heat Transfer Characteristics of Flow in Square Porous Tubes of Diesel Exhaust Particulate Filters

*Edward Bissett*, Gamma Technologies, Inc., USA; Margaritis Kostoglou and Athanasios Konstandopoulos, Aristotle University of Thessaloniki, Greece

#### 11:30-11:55 Solution Verification in Simulations of Drop Impact of Flexible Containers

Carlos A. Corrales and Mark Perry, Baxter Healthcare Corp., USA

## 12:00-12:25 Regularization in the Real World

Eric Voth, St. Jude Medical, USA

#### Monday, July 7

#### CP1 Reduced Order Models

10:30 AM-12:30 PM

Room:Logan - 3rd Floor

Chair: Tanya Kostova-Vassilevska, Lawrence Livermore National Laboratory, USA

#### 10:30-10:45 Using Snapshots of the Derivatives in Proper Orthogonal Decomposition (POD)-Based Reduced Order Methods (ROM) for Dynamical Systems

Tanya Kostova-Vassilevska, Geoffrey Oxberry, Kyle Chand, and Bill Arrighi, Lawrence Livermore National Laboratory, USA

#### 10:50-11:05 Filtering Algorithm For Pod-Based Reduced Order Modeling Techniques

Hany S. Abdel-Khalik and Bassam A. Khuwaileh, North Carolina State University, USA

#### 11:10-11:25 An Efficient Output Error Bound for Reduced Basis Methods Applied to Parametrized Evolution Equations

Yongjin Zhang, *Lihong Feng*, and Suzhou Li, Max Planck Institute for Dynamics of Complex Technical Systems, Germany; Peter Benner, Max Planck Institute for Dynamics of Complex Systems, Germany

#### 11:30-11:45 Employing Non-Converged Iterates for Reduced Order Modeling

Bassam A. Khuwaileh, Congjian Wang, Youngsuk Bang, and Hany S. Abdel-Khalik, North Carolina State University, USA

#### 11:50-12:05 Robust Reduced-Order Models Via Fast, Low-Rank Basis Updates

Matthew J. Zahr, University of California, Berkeley and Stanford University, USA; Kyle Washabaugh and Charbel Farhat, Stanford University, USA

#### 12:10-12:25 Adaptive Proper Orthogonal Decomposition Reduced Order Models Via Incremental SVD

*Geoffrey M. Oxberry*, Tanya Kostova-Vassilevska, William Arrighi, and Kyle Chand, Lawrence Livermore National Laboratory, USA
## CP2

## Partial Differential Equations I

10:30 AM-12:30 PM

Room: Madison - 3rd Floor

Chair: Dmitry Altshuller, Dassault Systèmes, USA

#### 10:30-10:45 A Free Boundary Approach for Solving a Two-Dimensional Riemann Problem for the Isentropic Gas Dynamics Equations

Katarina Jegdic, University of Houston-Downtown, USA

#### 10:50-11:05 Two-Point Riemann Problem for Inhomogeneous Conservation Laws: Geometric Construction of Solutions

Dmitry A. Altshuller, Dassault Systèmes, USA

#### 11:10-11:25 On Eigenfunction Expansion Solutions for the Start-Up of Fluid Flow

Ivan C. Christov, Los Alamos National Laboratory, USA

#### 11:30-11:45 Singular Behavior of the Navier Stokes Flow Through a Non-Convex Polyhedral Cylinder

*Oh Sung Kwon*, National Institute for Mathematical Sciences, Korea; Jae Ryong Kweon, Pohang University of Science and Technology, Korea

#### 11:50-12:05 Higher Order Analyses of Laminated Composite Shells and Plates

Mohammad Zannon, Central Michigan University, USA; Mohamad Qatu, Carnegie Mellon University, USA; Leela Rakesh, Central Michigan University, USA

#### 12:10-12:25 Transport in Confined Structures As a Multiscale Problem and Numerical Results for Nanopores

Clemens F. Heitzinger, Arizona State University, USA and Vienna University of Technology, Austria; Christian Ringhofer, Arizona State University, USA

### Monday, July 7

## CP3 Dynamical Systems I

10:30 AM-12:30 PM

Room:Salon 4 - 3rd Floor

Chair: Poul G. Hjorth, Technical University of Denmark, Denmark

#### 10:30-10:45 Billiard Dynamics of Bouncing Dumbbell

*Ki Yeun Kim*, Yuliy Baryshnikov, Victoria Blumen, and Vadim Zharnitsky, University of Illinois at Urbana-Champaign, USA

#### 10:50-11:05 Phyllotaxis As a Pattern-Forming Front

Matthew Pennybacker, University of New Mexico, USA

#### 11:10-11:25 Spatial Localization in Heterogeneous Systems

Hsien-Ching Kao, Wolfram Research Inc., USA; Cédric Beaume and Edgar Knobloch, University of California, Berkeley, USA

## 11:30-11:45 Pushing and Showing in Hallways and Doorways

*Poul G. Hjorth*, Kristian Berg Thomsen, Christian Marschler, and Jens Starke, Technical University of Denmark, Denmark

#### 11:50-12:05 Solitary Waves and the *N*-particle Algorithm for a Class of Euler-Poincaré Equations

*Long Lee*, University of Wyoming, USA; Roberto Camassa, University of North Carolina at Chapel Hill, USA; Dongyang Kuang, University of Wyoming, USA

#### 12:10-12:25 The Gaussian Semiclassical Soliton Ensemble

Gregory Lyng, University of Wyoming, USA

### Monday, July 7

## CP4

## Signal and Image Processing

10:30 AM-12:30 PM

Room:Salon 8 - 3rd Floor

Chair: Thomas J. Peters, University of Connecticut, USA

#### 10:30-10:45 Topology and Numerical Analysis in Molecular Simulations

Thomas J. Peters, University of Connecticut, USA

10:50-11:05 Synchrosqueezed Wave Packet Transforms and Diffeomorphism Based Spectral Analysis for 1D General Mode Decompositions

Haizhao Yang, Stanford University, USA

#### 11:10-11:25 The Generalized Haar-Walsh Transform (GHWT) for Data Analysis on Graphs and Networks

*Jeffrey Irion* and Naoki Saito, University of California, Davis, USA

#### 11:30-11:45 Alternating Direction Approximate Newton (ADAN) Method for Partially Parallel Imaging

William Hager, *Cuong K. Ngo*, and Maryam Yashtini, University of Florida, USA; Hongchao Zhang, Louisiana State University, USA

#### 11:50-12:05 Automatic Segmentation of Microscopy Images Based on the Starlet Wavelet Transform

*Alexandre F. De Siqueira*, Flávio Cabrera, Wagner Nakasuga, Aylton Pagamisse, and Aldo Job, Universidade Estadual Paulista, Brazil

#### 12:10-12:25 Per-Class Pca-Src: Increased Flexibility and Specificity in Sparse Representation-Based Classification

Chelsea Weaver and Naoki Saito, University of California, Davis, USA

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Minisymposia from various conferences. These are available by visiting SIAM Presents (http://www.siam.org/meetings/ presents.php).

**Major Awards Committee** Lunch Meeting 12:30 PM-2:00 PM Room:Buckingham - 5th Floor

## **MMS Editorial Board Lunch** Meeting

12:30 PM-2:00 PM Room:Price - 5th Floor

## Lunch Break

Monday

12:30 PM-2:00 PM Attendees on their own

#### Monday, July 7

## SP1

**AWM-SIAM Sonia** Kovalevsky Lecture: The Evolution of Complex Interactions in Non-Linear **Kinetic Systems** 

2:00 PM-2:45 PM

Room: Grand Ballroom - 4th Floor Chair: Ruth Charney, Brandeis University, USA

Recent developments in statistical transport modeling, ranging from rarefied gas dynamics, collisional plasmas and electron transport in nanostructures, to self-organized or social interacting dynamics, share a common description based in a Markovian framework of birth and death processes. Under the regime of molecular chaos propagation, their evolution is given by kinetic equations of non-linear collisional (integral) Boltzmann type. We will present an overview of analytical issues and novel numerical methods for these equations that preserve the expected conserved properties of the described phenomena, while enabling rigorous stability, convergence and error analysis.

### Irene M. Gamba

University of Texas at Austin, USA

#### Monday, July 7

## IP2

**Big Data, Sparse Information: Bayesian Inference for** Large-scale Models, with **Application to Inverse** Modeling of Antarctic Ice **Sheet Dynamics** 

2:50 PM-3:35 PM

Room: Grand Ballroom - 4th Floor Chair: Amr El-Bakry, ExxonMobil Upstream Research Company, USA

Predictive models of complex geosystems often contain numerous uncertain parameters. Rapidly expanding volumes of observational data present opportunities to reduce these uncertainties via solution of inverse problems. Bayesian inference provides a systematic framework for inferring model parameters with associated uncertainties from (possibly noisy) data and prior information. However, solution of Bayesian inverse problems via conventional MCMC methods remains prohibitive for expensive models and highdimensional parameters. Observational data, while large-scale, typically can provide only sparse information on model parameters. Based on this property we design MCMC methods that adapt to the structure of the posterior probability and exploit an effectively-reduced parameter dimension, thereby rendering Bayesian inference tractable for high-dimensional Antarctic ice sheet flow inverse problems.

**Omar Ghattas** University of Texas at Austin, USA

Coffee Break 3:30 PM-4:00 PM



Room:Exhibit Hall



## MS14

### Towards Exascale Geophysical Flow Computations - Part I of II

4:00 PM-6:00 PM

Room: Grand Ballroom - 4th Floor

#### For Part 2 see MS28 Organized by SIAG/CSE

An essential part of geophysical research deals with the study of large-scale flow phenomena on and inside Earth, e.g., the dynamics of the atmosphere, the ocean, ice-sheets and the mantle. Besides the cost for solving the forward problem, inverse computations and uncertainty quantification techniques demand enormous computational effort. To maintain good parallel efficiency on future exascale systems, a performance driven co-design is necessary, involving the systematic complexity analysis of mathematical methods and the design of physics-aware approaches. In this minisymposium we bring together experts of different disciplines to discuss scalable computational methods for geophysical large-scale simulations while highlighting recent advances.

**Organizer: Omar Ghattas** University of Texas at Austin, USA

Organizer: Björn Gmeiner Universität Erlangen, Germany

**Organizer: Christian Waluga** *Technical University of Munich, Germany* 

**Organizer: Christian Waluga** *Technical University of Munich, Germany* 

4:00-4:25 Plate Boundary-resolving Nonlinear Global Mantle Flow Simulations using Parallel High-order Geometric Multigrid Methods on Adaptive Meshes

Johann Rudi, Hari Sundar, Tobin Isaac, and Georg Stadler, University of Texas at Austin, USA; Michael Gurnis, California Institute of Technology, USA; Omar Ghattas, University of Texas at Austin, USA

#### 4:30-4:55 Hybrid Parallelism for Largescale Adaptive-mesh Simulations *Carsten Burstedde*, Universität Bonn,

Germany; Donna Calhoun, Boise State University, USA; Bram Metsch, University of Bonn, Germany

#### 5:00-5:25 Towards T Adaptivity for Lithosphere Dynamics: Nonsmooth Processes in Heterogeneous Media

Jed Brown, Argonne National Laboratory, USA and University of Colorado Boulder, USA; Mark Adams, Lawrence Berkeley National Laboratory, USA; Matthew G. Knepley, University of Chicago, USA; Dave May, ETH Zürich, Switzerland

## 5:30-5:55 Title Not Available at Time of Publication

*Olaf Schenk*, Universita' della Svizzera Italiana, Italy

### Monday, July 7

## MS15 Geometric Approaches to Flying and Swimming

4:00 PM-6:00 PM

### Room:Red Lacquer - 4th Floor

The fluid-body interactions in swimming and flying often produce highly nonlinear differential equations of motion. Differential geometric approaches to analyzing systems performing these motions can provide elucidating structure to these equations, such as when Lie group symmetries allow a swimmer's dynamics to be reduced into the body frame. This session will highlight recent developments in this area, including techniques to handle flexible body elements, integrate sensing and locomotion, and assess the energetic costs of different locomotion patterns. This minisymposium is part of a series on locomotion and flow-body interactions.

Organizer: Ross L. Hatton Oregon State University, USA

#### 4:00-4:25 Numerical-Geometric Analysis of Sandswimming

Ross L. Hatton, Oregon State University, USA

4:30-4:55 Geometric Locomotion with Passive Internal Degrees of Freedom: Hovering Flight and Passive Swimming *Frédéric Boyer*, Ecole des Mines de Nantes, France

#### 5:00-5:25 Mapping Effort: Cartographically-Inspired Methods for Representing the Energetic Cost of Locomotion

Howie Choset, Carnegie Mellon University, USA

#### 5:30-5:55 Coupling of Locomotion Control and Sensing in Biological Systems

Brian Hinson and Kristi Morgansen, University of Washington, USA

## MS16 Multiple-scale Models of Neuronal Dynamics

## 4:00 PM-6:00 PM

Room:Crystal - 3rd Floor

This minisymposium will discuss methods that can be used to model neuronal systems in which multiple time scales are relevant. Aushra Abouzeid will discuss a fully automated optimization methodology for fitting spatially extended neuronal models with multiple time scales. Hannah Choi will demonstrate how the slow-fast analysis of biophysical models of specific neurons in the retina can explain the pathological behavior in certain retinal diseases. Avinash Karamchandani will address how in the olfactory system rhythms with different frequencies might arise from the phase-locking of neurons exhibiting mixedmode oscillations. Hermann Riecke will discuss interacting, adaptive neuronal networks that learn to discriminate similar inputs.

#### Organizer: William Kath

Northwestern University, USA

#### Organizer: Hermann Riecke Northwestern University, USA

#### 4:00-4:25 Intrinsically Bursting All Amacrine Cells Drive Oscillations in the Degenerated Rd1 Retina

Hannah Choi, Northwestern University, USA; Lei Zhang, University of Maryland, USA; Mark Cembrowski, HHMI Janelia Farm, USA; Joshua Singer, University of Maryland, USA; William Kath and Hermann Riecke, Northwestern University, USA

#### 4:30-4:55 Synchrony and Phase-Locking of Mixed-Mode Oscillations in a System of Pulse-Coupled Neurons

Avinash J. Karamchandani and Hermann Riecke, Northwestern University, USA

#### 5:00-5:25 Network Restructuring Guided by Associative Feedback for Enhanced Stimulus Discrimination

Hermann Riecke, Wayne Adams, James Graham, Cameron Dennis, Tom Zhao, and Siu Fai Chow, Northwestern University, USA

#### 5:30-5:55 Fully-Automated Multi-Objective Optimization for Fitting Spatial and Temporal Constraints in a Neuronal Model with Real Morphology *Aushra Abouzeid* and William Kath,

Northwestern University, USA

### Monday, July 7

## MS17 Numerical Methods for the Ocean and Atmosphere -Part II of II

4:00 PM-5:30 PM

Room:Salon 3 - 3rd Floor

#### For Part 1 see MS4 Organized by SIAG/GS

This minisymposium describes some recent progress in the numerical solution of partial differential equations, as applied to oceanic and atmospheric flows. Topics addressed by the speakers include adaptive grids, multiple time scales, multi-layer models, and spatial discretization schemes including discontinuous Galerkin, finite volume, and spectral element methods.

#### Organizer: Robert L. Higdon Oregon State University, USA

#### 4:00-4:25 Hardcore – Efficient Computation of Atmospheric Flows Using High-Order Local Discretization Methods

Jorge E. Guerra and Paul Ullrich, University of California, Davis, USA

#### 4:30-4:55 Using the Multilayer Shallow Water Equations for Storm Surge Modeling

*Kyle T. Mandli*, University of Texas at Austin, USA

#### 5:00-5:25 Transport Methods for the Community Atmosphere Model's Spectral Element Dynamical Core Kara Peterson and Mark A. Taylor, Sandia

National Laboratories, USA

## Monday, July 7

## MS18 Applied Mathematics in Industry - Part II of II 4:00 PM-6:00 PM

Room:Salon 12 - 3rd Floor

## For Part 1 see MS13

Organized by the SIAM Industry Committee

This minisymposium will highlight the work performed by SIAM's industrial members. The presentations may focus on any aspect of mathematics being performed or used within industry and can focus on production, theory, experiment, or development. The talks will target the general audience. They are intended be of interest to the general SIAM member wishing to learn more about industrial mathematics and to postdocs and graduate students considering a career in industry.

#### **Organizer: Michael Miksis**

Northwestern University, USA

#### 4:00-4:25 Interpreting the Impact of Constraints for Mean Variance and Cvar Optimization

Chris Bemis, Whitebox Advisors, USA

#### 4:30-4:55 Addressing the Potential Non-Robustness of Subadditive Portfolio Risk Measures

John A. Dodson, Options Clearing Corporation, USA

#### 5:00-5:25 Efficient High-Precision Numerical Computation

Mark Sofroniou, Wolfram Research Inc., Italy

#### 5:30-5:55 Using Social Influence to Predict Subscriber Churn

Veena Mendiratta, Chitra Phadke, Huseyin Uzunalioglu, and Dan Kushnir, Bell Labs, Alcatel-Lucent, USA

## MS19

### AWM Workshop - Career Panel: Women and Challenges in Mathematics, Science, and Engineering II

#### 4:00 PM-6:00 PM

#### Room:Salon 2 - 3rd Floor

#### For Part 1 see MS5

Increasingly, women are earning advanced degrees in mathematics, science, and engineering and are entering the workforce. Yet these women still face a variety of challenges – from lower salaries to juggling a family with a career. We will share experiences, ideas, and strategies that can help women develop and advance their careers and increase their contribution to science and technology. Topics include:

- Analyzing success factors and barriers
- Enhancing networking and leadership
- Promoting capability and skills
- Learning career paths in universities, national laboratories, and industries
- Advancing to senior levels with increasing visibility
- Mentoring and sponsoring women
- Balancing between family and career

#### Organizer: MiSun Min

Argonne National Laboratory, USA

## Organizer: Xueying Wang

Washington State University, USA

#### 4:00-4:20 Two Jobs, Two Children, and Two Cars: What can Possibly go Wrong?

Barbara Lee Keyfitz, The Ohio State University, USA

#### 4:25-4:45 Perspectives of an Assistant Professor

Joan Lind, University of Tennessee, USA

#### 4:50-5:10 Changing Directions

May Boggess, Arizona State University, USA

#### 5:15-5:55 Career Panel Discussion with Speakers from Two Parts of the Minisymposium

MiSun Min, Argonne National Laboratory, USA; Xueying Wang, Washington State University, USA

### Monday, July 7

## **MS20**

Linear Algebra Aspects and Scalable Methods for Stochastic/parameterized Partial Differential Equations - Part I of II

#### 4:00 PM-6:00 PM

Room:Salon 7 - 3rd Floor

#### For Part 2 see MS34 Organized by SIAG/ALA

organized by Shrid/HEA

Uncertainty quantification is now recognized as an essential component of predictive simulation. Physical models with uncertainties are often packaged as partial differential equations, where imprecisely prescribed inputs are modeled with a set of random variables. This minisymposium will explore state-of-the-art scalable computational methods for solving these problems---with a particular emphasis on the linear algebra challenges that arise in computation.

#### Organizer: Paul Constantine Colorado School of Mines, USA

## Organizer: Alireza Doostan

University of Colorado Boulder, USA

#### 4:00-4:25 A Linear Algebra Perspective on Modeling and Computation with Stochastic PDEs

Paul Constantine, Colorado School of Mines, USA; David F. Gleich, Purdue University, USA

#### 4:30-4:55 Strategies for the Efficient Solution of Parameterized or Stochastic PDEs

Eric De Sturler, Virginia Tech, USA

#### 5:00-5:25 Computational Complexity of Stochastic Galerkin and Collocation Methods for PDEs with Random Coefficients

Nick Dexter, University of Tennessee, USA; Clayton G. Webster and Guannan Zhang, Oak Ridge National Laboratory, USA

#### 5:30-5:55 Compressive Sensing Method for Solving Stochastic Differential Equations

*Xiu Yang* and George E. Karniadakis, Brown University, USA

### Monday, July 7

## **MS21**

Recent Progress on Computation and Application of Time Varying Systems - Part II of III

4:00 PM-6:00 PM

Room:Wilson - 3rd Floor

#### For Part 1 see MS7 For Part 3 see MS35

Time varying systems are common in many science and engineering fields. There are many open challenges in computation and application of time varying systems. In this minisymposium we will present recent progress in three aspects in this area: Algorithm Development (session 1); Stochastic Simulation (session 2); Application (session 3).

Organizer: Yang Cao Virginia Tech, USA

Organizer: Shengtai Li

Los Alamos National Laboratory, USA

Organizer: Soumyendu Raha

Indian Institute of Science, Bangalore, India

#### 4:00-4:25 Stochastic Simulation of Biochemical Networks: Diffusion and Parameter Sensitivity

Per Lotstedt, University of Uppsala, Sweden

#### 4:30-4:55 Stochastic Turing Patterns: Analysis of Compartment-based Approaches

Yang Cao, Virginia Tech, USA; Radek Erban, University of Oxford, United Kingdom

#### 5:00-5:25 SParSE: Efficient Stochastic Parameter Search Algorithm for Events

Min K. Roh, Institute for Disease Modeling, USA

#### 5:30-5:55 Adaptive Accelerated Spatial Stochastic Simulation of Biochemical Systems

Brian Drawert, University of California, Santa Barbara, USA

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This book surveys the main mathematical ideas and techniques behind some well established imaging modalities such as X-ray CT and emission tomography, as well as a variety of newly developing coupled-physics or hybrid techniques, including thermoacoustic tomography. It also explains important concepts concerning inversion, stability, and incomplete data effects.

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#### Semi-Lagrangian Approximation Schemes for Linear and Hamilton–Jacobi Equations Maurizio Falcone and Roberto Ferretti

This largely self-contained book provides a unified framework of semi-Lagrangian strategy for the approximation of hyperbolic PDEs, with a special focus on Hamilton–Jacobi equations. The authors provide a rigorous discussion of the theory of viscosity solutions and the concepts underlying the construction and analysis of difference schemes; they then proceed to high-order semi-Lagrangian schemes and their applications.  $2013 * \pi i + 319$  pages \* Softcover \* 978-1-611973-04-4 List \$99.00 \* SIAM Member \$69.30 \* OT133

#### Chaotic Signal Processing Edited by Henry Leung

This book presents up-to-date research results on chaotic signal processing, including the application of nonlinear dynamics to radar target recognition, an exactly solvable chaos approach for communications, a chaotic approach for reconfigurable computing, and the use of chaos in compressive sensing.

2014 • x + 179 pages • Softcover • 978-1-611973-25-9 List \$79.00 • SIAM Member \$55.30 • OT136

## Physics and Partial Differential Equations, Volume II

Tatsien Li and Tiehu Qin / Translated by Yachun Li Proceeding directly from Volume 1 (SIAM, 2012), this book provides five additional chapters that bridge physics and applied mathematics in a manner that is easily accessible to readers with an undergraduate-level background in these disciplines.

2014 • x + 271 pages • Softcover • 978-1-611973-31-0 List \$89.00 • SIAM Member \$62.30 • OT137

Vols. I and II (OT126 and OT137) are available as a set: Special combined set prices for AN14: List \$106.80 / SIAM Member \$99.40

#### Nonlinear Time Scale Systems in Standard and Nonstandard Forms: Analysis and Control Anshu Narang-Siddarth and John Valasek

Advances in Design and Control 26

This book introduces key concepts for systematically controlling engineering systems that possess interacting phenomena occurring at widely different speeds. The aim is to present the reader with control techniques that extend the benefits of model reduction of singular perturbation theory to a larger class of nonlinear dynamical systems. 2014 • xvi + 219 pages • Hardcover • 978-1-611973-33-4 List \$94.00 • SIAM Member \$65.80 • DC26

#### Practical Augmented Lagrangian Methods for Constrained Optimization Ernesto G. Birgin and José Mario Martínez

Fundamentals of Algorithms 10

This book focuses on Augmented Lagrangian techniques for solving practical constrained optimization problems. The authors rigorously delineate mathematical convergence theory based on sequential optimality conditions and novel constraint qualifications.

2014 • xiv + 220 pages • Softcover • 978-1-611973-35-8 List \$65.00 • SIAM Member \$45.50 • FA10



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## MS22

Session Cancelled 4:00 PM-6:00 PM

## MS23

Student Days: Undergraduate Sessions

4:00 PM-5:30 PM

Room:Salon 6 - 3rd Floor

For Part 1 see MS9 Organized by the SIAM Education Committee

Undergraduate Research in Applied and Computational Mathematics.

Organizer: Peter R. Turner Clarkson University, USA

4:00-4:25 Optimal Control in Time-Varying Velocity Fields using Alpha Hulls

Nicholas Sharp, Virginia Tech, USA

4:30-4:55 An Extensible Test Matrix Collection

Weijian Zhang, University of Manchester, United Kingdom

#### 5:00-5:25 Machine Learning Models for Terrestrial Space Weather Forecasting

Brendan Avent and Nicholas Sharp, Virginia Tech, USA

Monday, July 7

## **MS24**

## Multiscale Modeling and Simulation of Cardiac Excitation-Contraction Coupling - Part II

4:00 PM-5:30 PM

Room:Salon 10 - 3rd Floor

#### For Part 1 see MS10

ECC denotes translation of a membrane potential depolarization into a contraction in cardiac muscle cells. It is a multi-scale process since it involves membrane potential dynamics on the length scale of the cell, reaction-diffusion processes with random source terms on length scales from the cell (~100µm) down to specialized subvolumes (diadic clefts, 0.2µm) and time scales from fractions of milliseconds to hundreds of seconds. The interesting mathematical questions concern numerical techniques to deal with the multi-scale character of the problem, methods to determine the deterministic limit of the stochastic reactiondiffusion process and model simplification techniques. The minisymposium will discuss them.

#### Organizer: Martin Falcke

MDC for Molecular Medicine, Germany

Organizer: Nagaiah Chamakuri Austrian Academy of Sciences, Austria

4:00-4:25 Mathematical Modelling of Excitation Contraction Coupling Martin Falcke, MDC for Molecular Medicine, Germany

4:30-4:55 Ca2+ Signaling in the Cardiomyocyte: An Atomistic to Cellular Multi-Scale Perspective Peter Kekenes-Huskey, University of California, San Diego, USA

#### 5:00-5:25 Subcellular Calcium Dynamics in a Whole-cell Model of an Atrial Myocyte

*Ruediger Thul* and Steve Coombes, University of Nottingham, United Kingdom; Martin Bootman, The Open University, United Kingdom

#### SIAM Presents Since 2008, SIAM has recorded many Invited Lectures, Prize Lectures, and selected



Minisymposia from various conferences. These are available by visiting SIAM Presents (http://www.siam.org/meetings/ presents.php).

## **MS25**

### Tensor Analysis, Computation and Application - Part II of III

4:00 PM-6:00 PM

Room:Salon 5 - 3rd Floor

#### For Part 1 see MS11 For Part 3 see MS39

Multilinear algebra and tensor computations have made some great strides in advancing applied and computational mathematics as well as engineering and science fields. Here we present several talks which report on state-of-the-art methods in tensor decompositions (canonical polyadic, tucker and spectral), answer the questions of tensor complexity and include applications in object recognition, data compression and pollution sources identification.

#### Organizer: Carmeliza Navasca

University of Alabama at Birmingham, USA

#### 4:00-4:25 Complexity and Approximability of Tensor Nuclear Norm

Shmuel Friedland, University of Illinois, Chicago, USA; Lek-Heng Lim, University of Chicago, USA

#### 4:30-4:55 Combinatorial Interpretation of the Mesner-Bhattacharya Algebra with Application to Hypermatrix Spectral Decomposition

*Edinah Gnang*, Institute for Advanced Study, USA; Vladimir Retakh and Ahmed Elgammal, Rutgers University, USA; Ori Parzanchevski, Institute for Advanced Study, USA

#### 5:00-5:25 Tensor Linear Discriminant Analysis for Object Recognition

William E. Sorenson, Randy Hoover, Karen S. Braman, and Nels Leonard, South Dakota School of Mines & Technology, USA

#### 5:30-5:55 Randomized Methods for Higher-Order SVD

Deonnia Pompey and Carmeliza Navasca, University of Alabama at Birmingham, USA Monday, July 7

## MS26 Plant and Protist Biomechanics

4:00 PM-6:00 PM

#### Room:Indiana - 3rd Floor

Biofluid dynamics is a rapidly expanding area of research in applied mathematics, but nearly all macroscale studies have focused on animal locomotion and circulatory systems. Other organisms such as plants, fungi, and protists have evolved novel mechanisms for pumping fluids, moving through fluids, and withstanding fluid forces. For example, the ability to withstand aerodynamic and hydrodynamic forces is important to the survival of many plants, a number of morphological and structural adaptations have evolved to mitigate the resulting mechanical stresses. This minisymposium is part of a series on locomotion and flow-body interactions.

#### Organizer: Laura A. Miller

University of North Carolina, Chapel Hill, USA

#### 4:00-4:25 Plant Leaves Reconfigure into Cone Shapes to Reduce Drag and Flutter

Laura A. Miller, University of North Carolina, Chapel Hill, USA

#### 4:30-4:55 Leaf Compliance and Foliar Disease Transmission

Lydia Bourouiba, Massachusetts Institute of Technology, USA

#### 5:00-5:25 Simulation of Fluid Flow Past Conic Obstacles with Applications to Leaves

Jeremy L. Marzuola, University of North Carolina, Chapel Hill, USA

#### 5:30-5:55 Hydrodynamic Contributions to Amoeboid Cell Motility

Owen Lewis, University of California, Davis, USA

## Monday, July 7

## MS27 Information Engines 4:00 PM-6:00 PM

#### Room:Kimball - 3rd Floor

A term "information engine" is used to describe any dynamical system that manipulates both information and energy. These two concepts are most commonly studied separately even though a mechanism of creating and processing information is closely related to thermodynamic concept of energy. In this minisymposium we will present an overview that connects the fields of computational mechanics and thermodynamics and explore new developments in both mathematical and numerical models of information engines.

#### Organizer: Korana Burke

University of California, Davis, USA

### 4:00-4:25 Towards A Physics of

Information: Bit by Bit Christopher J. Ellison, University of Wisconsin, Madison, USA

#### 4:30-4:55 Demon Design:

Circumnavigating Landauer's Limit

Alec Boyd and James P. Crutchfield, University of California, Davis, USA

#### 5:00-5:25 Information Processing and the Second Law of Thermodynamics: An Inclusive, Hamiltonian Approach Sebastian Deffner, University of Maryland,

College Park, USA

#### 5:30-5:55 Predictive Inference in Nonequilibrium Steady State

Sarah Marzen, University of California, Berkeley, USA; James Crutchfield, University of California, Davis, USA

## CP5 Social Science

4:00 PM-5:40 PM

Room:Logan - 3rd Floor

Chair: Heather Harrington, University of Oxford, United Kingdom

#### 4:00-4:15 Two Mode Matrix of Urban Structure

James R. Gatewood, United States Military Academy at West Point, USA

#### 4:20-4:35 On Continuous Time Bounded Confidence Opinion Dynamics with Multidimensional Opinions

Serap Tay and Muruhan Rathinam, University of Maryland, Baltimore County, USA

#### 4:40-4:55 Classifying Contagion Dynamics on a Noisy Network Using Persistent Homology

Heather Harrington, University of Oxford, United Kingdom; Florian Klimm, Humboldt University Berlin, Germany; Miro Kramar and Konstantin Mischaikow, Rutgers University, USA; Peter J. Mucha, University of North Carolina at Chapel Hill, USA; Mason A. Porter, University of Oxford, United Kingdom; Dane Taylor, University of North Carolina at Chapel Hill, USA

#### 5:00-5:15 Support System for Mathematical Models Based on Optimization Problems of Economic Agents

Aleksandra A. Zhukova and Igor Pospelov, Russian Academy of Sciences, Russia; Mikhail Khokhlov, Yandex LLC, Russia; Valentin Vrzhesch, Russian Academy of Sciences, Russia

## 5:20-5:35 Numerical Study on G-Expectation

Xingye Yue, Soochow University, China

### Monday, July 7

## CP6 Partial Differential Equations II

4:00 PM-6:00 PM

Room: Madison - 3rd Floor

Chair: Deena H. Giffen, North Carolina State University, USA

#### 4:00-4:15 Simulating Non-Dilute Transport in Porous Media Using a TCAT-Based Model

Deena Hannoun Giffen and C.T. Kelley, North Carolina State University, USA; Casey Miller, William Gray, and Pamela Schultz, University of North Carolina, USA

#### 4:20-4:35 A General Methodology for Approximating the Discrete Chemical Master Equation with Short Range Spatial Correlations in Homogeneous Systems

Gregory J. Herschlag, Duke University, USA

#### 4:40-4:55 On the Initial-Boundary Value Problem for the Korteweg-De Vries Equation

Steve Taylor, University of Auckland, New Zealand

#### 5:00-5:15 Eigenvalue Problems for Rapidly Growing Operators in Divergence Form

Marian Bocea, Loyola University of Chicago, USA

#### 5:20-5:35 Solution of a 2D Electrodiffusion Problem: Mathematical Modeling of Contact Resistance in Silicon Photovoltaic Cells

Jonathan P. Black, Christopher Breward, and Peter D. Howell, University of Oxford, United Kingdom; Gareth Fuge, DuPont, United Kingdom

#### 5:40-5:55 Transmission Eigenvalues for Regions on a Conducting Surface

Fan Yang and Peter B. Monk, University of Delaware, USA

### Monday, July 7

## CP7 Control

4:00 PM-5:40 PM

Room:Salon 4 - 3rd Floor

Chair: Boris Kramer, Virginia Tech, USA

4:00-4:15 A Proper Orthogonal Decomposition Based Method for Solving Algebraic Riccati Equations *Boris Kramer*, Virginia Tech, USA

#### 4:20-4:35 Robust Dynamic Shaping of Distributed Parameter Systems Via Recursively Updated Empirical Basis Functions

Davood Babaei Pourkargar and Antonios Armaou, Pennsylvania State University, USA

#### 4:40-4:55 Computationally-Based Technique for Bifurcation Control

*Gerard Olivar* and Daniel Morcillo, Universidad Nacional de Colombia, Colombia; Daniel Burbano, Università degli Studi di Napoli Federico II, Italy; Fabiola Angulo, Universidad Nacional de Colombia, Colombia

#### 5:00-5:15 Anytime A\* for Continuous Optimal Path Planning

Zachary D. Clawson and Alexander Vladimirsky, Cornell University, USA

#### 5:20-5:35 A New Semi-smooth Newton Multigrid Method for Parabolic PDE Optimal Control Problems

Jun Liu, Southern Illinois University, USA; Mingqing Xiao, Southern Illinois University, Carbondale, USA

## CP8

## Uncertainty Quantification

4:00 PM-5:40 PM

Room:Salon 8 - 3rd Floor

Chair: Martin W. Hess, Max Planck Institute for Dynamics of Complex Systems, Germany

#### 4:00-4:15 Accelerated Hierarchical Stochastic Collocation - Finite Element Methods for PDEs with Random Inputs

*Diego Galindo*, Clayton G. Webster, and Guannan Zhang, Oak Ridge National Laboratory, USA

#### 4:20-4:35 Quasi Optimal Sparse-Grid Approximations for Elliptic PDEs with Stochastic Coefficients

Lorenzo Tamellini and Fabio Nobile, EPFL, Switzerland; Raul F. Tempone, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

#### 4:40-4:55 Reduced Basis Methods for Maxwell's Equations with Stochastic Coefficients

Martin W. Hess and Peter Benner, Max Planck Institute for Dynamics of Complex Systems, Germany

#### 5:00-5:15 Uncertainty Qualification Based on Ranking Fuzzy Numbers

Tayebeh Hajjari, Islamic Azad University, Iran

#### 5:20-5:35 Use of Polynomials of Chaos as Regression Functions for Universal Kriging Models and Application to Numerical Dosimetry

*Pierric Kersaudy*, Université Paris-Est, France; Bruno Sudret, ETH Zürich, Switzerland; Odile Picon, Université Paris-Est, France; Joe Wiart, Orange Labs, France

### Intermission

6:00 PM-6:15 PM

## Monday, July 7

## PD1 Motivating Industrial Participation and Collaboration

6:15 PM-7:15 PM

Room:Grand Ballroom - 4th Floor

Chair: Thomas A. Grandine, The Boeing Company, USA

Funding agencies worldwide are increasing their emphasis on industrial mathematics, devoting larger and larger portions of their mathematical research budgets to topics of direct interest to industry and other groups for whom the economic benefit can be most readily realized and measured. Many academic institutions and government labs and their researchers have responded to this shift in emphasis by developing new initiatives and programs. In contrast, many industrial institutions and intended partners, both institutionally and individually, have been relatively slow to respond. This panel discussion will discuss reasons behind this apparent apathy and brainstorm strategies for overcoming it, including business case development for companies to recognize the value of and reward collaborative behavior on the part of their employees.

Mark J. Andrews

Caterpillar Corporation, USA

Jennifer Tour Chayes Microsoft, USA

Carlos Corrales Baxter Healthcare Corporation, USA

Veena Mendiratta Bell Labs, Alcatel-Lucent, USA

Massimo Noro Unilever, United Kingdom

### Monday, July 7

## PD2 Thinking of Writing a Book? 6:15 PM-7:15 PM

Room:Red Lacquer - 4th Floor

Chair: L. Pamela Cook, University of Delaware, USA

Ever thought about writing a book? Ever wondered just what that entails? This session brings together successful authors and publishing staff to discuss the process. Topics of interest will include: • Why and when you should consider writing a book • A step-by-step description of the process, from idea to published book • The author/publisher relationship – who does what • Pitfalls to avoid • Tips from successful authors Even if you aren't currently thinking of becoming an author, this session promises to be lively and engaging!

#### Uri Ascher

University of British Columbia, Canada

Chen Greif University of British Columbia, Canada

**llse lpsen** North Carolina State University, USA

Elizabeth Greenspan SIAM, USA

David Marshall SIAM, USA

Sara Murphy SIAM, USA

### Career Fair / Graduate Student Reception / Industry Reception 7:15 PM-9:15 PM

Room: Empire Room - Lobby Level

### Journals EIC Dinner Meeting

7:15 PM-10:00 PM Room:Price - 5th Floor 47

Student Days: Student Chapter Meeting with SIAM Leadership (by invitation only) 7:00 AM-8:15 AM

Room:Empire Room - Lobby Level

#### Registration

8:00 AM-4:30 PM

Room:State - 4th Floor

#### Tuesday, July 8

## MS28 Towards Exascale Geophysical Flow Computations - Part II of II

8:30 AM-10:00 AM

Room: Grand Ballroom - 4th Floor

For Part 1 see MS14 Organized by SIAG/CSE

An essential part of geophysical research deals with the study of large-scale flow phenomena on and inside Earth, e.g., the dynamics of the atmosphere, the ocean, ice-sheets and the mantle. Besides the cost for solving the forward problem, inverse computations and uncertainty quantification techniques demand enormous computational effort. To maintain good parallel efficiency on future exascale systems, a performance driven co-design is necessary, involving the systematic complexity analysis of mathematical methods and the design of physics-aware approaches. In this minisymposium we bring together experts of different disciplines to discuss scalable computational methods for geophysical large-scale simulations while highlighting recent advances.

**Organizer: Omar Ghattas** University of Texas at Austin, USA

**Organizer: Björn Gmeiner** Universität Erlangen, Germany

**Organizer: Christian Waluga** *Technical University of Munich, Germany* 

8:30-8:55 Performance and Scalability of Multigrid Solvers for Geophysical Flow

Björn Gmeiner, Universität Erlangen, Germany; Christian Waluga, Technical University of Munich, Germany; *Ulrich J. Ruede*, University of Erlangen-Nuremberg, Germany

#### 9:00-9:25 Computational Environments for Modeling Multiphase Flow, Geochemistry and Geomechanics

Mary F. Wheeler, University of Texas at Austin, USA

#### 9:30-9:55 Scalable Nonlinear Solvers for Geophysical Problems

Matthew G. Knepley, University of Chicago, USA

### Tuesday, July 8

## **MS29**

### Recent Advances in Uncertainty Quantification at the Extreme Scale - Part I of II

#### 8:30 AM-10:30 AM

#### Room:Red Lacquer - 4th Floor

#### For Part 2 see MS45

Enabling predictions of next-generation, complex, stochastic simulations is critical to realizing the potential of future computing platforms, including exascale, and will ultimately enable scientists to address a fundamental question, namely "how do the uncertainties ubiquitous in all modeling efforts affect our predictions and understanding of complex phenomena?" Addressing this challenge is the aim of the talks in this session. Topics include: novel hierarchical, low-discrepancy sampling methods, advanced multilevel methods, architecture-aware UQ paradigms, and adaptive and robust experimental design strategies.

Organizer: Clayton G. Webster Oak Ridge National Laboratory, USA

Organizer: Guannan Zhang Oak Ridge National Laboratory, USA

8:30-8:55 Improving Performance of Sampling-Based Uncertainty Quantification on Advanced Computing Architectures Through Embedded Ensemble Propagation Eric Phipps and H. Carter Edwards, Sandia National Laboratories, USA

9:00-9:25 A Generalized Clusteringbased Stochastic Collocation Approach for High-dimensional Approximation of SPDEs

*Guannan Zhang* and Clayton G. Webster, Oak Ridge National Laboratory, USA

#### 9:30-9:55 A Hyperspherical Method for Discontinuity Detection

John Burkardt, Florida State University, USA; Guannan Zhang and Clayton G. Webster, Oak Ridge National Laboratory, USA

#### 10:00-10:25 A Hierarchical Stochastic Collocation Method for Adaptive Acceleration of PDEs with Random Input Data

Peter Jantsch, University of Tennessee, USA; Guannan Zhang and Clayton G. Webster, Oak Ridge National Laboratory, USA

## **MS30**

## **Innovative Linear Algebra Techniques for Complex Networks**

## 8:30 AM-10:30 AM

Room: Crystal - 3rd Floor

Complex networks arising in modern applications, such as gene interactions or social networking, typically have very large and sparse adjacency matrices associated with them. Active research is devoted to the development of efficient numerical linear algebra techniques for analyzing the properties of such networks, including centrality measures based on large-scale matrix functions or the simulation of network dynamics. In this minisymposium we will consider both theoretical and computational aspects of numerically characterizing and simulating networks. We will also discuss novel linear algebra algorithms specifically tailored to network matrices.

**Organizer: Mary Aprahamian** University of Manchester, United Kingdom

#### **Organizer: Stefan Guettel**

University of Manchester, United Kingdom

#### 8:30-8:55 Matching Exponential and **Resolvent Based Centrality Measures** in Complex Networks

Mary Aprahamian, University of Manchester, United Kingdom; Des Higham, University of Strathclyde, United Kingdom; Nicholas J. Higham, University of Manchester, United Kingdom

#### 9:00-9:25 A Matrix Analysis of **Different Centrality Measures**

Christine Klymko and Michele Benzi, Emory University, USA

#### 9:30-9:55 Anticipating Behavior **During Twitter Spikes**

Desmond Higham, University of Strathclyde, United Kingdom; Peter Laflin, Bloom Agency, Leeds, United Kingdom; Peter Grindrod, University of Oxford, United Kingdom; Alex Mantzaris, University of Strathclyde, United Kingdom; Amanda Otley, Bloom Agency, Leeds, United Kingdom

#### 10:00-10:25 Low-rank Approximation Methods for Ranking the Nodes of a **Complex Network**

Giuseppe Rodriguez and Caterina Fenu, University of Cagliari, Italy; Lothar Reichel, Kent State University, USA

### Tuesday, July 8

## **MS31** Modeling and Numerical **Issues for Fractured-porous** Media - Part I of III

8:30 AM-10:30 AM

Room:Salon 3 - 3rd Floor

#### For Part 2 see MS47 Organized by SIAG/GS

Fractured-porous media are exploited for a large variety of applications, like oil and gas extraction, CO2 sequestration, water supply or geothermy. The complex geometry is coupled with complex phenomena like multiphase flows, hydraulic fracturing, solute transport... This minisymposium is concerned with some of the most recent methods, from both the point of view of mathematical modelling and numerical schemes to model and simulate these challenging applications, balancing accuracy and computational effort.

**Organizer: Géraldine Pichot** INRIA Rennes Bretagne Atlantique, France

Organizer: Alessio Fumagalli Institut Français du Pétrole, France

#### Organizer: Alessio Fumagalli

Institut Français du Pétrole, France

#### 8:30-8:55 Meshing Strategies and the Impact of Finite Element Quality on the Velocity Field in Fractured Media Géraldine Pichot, INRIA Rennes Bretagne

Atlantique, France; Patrick Laug, INRIA Rocquencourt, France; Jocelyne Erhel, INRIA-Rennes, France; Jean E. Roberts and Jérôme Jaffré, INRIA Rocquencourt, France; Jean-Raynald de Dreuzy, Université de Rennes 1, France

#### 9:00-9:25 Adaptive Mesh Refinement for Flow in Fractured Porous Media

Mohammad Karimi-Fard and Louis Durlofsky, Stanford University, USA

#### 9:30-9:55 A Family of Numerical Methods for Large Scale DFN Flow Simulations avoiding Complex Mesh Generation

Matias Benedetto, Stefano Berrone, Caludio Canuto, Sandra Pieraccini, and Stefano Scialo, Politecnico di Torino, Italy

#### 10:00-10:25 XFEM for Flow in Fractured **Porous Media**

Anna Scotti and Luca Formaggia, Politecnico di Milano, Italy

### Tuesday, July 8

## **MS32**

## Mathematical Modeling of **Health Problems**

8:30 AM-10:30 AM

Room:Salon 12 - 3rd Floor

Part of the SIAM Workshop Celebrating Diversity

Mathematical modeling has become an increasingly important tool used to shed light on health issues. This minisymposium, under SIAM's Workshop Celebrating Diversity, will feature a range of applied mathematics tools (nonlinear dynamical systems and stochastic processes) that are currently used to model and analyze health problems including diabetes and fetal distress. The talks will address issues relating to models and analysis as well as problem implications.

**Organizer: Raegan Higgins** Texas Tech University, USA

**Organizer: Sue Minkoff** University of Texas at Dallas, USA

**Organizer: Cristina Villalobos** University of Texas - Pan American, USA

**Organizer: Stephen Wirkus** 

Arizona State University, USA

8:30-8:55 Oscillation of Nabla **Dynamic Equations on Time Scales** Raegan Higgins, Texas Tech University, USA

#### 9:00-9:25 Fetal Heart Rate and EEG Modeling: Predicting Fetal Distress in Labor

Aisha Najera Chesler, Claremont Graduate University, USA; Ami Radunskaya, Pomona College, USA

#### 9:30-9:55 Mathematical Models of Metabolic Dysfunction in Type 2 **Diabetes**

Erica J. Graham, North Carolina State University, USA

#### 10:00-10:25 A Biological Application of the Oriented Skein Relation

Candice Price, United States Military Academy at West Point, USA

49

## MS33

## AWM Meeting - Workshop: Research Talks by Recent Ph.D.s I

8:30 AM-10:30 AM

Room:Salon 2 - 3rd Floor

**For Part 2 see MS49** This minisymposium will feature research talks by female recent Ph.D.s.

Organizer: Ching-Shan Chou The Ohio State University, USA

Organizer: Chiu-Yen Kao Claremont McKenna College, USA

#### 8:30-8:55 Nonlinear Traveling Waves for a Model of the Madden-Julian Oscillation

Shengqian Chen, University of Wisconsin, Madison, USA

#### 9:00-9:25 Fast Sweeping Methods for Steady State Problems for Hyperbolic Conservation Laws

Weitao Chen, University of California, Irvine, USA

#### 9:30-9:55 Nonlinear Neutral Inclusions: Assemblages of Spheres and Ellipsoids

Silvia Jimenez Bolanos, Colgate University, USA

#### 10:00-10:25 Energy-Conserving Discontinuous Galerkin Methods for the Vlasov-Ampere System

Xinghui Zhong, Michigan State University, USA

#### Tuesday, July 8

## **MS34**

Linear Algebra Aspects and Scalable Methods for Stochastic/parameterized Partial Differential Equations - Part II of II

8:30 AM-10:30 AM

Room:Salon 7 - 3rd Floor

#### For Part 1 see MS20 Organized by SIAG/ALA

Uncertainty quantification is now recognized as an essential component of predictive simulation. Physical models with uncertainties are often packaged as partial differential equations, where imprecisely prescribed inputs are modeled with a set of random variables. This minisymposium will explore state-of-the-art scalable computational methods for solving these problems---with a particular emphasis on the linear algebra challenges that arise in computation.

#### Organizer: Paul Constantine Colorado School of Mines, USA

Organizer: Alireza Doostan

University of Colorado Boulder, USA

#### 8:30-8:55 Optimal Sampling of Polynomial Chaos Expansions

Alireza Doostan and Jerrad Hampton, University of Colorado Boulder, USA

#### 9:00-9:25 High-Dimensional Approximation with Discrete Leja Sequences

Akil Narayan, University of Massachusetts, Dartmouth, USA

#### 9:30-9:55 Bayesian Inference with Reduced-order Models and Statistical Error Estimates

*Kevin T. Carlberg* and Martin Drohmann, Sandia National Laboratories, USA; Matthias Morzfeld and Fei Lu, Lawrence Berkeley National Laboratory, USA

#### 10:00-10:25 Partial Eigenvalue Assignment in Large-Scale Linear Stochastic Dynamic Systems

Sonjoy Das and Kundan Goswami, State University of New York at Buffalo, USA; Biswa N. Datta, Northern Illinois University, USA

#### Tuesday, July 8

## **MS35**

## Recent Progress on Computation and Application of Time Varying Systems - Part III of III

8:30 AM-10:30 AM

Room: Wilson - 3rd Floor

#### For Part 2 see MS21

Time varying systems are common in many science and engineering fields. There are many open challenges in computation and application of time varying systems. In this minisymposium we will present recent progress in three aspects in this area: Algorithm Development (session 1); Stochastic Simulation (session 2); Application (session 3).

Organizer: Yang Cao Virginia Tech, USA

Organizer: Shengtai Li Los Alamos National Laboratory, USA

Organizer: Soumyendu Raha

#### Indian Institute of Science, Bangalore, India 8:30-8:55 Multi-Physics Multiscale Simulations for Dusty Proto-Planetary Disks

Shengtai Li, Los Alamos National Laboratory, USA

9:00-9:25 Understanding the Network of Oscillators in the Mammalian Circadian Clock

Stephanie Taylor, Colby College, USA

#### 9:30-9:55 Integration of Molecular Science and Engineering

*Richard C. Alkire*, University of Illinois at Urbana-Champaign, USA

#### 10:00-10:25 Intrinsic and Extrinsic Fluctuations in a Spatiotemporal Oscillatory System

Andreas Hellander, University of California, Santa Barbara, USA

## **MS36**

## Experimental Nonlinear Dynamics - Part I of II

8:30 AM-10:30 AM

Room:Salon 1 - 3rd Floor

For Part 2 see MS136 Organized by SIAG/DS

This minisymposium brings together reports on experimental investigations.

#### Organizer: Eberhard Bodenschatz

Max-Planck-Institute for Dynamics and Self-Organization, Germany

#### 8:30-8:55 Low Energy Cardiac Defibrillation

*Stefan Luther*, Max-Planck-Institute for Dynamics and Self-Organization, Germany

#### 9:00-9:25 Capillary Fracture

Karen Daniels, North Carolina State University, USA; Joshua Bostwick, Northwestern University, USA

#### 9:30-9:55 Nonlinear Waves and Wave Turbulence

Nicolas Mordant, Université de Grenoble Alpes, France

#### 10:00-10:25 Inertial Particles in Turbulence, Caustics and Collisions

*Gregory Bewley*, Max-Planck-Institute for Dynamics and Self-Organization, Germany

### Tuesday, July 8

## MS37 Student Days: SIAM Student Chapter Presentations

8:30 AM-10:30 AM

## Room:Salon 6 - 3rd Floor

For Part 2 see MS68 Organized by the SIAM Education Committee

#### SIAM Student Chapter presentations. Organizer: Peter R. Turner

Clarkson University, USA

#### 8:30-8:45 Solving Differential Algebraic Equations Using Structural Analysis Based Dummy Derivatives

*Ross McKenzie* and John Pryce, Cardiff University, United Kingdom; Guangning Tan and Ned Nedialkov, McMaster University, Canada

#### 8:50-9:05 A Mathematical Model of an Arterial Wall

*Marek Netušil*, Charles University, Czech Republic; Lukas Horny, Czech Technical University, Czech Republic

#### 9:10-9:25 A Linear Quadratic Programming Method for Nonlinear Model Predictive Control

*Felix Lenders*, Heidelberg University, Germany; Christian Kirches, University of Heidelberg, Germany

#### 9:30-9:45 Mathematical Model of Transplant Rejection: Roles of T cells, Antigen Presenting Cells, and Cytokines

Andrew Maturo, Indiana University - Purdue University Indianapolis, USA; Giorgio Raimondi, Johns Hopkins University, USA; Julia Arciero, Indiana University -Purdue University Indianapolis, USA

#### 9:50-10:05 Qualitative and Asymptotic Theory of Detonations

Luiz Faria and Aslan R. Kasimov, King Abdullah University of Science & Technology (KAUST), Saudi Arabia; Rodolfo R. Rosales, Massachusetts Institute of Technology, USA

#### 10:10-10:25 A Mathematical Model for the Sexual Selection of Extravagant and Costly Mating Displays

Sara Clifton and Danny Abrams, Northwestern University, USA

### Tuesday, July 8

## MS38 Numerical Methods for Viscosity Solutions and Applications - Part I of II

8:30 AM-10:30 AM

Room:Salon 10 - 3rd Floor

#### For Part 2 see MS54

The theory of viscosity solutions for PDEs (partial differential equations) began with the seminal work of Crandall and Lions in the early 80's, and was initially developed to provide a framework for global existence and uniqueness for Hamilton-Jacobi equations. The theory has since been extended to second order degenerate elliptic/parabolic equations, and has found applications in a wide (and growing) range of problems, including curvature motion, image processing, optimal mass transportation, and optimal control theory. This session aims to bring together researchers whose work involves numerical schemes for viscosity solutions and applications in the computational and physical sciences.

#### Organizer: Jeff Calder

University of Michigan, USA

#### Organizer: Adam M. Oberman McGill University, Canada

8:30-8:55 Hamilton-Jacobi Equations for the Continuum Limits of Sorting and Percolation Problems *Jeff Calder*, University of Michigan, USA

#### 9:00-9:25 Convergent Filtered Schemes for the Eikonal Equation

Tiago Salvador, McGill University, Canada

#### 9:30-9:55 Fast and Accurate Redistancing Via Directional Optimization

Selim Esedoglu, University of Michigan, USA

#### 10:00-10:25 Numerical Solution of the Second Boundary Value Problem for the Monge-Ampère Equation

Brittany Froese, University of Texas at Austin, USA

## MS39

## Tensor Analysis, Computation and Application - Part III of III

8:30 AM-10:00 AM

Room:Salon 5 - 3rd Floor

### For Part 2 see MS25

Multilinear algebra and tensor computations have made some great strides in advancing applied and computational mathematics as well as engineering and science fields. Here we present several talks which report on state-of-the-art methods in tensor decompositions (canonical polyadic, tucker and spectral), answer the questions of tensor complexity and include applications in object recognition, data compression and pollution sources identification.

## Organizer: Carmeliza Navasca

University of Alabama at Birmingham, USA

#### 8:30-8:55 Stochastic Approximation Algorithms for the Polyadic Decomposition

Nico Vervliet and Lieven De Lathauwer, Katholieke Universiteit Leuven, Belgium

#### 9:00-9:25 Source Apportionment of Time and Size Resolved Ambient Particulate Matter

*Na Li*, MathWorks, USA; Carmeliza Navasca, University of Alabama at Birmingham, USA

#### 9:30-9:55 Using Krylov Subspace Method for the Canonical Polyadic Decomposition

*Christina Glenn* and Carmeliza Navasca, University of Alabama at Birmingham, USA

SIAM Presents Since 2008, SIAM has recorded many Invited Lectures, Prize Lectures, and selected



Minisymposia from various conferences. These are available by visiting SIAM Presents (http://www.siam.org/meetings/ presents.php). Tuesday, July 8

## MS40 Collective Dynamics in Active Suspensions-Part I of II

8:30 AM-10:30 AM

## Room:Indiana - 3rd Floor

#### For Part 2 see MS56

The dynamics of active suspensions (bacteria, algae, active colloids) has recently attracted great interest. Various mathematical models have been proposed to describe locomotion of individual swimmers, their interactions and collective dynamics, spanning a wide range of length and time scales. The goal of this minisymposium is to bring together applied mathematicians, physicists and engineers to survey the current state of this research field and to stimulate new collaborations that may help to solve open problems.

#### **Organizer: Jorn Dunkel** *Massachusetts Institute of Technology, USA*

Organizer: Enkeleida Lushi

Brown University, USA

#### **Organizer: David Saintillan** University of Illinois at Urbana-Champaign, USA

#### 8:30-8:55 Hydrodynamics and Control of Microbial Locomotion

Jorn Dunkel, Massachusetts Institute of Technology, USA; Vasily Kantsler, University of Warwick, United Kingdom; Raymond E. Goldstein, University of Cambridge, United Kingdom

## 9:00-9:25 Surface Interactions in Suspensions of Swimming Cells

Vasily Kantsler, University of Warwick, United Kingdom; Jorn Dunkel, Massachusetts Institute of Technology, USA; Raymond E. Goldstein, University of Cambridge, United Kingdom

#### 9:30-9:55 Orientational Order in Two-Dimensional Confined Active Suspensions

Alan Cheng Hou Tsang and *Eva Kanso*, University of Southern California, USA

10:00-10:25 Modeling of Hydrodynamic Interactions of Large Groups of Swimming Microorganisms in Viscoelastic Fluids

Patrick Underhill and Yaser Bozorgi, Rensselaer Polytechnic Institute, USA Tuesday, July 8

## MS41 Dynamics of Large

## Stochastic Neuronal Networks

## 8:30 AM-10:30 AM

Room:Kimball - 3rd Floor

This session brings together researchers exploring a wide range of phenomena that arise in large random and stochastic neuronal networks. One prominent thread underlying these talks is the low-dimensional structures that arise in such networks; how to characterize and mathematically model them, how to use them to perform network reconstruction, and how they are reflected in the computational tasks being performed by neuronal networks.

### Organizer: Andrea K. Barreiro

Southern Methodist University, USA

#### Organizer: Katherine Newhall

Courant Institute of Mathematical Sciences, New York University, USA

#### 8:30-8:55 Low-Dimensional Dynamics Embedded in Echo-State Networks

Andrea K. Barreiro, Southern Methodist University, USA

#### 9:00-9:25 Integrate-and-Fire Model of Insect Olfaction

Pamela B. Fuller, Rensselaer Polytechnic Institute, USA

#### 9:30-9:55 Metastability and Coherent Structures in Large Stochastic Neuronal Networks

Lee DeVille, University of Illinois, USA

10:00-10:25 Generalized Linear Models for Networks of Spiking Neurons

#### Sara A. Solla, Northwestern University, USA

Tuesday

## **MS42**

## Active Complex Fluids in Biology at Multiple Scales

## 8:30 AM-10:30 AM

#### Room:Logan - 3rd Floor

In biological systems many interesting fluid flow problems arise at various length-scales. We explore in this session approaches to modeling, analysis, and simulations of active complex fluids and fluid-body interactions on scales ranging from the subcellular scale to the level of populations of motile organisms. This minisymposium is part of a series on locomotion and flowbody interactions.

#### Organizer: Paul J. Atzberger

University of California, Santa Barbara, USA

#### **Organizer: Kajetan M. Sikorski** University of California, Santa Barbara, USA

#### 8:30-8:55 Cytoplasm Rheology and Its Role Cellular Blebbing Dynamics *Robert Guy*, University of California, Davis,

*Robert Guy*, University of California, Davis USA

9:00-9:25 Exploring the Effect of Glass-Forming Sugars on Vesicle Membrane Dynamics During Drying *Chris Vogl*, University of Washington, USA

#### 9:30-9:55 Finite Length Undulatory Swimmers: Whether to Kick Or to Burrow in a Viscoelastic Fluid

*Becca Thomases*, University of California, Davis, USA

#### 10:00-10:25 An Analytic Framework for Pairwise Correlations in Active Swimming

Kajetan M. Sikorski, University of California, Santa Barbara, USA

## Tuesday, July 8

## MS43 Solving Industrial Problems with Modelica

### 8:30 AM-10:30 AM

#### Room:Madison - 3rd Floor

Modelica language has emerged as a standard for mathematical modeling and simulation in Europe and is gaining popularity in the United States. The presentations of this minisymposium, all given by distinguished industry experts, will describe some real simulation problems that have been solved using Modelica. Presentations will include a general overview of the language, a talk about using Modelica to build Web-based solutions, a discussion of a problem of building community energy systems, and a talk on using Modelica for qualitative reasoning.

#### Organizer: Dmitry A. Altshuller Dassault Systèmes, USA

## 8:30-8:55 Introduction and Overview of Modelica

Hubertus Tummescheit, Modelon, Inc., USA

9:00-9:25 Enabling Technologies for Web-Based Engineering Analysis Michael Tiller, Xogeny, USA

#### 9:30-9:55 Modelica for Building and Community Energy Systems

Michael Wetter, Lawrence Berkeley National Laboratory, USA

#### 10:00-10:25 Qualitative Reasoning with Modelica Models *Bill Janssen*, PARC, USA

Tuesday, July 8

## CP9 Dynamical Systems II

8:30 AM-10:10 AM

Room:Salon 4 - 3rd Floor

Chair: Helen F. Parks, University of California, San Diego, USA

#### 8:30-8:45 Variational Integrators for Interconnected Dirac Mechanical Systems

Helen F. Parks and Melvin Leok, University of California, San Diego, USA

#### 8:50-9:05 A Global Bifurcation of Mixed-Mode Oscillations

Ian M. Lizarraga and John Guckenheimer, Cornell University, USA

#### 9:10-9:25 Subharmonic Response and Threshold of Chirp Driven Microbubbles

John S. Allen and *Rintaro Hayashi*, University of Hawaii, Manoa, USA

#### 9:30-9:45 Different Wave Solutions Associated with Singular Lines on Phase Plane

Yu V. Wang, City College of New York, USA

#### 9:50-10:05 Mixing and Piecewise Isometries on a Hemisphere

Paul Park, Paul Umbanhowar, Julio Ottino, and Richard M. Lueptow, Northwestern University, USA

## CP10 Materials Science

8:30 AM-10:10 AM

Room:Salon 8 - 3rd Floor

Chair: Stewart Silling, Sandia National Laboratories, USA

#### 8:30-8:45 On Strong Ellipticity for Implicit and Strain-Limiting Theories of Elasticity

*Tina Mai* and Jay R. Walton, Texas A&M University, USA

8:50-9:05 Peridynamics As a Multiscale Method

Stewart Silling, Sandia National Laboratories, USA

## 9:10-9:25 Light Beam Interaction in Nonlinear Optical Media

Rajah P. Varatharajah, North Carolina A&T State University, USA

#### 9:30-9:45 Direct Numerical Simulation of Anti-Plane Shear Fracture in New Class of Elastic Bodies

Mallikarjunaiah S. Muddamallappa and Jay R. Walton, Texas A&M University, USA

#### 9:50-10:05 A Domain Decomposition Method for Cavitation Computation in Nonlinear Elasticity

*Zhiping Li* and Wulin Luo, Peking University, China

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## Coffee Break

10:30 AM-11:00 AM

Room: Exhibit Hall

### Tuesday, July 8

## IC3

## Computational Biology in the 21st Century: Making Sense out of Massive Data

11:00 AM-11:45 AM

Room:Grand Ballroom - 4th Floor

Chair: Anna-Karin Tornberg, KTH Royal Institute of Technology, Sweden

The last two decades have seen an exponential increase in genomic and biomedical data, which will soon outstrip advances in computing power to perform current methods of analysis. Extracting new science from these massive datasets will require not only faster computers; it will require smarter algorithms. We show how ideas from cutting-edge algorithms, including spectral graph theory and modern data structures, can be used to attack challenges in sequencing, medical genomics and biological networks.

#### **Bonnie Berger**

Massachusetts Institute of Technology, USA

## Tuesday, July 8



## The Evolution of Combinatorial Solvers for Laplacian Linear Systems 11:00 AM-11:45 AM

Room:Red Lacquer - 4th Floor

Chair: Chen Greif, University of British Columbia, Canada

Fast solvers that are based on combinatorial techniques have been investigated for more than two decades now. The most successful of these (at least theoretically) solve symmetric diagonally linear systems, a class that includes Laplacians of graphs. The talk will describe these techniques, starting with Vaidya's 1991 solver and ending with very recent algorithms by Kelner and others. The talk will focus on how the graph-matrix isomorphism is used in these solvers, on the class of matrices that they can be applied to, and on the gap between theory and practice in this area.

Sivan A. Toledo

Tel Aviv University, Israel

## IP3 Pattern Recognition with Weakly Coupled Oscillatory **Networks**

### 11:50 AM-12:35 PM

Room:Grand Ballroom - 4th Floor

Chair: Lennaert van Veen, University of Ontario Institute of Technology, Canada

One outstanding property of biological neural networks is the ability to perform pattern recognition tasks. To mimic this property with a man-made device that processes information in parallel has been a great challenge. Traditional approaches employ many interconnected units and are inherently difficult to construct. In the lecture, we will focus on neural network models of weakly coupled oscillators with time-dependent coupling. In these models, each oscillator has only one or a few connections to a common support, which makes them predestinated for hardware implementation. We will discuss the dynamics of different network architectures, compare their scalability, present experimental realizations of the networks and point out open challenging mathematically problems.

#### Katharina Krischer

Technical University of Munich, Germany

### Tuesday, July 8

Intermission -- Walk to the Hilton Chicago (for Prizes and Awards Luncheon) 12:35 PM-12:50 PM

### Prizes and Awards Luncheon

(Offsite at the Hilton Chicago) 12:50 PM-2:15 PM Room: Hilton Chicago Grand Ballroom



Intermission 2:15 PM-2:30 PM

### Tuesday, July 8

## SP2

The John von Neumann Lecture: Fast, Accurate **Tools for Physical Modeling** in Complex Geometry

2:30 PM-3:30 PM

University, USA

Room: Grand Ballroom - 4th Floor Chair: Irene Fonseca, Carnegie Mellon

During the last two decades, fast algorithms

have brought a variety of large-scale physical and biophysical modeling tasks within practical reach. This is particularly true of integral equation approaches to electromagnetics, acoustics, gravitation, elasticity, and fluid dynamics. The practical application of these methods, however, requires analytic representations that lead to well-conditioned linear systems, quadrature methods that permit the accurate evaluation of boundary integrals with singular kernels, and techniques for a posteriori error estimation that permit robust mesh refinement. I will give an overview of recent progress in these areas with a particular emphasis on wave scattering problems in complex geometry.

#### Leslie Greengard

Simons Foundation and Courant Institute of Mathematical Sciences, New York University, USA

**Coffee Break** 

3:30 PM-4:00 PM Room:Exhibit Hall



## MS44 Mathematics of Power Grid -Part I of III

#### 4:00 PM-6:00 PM

Room: Grand Ballroom - 4th Floor

#### For Part 2 see MS59

The power grid is a complex physical system that exhibits huge dimensionalities, multi-scale spatio-temporal behavior, complex network topologies, and high levels of uncertainty originating from cascading failures and interdependencies with climate and infrastructures such as natural gas networks. Understanding and predicting the behavior of the next-generation power grid requires of new advances in mathematics. In this minisymposium, we seek to motivate such advances by bringing together application domain experts and mathematicians.

Organizer: Victor Zavala Argonne National Laboratory, USA

#### Organizer: Mahantesh Halappanavar

Pacific Northwest National Laboratory, USA

Organizer: Shrirang Abhyankar Argonne National Laboratory, USA

#### 4:00-4:25 Dynamics Constrained Optimization of Power Grid Using Adjoint Sensitivity Analysis

Shrirang Abhyankar and Mihai Anitescu, Argonne National Laboratory, USA; Vishwas Rao, Virginia Tech, USA

#### 4:30-4:55 Dynamic-Feature Extraction, Attribution and Reconstruction (dear) Method for Power System Model Redution

Shuai Lu, Shaobu Wang, Ning Zhou, Marcelo Elizondo, and Guang Lin, Pacific Northwest National Laboratory, USA;M.A. Pai, University of Illinois at Urbana-Champaign, USA

#### 5:00-5:25 Predicting the Future with Faster Than Real-Time Power System Dynamics Simulation

Alexander J. Flueck, Illinois Institute of Technology, USA

#### 5:30-5:55 Global Error Estimation for Differential Equations

*Emil M. Constantinescu*, Argonne National Laboratory, USA

Tuesday, July 8

## **MS45**

Recent Advances in Uncertainty Quantification at the Extreme Scale - Part II of II

### 4:00 PM-6:00 PM

#### Room:Red Lacquer - 4th Floor

#### For Part 1 see MS29

Enabling predictions of next-generation, complex, stochastic simulations is critical to realizing the potential of future computing platforms, including exascale, and will ultimately enable scientists to address a fundamental question, namely <sup>3</sup>how do the uncertainties ubiquitous in all modeling efforts affect our predictions and understanding of complex phenomena?" Addressing this challenge is the aim of the talks in this session. Topics include: novel hierarchical, low-discrepancy sampling methods, advanced multilevel methods, architecture-aware UQ paradigms, and adaptive and robust experimental design strategies.

Organizer: Guannan Zhang Oak Ridge National Laboratory, USA

#### Organizer: Clayton G. Webster Oak Ridge National Laboratory, USA

## 4:00-4:25 A Multilevel Stochastic

Collocation Methods for SPDEs Max Gunzburger and Aretha L. Teckentrup, Florida State University, USA; Peter Jantsch, University of Tennessee, USA; Clayton G. Webster, Oak Ridge National Laboratory, USA

#### 4:30-4:55 A Comparison of Algebraic Multigrid Preconditioning Approaches for Sampling-Based Uncertainty Propagation on Advanced Computing Architectures

Jonathan J. Hu and Eric Phipps, Sandia National Laboratories, USA

#### 5:00-5:25 Improved Multilevel Monte Carlo for High Performance Computing

Zane Colgin and Abdul Khaliq, Middle Tennessee State University, USA; Guannan Zhang and Clayton G. Webster, Oak Ridge National Laboratory, USA; Viktor Reshniak, Middle Tennessee State University, USA

### 5:30-5:55 Calibration of a Computer Model with Functional Inputs

Matthew Plumlee, Georgia Institute of Technology, USA

#### Tuesday, July 8

## **MS46**

## High-Performance Algorithms for Functions of Matrices

## 4:00 PM-6:00 PM

Room: Crystal - 3rd Floor

Organized by SIAG/CSE

Algorithms for computing functions of matrices are becoming more widely-used and hence more important in many areas of computational science. (By functions of matrices we refer to functions such as the matrix exponential and logarithm, square root, trigonometric functions of matrices, etc.). Early investigations focused on finding stable algorithms with low arithmetic complexity (flop count). The focus is now changing toward algorithms that can exploit modern architectures with complex memory systems and many processors or cores. The minisymposium will focus on these emerging high-performance algorithms for functions of matrices.

#### Organizer: Edvin Deadman

University of Manchester, United Kingdom

Organizer: Sivan A. Toledo Tel Aviv University, Israel

## 4:00-4:25 Overview of High-Performance Algorithms for Functions of Matrices

*Edvin Deadman*, University of Manchester, United Kingdom

#### 4:30-4:55 Efficient and Stable Arnoldi Restarts for Matrix Functions Based on Quadrature

Stefan Guettel, University of Manchester, United Kingdom; Andreas J. Frommer, Bergische Universität, Germany; Marcel Schweitzer, Bergische Universität Wuppertal, Germany

#### 5:00-5:25 Exponential Iterative Methods of Runge-Kutta-type (EPIRK): Construction, Analysis and Software

Mayya Tokman, University of California, Merced, USA

## 5:30-5:55 Blocked Algorithms for the Matrix Sign Function

Sivan A. Toledo, Tel Aviv University, Israel

## **MS47**

## Modeling and Numerical Issues for Fractured-porous Media - Part II of III

4:00 PM-6:00 PM

Room:Salon 3 - 3rd Floor

#### For Part 1 see MS31 For Part 3 see MS62 Organized by SIAG/GS

Fractured-porous media are exploited for a large variety of applications, like oil and gas extraction, CO2 sequestration, water supply or geothermy. The complex geometry is coupled with complex phenomena like multiphase flows, hydraulic fracturing, solute transport... This minisymposium is concerned with some of the most recent methods, from both the point of view of mathematical modelling and numerical schemes to model and simulate these challenging applications, balancing accuracy and computational effort.

**Organizer: Géraldine Pichot** INRIA Rennes Bretagne Atlantique, France

**Organizer: Alessio Fumagalli** Institut Français du Pétrole, France

#### **Organizer: Alessio Fumagalli** *Institut Français du Pétrole, France*

#### 4:00-4:25 A Double-Layer Reduced Model for Flow in Fault Zones Using Hybrid Finite Volume Schemes Isabelle Faille, IFP Energies nouvelles,

France; *Alessio Fumagalli*, Institut Français du Pétrole, France; Jerome Jaffre and Jean E. Roberts, INRIA Rocquencourt, France

#### 4:30-4:55 Gradient Discretization of Hybrid Dimensional Two-Phase Darcy Flows in Fractured Porous Media

Konstantin Brenner, University of Nice, France; Cindy Guichard, LJLL, University Paris 6, France; Mayya Groza, Gilles Lebeau, and Roland Masson, University of Nice, France

5:00-5:25 A Fracture Indicator to Identify Fractures in Porous Media

*Vincent Martin*, Université de Technologie de Compiègne, France

#### 5:30-5:55 Controlling Uncertainty in Fractured Porous Media Flow

Markus Köppel, University of Stuttgart, Germany Tuesday, July 8

## MS48 Applications in Human Performance, Counterterrorism, and Risk Analysis

4:00 PM-6:00 PM

Room:Salon 12 - 3rd Floor

Part of the SIAM Workshop Celebrating Diversity

Techniques from the areas of biomechanics, image processing, and decision making are used to model and analyze different sets of data for the purpose of better situational awareness in military force protection. The techniques provided contribute to national efforts made by homeland security to mitigate public threats through developments in human motion models, action recognition, and the investigation of intentional attacks. Presentations of recent undertakings, their results and challenges are given.

#### Organizer: Kimberly Kendricks Central State University, USA

Organizer: Sue Minkoff University of Texas at Dallas, USA

Organizer: Cristina Villalobos University of Texas - Pan American, USA

Organizer: Stephen Wirkus Arizona State University, USA

#### 4:00-4:25 Learning Hierarchical Invariant Spatio-Temporal Features for Human Action and Activity Recognition Binu Nair and Vijay Asari, University of Dayton, USA

4:30-4:55 Game-Theoretic and Reliability Methods in Counterterrorism and Security Vicki Bier, University of Wisconsin, Madison, USA

#### 5:00-5:25 An Inverse Kinematic Approach Using Groebner Basis Theory Applied to Gait Analysis of the Lower Extremity Joint Angles

Anum Barki, NASA Langley Research Center, USA; Kimberly Kendricks, Central State University, USA; Ronald Tuttle, David Bunker, and Borel Christoph, Air Force Institute of Technology, USA

#### 5:30-5:55 Biomechanical Analysis of Pack Load Influence on Gait Signatures Derived from Grobner Basis Theory

Sean Kohles, Oregon Health & Science University, USA; Anum Barki, NASA Langley Research Center, USA; Kimberly Kendricks, Central State University, USA Tuesday, July 8

## **MS49**

## AWM Meeting - Workshop: Research Talks by Recent Ph.D.s II

4:00 PM-6:00 PM

Room:Salon 2 - 3rd Floor

**For Part 1 see MS33** This minisymposium will feature research talks by female recent Ph.D.s.

Organizer: Ching-Shan Chou The Ohio State University, USA

Organizer: Chiu-Yen Kao Claremont McKenna College, USA

#### 4:00-4:25 Numerical Optimization Method for Simulation Based Optimal Design Problems

Carmen Caiseda, Inter American University of Puerto Rico, Puerto Rico

## 4:30-4:55 A Characterization of the Reflected Quasipotential

Kasie Farlow, United States Military Academy, USA

#### 5:00-5:25 Analysis of Finite Difference Schemes for Diffusion in Spheres with Variable Diffusivity

Ashlee Ford Versypt, Massachusetts Institute of Technology, USA

5:30-5:55 Analysis of Si Models with Multiple Interacting Populations Using Subpopulations with Forcing Terms Evelyn Thomas, Bennett College For

Women, USA



MBAN14

## **MS50**

### Advances in Krylov and Extended Krylov Subspace Methods- Part I of III

4:00 PM-6:00 PM

Room:Salon 7 - 3rd Floor

#### For Part 2 see MS65 Organized by SIAG/ALA

Krylov Subspace methods have had a long illustrious history in numerical linear algebra. Acronyms like BiCG, BiCG-Stab, CG, GMRES, LSQR, MINRES, QMR, and IDR(s) have become part of the standard vocabulary of every numerical analyst. It is somewhat surprising that major advances are still being made to a subject so classical. This minisymposium will bring together researchers who have made recent major breakthroughs in the development of iterative methods built on Krylov subspaces and extended Krylov subspaces --- new algorithms that fill existing gaps, better convergence and stability analyses, and novel adaptations for efficiency under alternative measures of computational costs (such as communication complexity).

#### Organizer: Sou-Cheng T. Choi

University of Chicago and Argonne National Laboratory, USA

#### 4:00-4:25 Krylov Subspace Methods for Solving Singular Linear Systems or Least-Squares Problems

Sou-Cheng T. Choi, University of Chicago and Argonne National Laboratory, USA

#### 4:30-4:55 IDR-CGS-BiCGSTAB-IDR(s) a Case of Serendipity

Peter Sonneveld, Delft University of Technology, Netherlands

## 5:00-5:25 Multiple Preconditioners for GMRES

Daniel B. Szyld, Temple University, USA

#### 5:30-5:55 Probabilistic Bounds for Randomized Preconditioner for a Krylov Least Squares Solver

Ilse Ipsen, North Carolina State University, USA

Tuesday, July 8

## MS51 Mesoscale and Nonlocal Models of Materials with Microstructure - Part I of IV

4:00 PM-6:00 PM

### Room:Wilson - 3rd Floor

#### For Part 2 see MS66

This session will present recent developments concerning linking micro- and mesoscales in materials with complex behavior. It will focus on homogenization of partial differential equations with oscillatory coefficients, fine-scale stress concentration modeling, nonlocal continuum modeling, peridynamics, complexity reduction and multiscale computational modeling with applications to composites, suspensions, and biomaterials.

Organizer: Lyudmyla Barannyk University of Idaho, USA

Organizer: Yuliya Gorb University of Houston, USA

Organizer: Alexander Panchenko Washington State University, USA

Organizer: Alexandre Tartakovsky Pacific Northwest National Laboratory, USA

4:00-4:25 Title Not Available at Time of Publication

Robert P. Gilbert, University of Delaware, USA

#### 4:30-4:55 Is Dynamic Fracture at the Macroscale a Distinguished Limit of Unstable Nonlocal Bond Models?

Robert P. Lipton, Louisiana State University, USA

## 5:00-5:25 Peridynamics as a Multiscale Method

Stewart Silling, Sandia National Laboratories, USA

#### 5:30-5:55 Analysis of the Volume-Constrained Peridynamic Navier Equation of Linear Elasticity *Richard B. Lehoucq*, Sandia National

Laboratories, USA

Tuesday, July 8

## MS52 Rigorous Computations for Nonlinear PDEs

4:00 PM-6:00 PM

Room:Salon 1 - 3rd Floor

Organized by SIAG/DS

Standard computational methods to simulate PDEs require a finite dimensional, bounded, discrete setting, whereas the solutions are infinite dimensional, unbounded and continuous. With any numerical method there is the question of validity of the output. To address this fundamental issue, the field of "rigorous computations" emerged in the intersection of numerical analysis, topological methods, functional analysis and approximation theory. This field aims at developing methods that provide approximate solutions to a problem together with precise bounds within which exact solutions are guaranteed to exist in the mathematically rigorous sense. This minisymposium introduces the field, recent advances and future directions

#### Organizer: Jean-Philippe Lessard Université Laval, Canada

4:00-4:25 Rigorous Computations for

Nonlinear Pdes: An Introduction Jean-Philippe Lessard, Université Laval, Canada

#### 4:30-4:55 Rigorous Computation of Connecting Orbits

Jan Bouwe Van Den Berg, VU University, Amsterdam, Netherlands

#### 5:00-5:25 Computer-Assisted Existence and Multiplicity Proofs for Semilinear Elliptic Boundary Value Problems *Michael Plum*, Karlsruhe University,

Germany

## 5:30-5:55 Title Not Available at Time of Publication

J.F. Williams, Simon Fraser University, Canada

## MS53 Student Days: An Informal Meeting

4:00 PM-6:00 PM

#### Room: Wabash - 3rd Floor

This informal session provides opportunities for students to meet invited speakers. This is your chance to ask research or career questions, or listen to advice provided by the experts. Discussions will be conducted in smaller groups; after about 20 minutes, the groups will change, so you get a chance to talk to all of the invited speakers present.

#### Organizer: Esmond G. Ng

Lawrence Berkeley National Laboratory, USA

#### Organizer: Margot Gerritsen Stanford University, USA

Meet Informally with the 2014 SIAM Annual Meeting Co-Chairs and Several Invited Speakers

## MS54 Numerical Methods for Viscosity Solutions and Applications - Part II of II

4:00 PM-6:00 PM

#### Room:Salon 10 - 3rd Floor

#### For Part 1 see MS38

The theory of viscosity solutions for PDEs (partial differential equations) began with the seminal work of Crandall and Lions in the early 80's, and was initially developed to provide a framework for global existence and uniqueness for Hamilton-Jacobi equations. The theory has since been extended to second order degenerate elliptic/parabolic equations, and has found applications in a wide (and growing) range of problems, including curvature motion, image processing, optimal mass transportation, and optimal control theory. This session aims to bring together researchers whose work involves numerical schemes for viscosity solutions and applications in the computational and physical sciences.

#### Organizer: Jeff Calder

University of Michigan, USA

Organizer: Adam M. Oberman McGill University, Canada

4:00-4:25 The Exponential Formula for The Wasserstein Metric *Katy Craig*, Rutgers University, USA

Kaly Craig, Ruigers Oniversity, USA

#### 4:30-4:55 Error Estimates for Approximations to Fully Nonlinear PDE

Olga Turanova, University of Chicago, USA

5:00-5:25 Numerical Methods for the Fractional Laplacian

Adam M. Oberman, McGill University, Canada; Yanghong Huang, Imperial College London, United Kingdom

#### 5:30-5:55 A Finite-Volume Method for Nonlinear Nonlocal Equations with a Gradient Flow Structure

Yanghong Huang and José Carrillo, Imperial College London, United Kingdom; Alina Chertock, North Carolina State University, USA Tuesday, July 8

## MS55 Nonlinear Fluids -

## Part I of III

4:00 PM-6:00 PM

Room:Salon 5 - 3rd Floor

#### For Part 2 see MS70

This minisymposium will be on analysis, numerics, and applications of fluid flows that exhibit non-linear behavior. Topics will be fluid flows with non-linear constitutive laws, such as non-Newtonian fluids, microstructural fluids, and multi-phase/multiphysics coupling including interfacial effects and ion transport.

#### Organizer: Abner J. Salgado

University of Tennessee, USA

Organizer: Shawn W. Walker Louisiana State University, USA

#### 4:00-4:25 A Saddle-Point Formulation And Finite Element Method For The Stefan Problem With Surface Tension

Christopher B. Davis and *Shawn W. Walker*, Louisiana State University, USA

#### 4:30-4:55 Two-Fluid Flow in a Capillary Tube

Michael Shearer and *Melissa Strait*, North Carolina State University, USA

#### 5:00-5:25 Physiological Boundary Conditions for Hemodynamics

Pierre Gremaud, North Carolina State University, USA

#### 5:30-5:55 Active Nano-Rod Dispersions

*M. Gregory Forest*, University of North Carolina at Chapel Hill, USA; Qi Wang, University of South Carolina, USA; Ruhai Zhou, Old Dominion University, USA

## MS56 Collective Dynamics in Active Suspensions-Part I of II

## 4:00 PM-6:00 PM

Room:Indiana - 3rd Floor

#### For Part 1 see MS40

The dynamics of active suspensions (bacteria, algae, active colloids) has recently attracted great interest. Various mathematical models have been proposed to describe locomotion of individual swimmers, their interactions and collective dynamics, spanning a wide range of length and time scales. The goal of this minisymposium is to bring together applied mathematicians, physicists and engineers to survey the current state of this research field and to stimulate new collaborations that may help to solve open problems.

#### Organizer: Jorn Dunkel

Massachusetts Institute of Technology, USA

Organizer: Enkeleida Lushi Brown University, USA

#### Organizer: David Saintillan

University of Illinois at Urbana-Champaign, USA

4:00-4:25 Hydrodynamics Affects Ordering and Organization in Bacterial Suspensions Enkeleida Lushi, Brown University, USA

#### 4:30-4:55 Mechanics and Evolution in Bacterial Biofilms

Knut Drescher and Howard Stone, Princeton University, USA

## 5:00-5:25 Active Suspensions in Confinement

David Saintillan and Barath Ezhilan, University of Illinois at Urbana-Champaign, USA

#### 5:30-5:55 Effects of Micro-swimmer Locomotion in Peristaltic Pumping

Adam Stinchcombe, University of Michigan, USA; Enkeleida Lushi, Brown University, USA; Charles S. Peskin, Courant Institute of Mathematical Sciences, New York University, USA

## Tuesday, July 8

## MS57 Models of Social Interactions in Biology: From Random to Deterministic

4:00 PM-6:00 PM

#### Room:Kimball - 3rd Floor

This session presents recent research on models for the movement of biological organisms that interact socially. In some models, motion is deterministic, with organisms moving deliberately towards or away from each other. Other models describe aggregation probabilistically, with motion that is largely random, though biased toward nearby individuals, promoting aggregation. The four talks in this session include models that range along the spectrum from random to deterministic. The models also span discrete and continuous frameworks, theoretical and experimental viewpoints, and involve a variety of biological species. This minisymposium is part of a series on locomotion and flow-body interactions.

Organizer: Chad M. Topaz Macalester College, USA

Organizer: Andrew J. Bernoff Harvey Mudd College, USA

#### 4:00-4:25 Social Aggregation in Pea Aphids: Experimental Measurement and Random Walk Modeling

Andrew J. Bernoff, Harvey Mudd College, USA; Chad M. Topaz, Macalester College, USA

4:30-4:55 Collective Dynamics in Laboratory Insect Swarms James Puckett, Yale University, USA

5:00-5:25 Oscillatory Patch Formations from Social Foraging *Nessy Tania*, Smith College, USA

5:30-5:55 Trajectory Dynamics of Aquatic Kleptoparasitic Interactions Ryan Lukeman, St. Francis Xavier University, Canada

## Tuesday, July 8

## **MS58**

## Low-Reynolds Number Fluid Dynamics: Modeling and Simulations of Fluidstructure Interactions

## 4:00 PM-6:00 PM

#### Room:Logan - 3rd Floor

Low-Reynolds number fluid dynamics is ubiquitous and the fluid-structure interactions are especially important to mathematical biology and novel engineering applications in MEMS and biofluidics. In this minisymposium we will focus on the modeling and numerical simulations of fluid-structure interactions in low-Reynolds number flow. Multi-scale models will be presented for modeling specific motions related to biology, and advanced fast numerical algorithms will show how efficient mass computations can be conducted for a large many-body system in low-Reynolds number flow. This minisymposium is part of a series on locomotion and flow-body interactions.

Organizer: Yuan-Nan Young New Jersey Institute of Technology, USA

## Organizer: Silas Alben

University of Michigan, USA 4:00-4:25 Elastic Swimmer in Viscous

Fluid: How to Swim Efficiently?

Alexander Alexeev and Peter Derek Yeh, Georgia Institute of Technology, USA

#### 4:30-4:55 Mathematical Models for Microstructured Optical Fibre (MOF) Fabrication

Darren G. Crowdy, Imperial College London, United Kingdom

#### 5:00-5:25 Self-Propulsion of An Inextensible Elastic Membrane in An Electric Field

*Yuan-Nan Young*, New Jersey Institute of Technology, USA; Petia Vlahovska, Brown University, USA

#### 5:30-5:55 Accelerated Boundary Integral Simulations for Interactions of Drops and Solids in Micro-Fluidics Anna-Karin Tornberg, KTH Royal Institute

of Technology, Sweden

## **CP11** Numerical Methods in PDE I

#### 4:00 PM-6:00 PM

Room:Madison - 3rd Floor

Chair: David Horntrop, New Jersey Institute of Technology, USA

#### 4:00-4:15 Variance Reduction in the Simulation of Stochastic Differential Equations

David J. Horntrop, New Jersey Institute of Technology, USA

#### 4:20-4:35 Various Strategies for the Numerical Stochastic Homogenization of the Stochastic Poisson and Helmholtz Equations

Gerhard Tulzer, Technische Universitat Vienna, Austria; Clemens F. Heitzinger, Arizona State University, USA and Vienna University of Technology, Austria

#### 4:40-4:55 Split-Step Balanced Milstein Methods for Multi-Channel Stiff Stochastic Differential Systems

Viktor Reshniak and Abdul Khaliq, Middle Tennessee State University, USA; David A. Voss, Western Illinois University, USA

## 5:00-5:15 Local Smoothers for Cdfem with Sub-Element Discontinuities

Christopher Siefert and Richard Kramer, Sandia National Laboratories, USA

#### 5:20-5:35 A Guaranteed Automatic Integration Library for Monte Carlo Simulation

Lan Jiang, Illinois Institute of Technology, USA

#### 5:40-5:55 Reliable Error Estimation for Quasi-Monte Carlo Methods

Lluis Antoni Jimenez Rugama and Fred J. Hickernell, Illinois Institute of Technology, USA Tuesday, July 8

## CP12 Life Sciences I

4:00 PM-6:00 PM

Room:Salon 4 - 3rd Floor

Chair: Peter E. Larsen, Argonne National Laboratory, USA

#### 4:00-4:15 Using Machine Learning and Metabolomic/transportomic Systems Modeling to Identify Bacterial Ecotype from Genomic Sequence of Uncharacterized Environmental Or Clinical Isolates

Peter E. Larsen and Frank Collart, Argonne National Laboratory, USA; Yang Dai, University of Illinois, Chicago, USA

#### 4:20-4:35 Bioechemical Network Structure can be Revealed with Timecourse Data

Jae Kyoung Kim, The Ohio State University, USA; Daniel B. Forger III, University of Michigan, USA

#### 4:40-4:55 Iron-dependent Oxidative Stress Response Pathway in Human Mammary Epithelial Cells

Seda Arat, Virginia Tech, USA; Julia Chifman, Wake Forest University, USA; Suzy Torti and Reinhard Laubenbacher, University of Connecticut Health Center, USA

#### 5:00-5:15 A Simulator of the Multi-Scale Dynamics of Gene Regulatory Networks

Liliana Ironi, CNR, Italy

#### 5:20-5:35 A Mathematical Model for Glucose and Fatty Acid Metabolism

Donald A. Drew and Julienne LaChance, Rensselaer Polytechnic Institute, USA

#### 5:40-5:55 Multiscale Simulation of Reaction-Diffusion Systems in Living Cells

Stefan Hellander, University of California, Santa Barbara, USA; Andreas Hellander, Uppsala University, Sweden; Linda Petzold, University of California, Santa Barbara, USA

### Tuesday, July 8

## CP13

## Probability and Statistics

4:00 PM-5:20 PM

Room:Salon 8 - 3rd Floor

## 4:00-4:15 Storage Allocation Models with Finite Capacity

*Eunju Sohn*, Columbia College Chicago, USA; Charles Knessl, University of Illinois, Chicago, USA

#### 4:20-4:35 Stationary Stability for Evolutionary Dynamics in Finite Populations

Dashiell Fryer, Pomona College, USA; Marc Harper, University of California, Los Angeles, USA

## 4:40-4:55 Non-Parametric Clustering

with Rank-Constrained Least-Squares Stephane Chretien, Universite de Franche-Comte, France

#### 5:00-5:15 A Novel Concept of Normal Exponential ROC Model

Sudesh Pundir, Pondicherry University, India

### Intermission

6:00 PM-6:15 PM

## **Funding Panel**

6:15 PM-7:15 PM Room:Red Lacquer - 4th Floor

## PD

## Joint EU-Maths-IN/SIAM Position Paper on Industrial Mathematics

6:15 PM-7:15 PM

Room: Grand Ballroom - 4th Floor

Chair: Thomas A. Grandine, The Boeing Company, USA

Chair: Wil Schilders, Eindhoven University of Technology, Netherlands

EU-Maths-IN, a new initiative to boost mathematics for industry in Europe initiated by ECMI and EMS, serves to leverage the impact of mathematics on innovations in key technologies by creating a European Network of Networks for enhanced communication and information exchange between involved stakeholders from industry and academia. SIAM and EU-Maths-IN have recently developed a position paper detailing strategies for enhancing the leverage of mathematics on industry worldwide. These strategies include targeted job fairs, online job portals, regional workshops, and other activities. This panel will discuss these strategies and solicit ideas for additional new initiatives to pursue.

Michael Guenther Bergische Universität, Germany

Kirk Jordan IBM T.J. Watson Research Center, USA

**Stephen O'Brien** University of Limerick, Ireland

Fadil Santosa University of Minnesota, USA

### SIAM Business Meeting

7:15 PM-8:00 PM Room:Grand Ballroom - 4th Floor



## SIREV Editorial Board Dinner Meeting

8:00 PM-10:00 PM Room:Price - 5th Floor

## Wednesday, July 9

## Program Committee Breakfast Meeting

7:00 AM-8:30 AM Room:Buckingham - 5th Floor

### Registration

7:30 AM-4:30 PM Room:State - 4th Floor

### Wednesday, July 9

## **MS59**

## Mathematics of Power Grid - Part II of III

8:30 AM-10:30 AM

Room: Grand Ballroom - 4th Floor

#### For Part 1 see MS44 For Part 3 see MS75

The power grid is a complex physical system that exhibits huge dimensionalities, multi-scale spatio-temporal behavior, complex network topologies, and high levels of uncertainty originating from cascading failures and interdependencies with climate and infrastructures such as natural gas networks. Understanding and predicting the behavior of the next-generation power grid requires of new advances in mathematics. In this minisymposium, we seek to motivate such advances by bringing together application domain experts and mathematicians.

#### Organizer: Victor Zavala

Argonne National Laboratory, USA

Organizer: Mahantesh Halappanavar

Pacific Northwest National Laboratory, USA

Organizer: Shrirang Abhyankar Argonne National Laboratory, USA

8:30-8:55 Algorithms for Monitoring Oscillations in the Power Grid

*Alex Pothen*, Purdue University, USA; Mani Venkatasubramanian, Tianying Wu, and Ananth Kalyanaraman, Washington State University, USA

#### 9:00-9:25 Centrality of Dynamical Graph Structures

David F. Gleich, Purdue University, USA

#### 9:30-9:55 Stochastic Graph Modeling of Power Grids

Mahantesh Halappanavar, Pacific Northwest National Laboratory, USA; Eduardo Cotilla-Sanchez, Oregon State University, USA; Emilie Hogan, Pacific Northwest National Laboratory, USA; Paul Hines, University of Vermont, USA

#### 10:00-10:25 Role of Network Topology in the Electromechanical Dynamics of Cascading Power Grid Failure

Christopher DeMarco and Honghao Zheng, University of Wisconsin, Madison, USA

## MS60 Radial Basis Functions (RBF-FD) for Geoscience and Combustion Modeling

### 8:30 AM-10:30 AM

#### Room:Salon 12 - 3rd Floor

Radial Basis Function-generated Finite Differences (RBF-FD) are gaining popularity in geoscience and engineering fields due to their competitive accuracy, natural extension into higher dimensions, low computational complexity and cost. As with classical finite differences (FD), they parallelize naturally on multi-core architectures due to sparse compact matrices. However, unlike FD, RBF-FD allow for scattered nodes, flexibility to handle irregular geometries, and easy local refinement. This minisymposium illustrates the computational versatility of RBF-FD in the areas of combustion research, seismic modeling, ocean dynamics, and nonhydrostatic atmospheric modeling. For theoretical aspects of RBFs, see session "Advances in Kernel Methods for Analysis and Statistics".

#### Organizer: Natasha Flyer

National Center for Atmospheric Research, USA

#### 8:30-8:55 RBF-FD for Mesoscale Nonhydrostatic Atmospheric Modeling

Natasha Flyer, National Center for Atmospheric Research, USA

#### 9:00-9:25 RBF-FD for Elastic Wave Propagation in Layered Media

Bengt Fornberg, University of Colorado Boulder, USA

#### 9:30-9:55 Modeling Ocean Dynamics Using RBF-FD

*Cecile M. Piret*, Université Catholique de Louvain, Belgium

#### 10:00-10:25 Application of the RBF-FD Method to Laminar Flame Propagation Problems

Manuel Kindelan, Universidad Carlos III de Madrid, Spain

### Wednesday, July 9

## MS61

## Wave Propagation and Imaging in Random Media -Part I of II

8:30 AM-10:30 AM

Room: Crystal - 3rd Floor

#### For Part 2 see MS77

Concomitant advances in sensing technologies and a wide range of remote sensing applications have sparked significant advances in the applied mathematics field of wave propagation and imaging in random media. When waves travel deep in complex media cumulative scattering effects by microstructure build up and coherency is partially lost. The microstructure cannot be inferred in imaging because data is band limited, so it is described with stochastic processes. This minisymposium seeks to be a forum for the exchange of novel theoretical and computational results in wave propagation in random media and their application to the development of robust imaging algorithms.

#### Organizer: Liliana Borcea University of Michigan, USA

Organizer: Chrysoula Tsogka University of Crete, Greece

8:30-8:55 Electromagnetic Wave Propagation in Random Waveguides *Liliana Borcea*, University of Michigan, USA

9:00-9:25 Correlation Based Imaging and Applications

George C. Papanicolaou, Stanford University, USA

#### 9:30-9:55 Imaging Multiply Scattering Point Targets Using Sparsity Promoting Optimization

Miguel Moscoso, Universidad Carlos III de Madrid, Spain

#### 10:00-10:25 Homogenization of Interfaces Moving with Spatiotemporal Periodic Velocity

*Wenjia Jing*, Panagiotis Souganidis, and Hung V. Tran, University of Chicago, USA

#### SIAM Presents

Since 2008, SIAM has recorded many Invited Lectures, Prize Lectures, and selected Minisumposia from you



Lectures, and selected Minisymposia from various conferences. These are available by visiting SIAM Presents (http://www.siam.org/meetings/ presents.php).

### Wednesday, July 9

## **MS62**

## Modeling and Numerical Issues for Fractured-porous Media - Part III of III

8:30 AM-10:30 AM

*Room:Salon 3 - 3rd Floor* For Part 2 see MS47 Organized by SIAG/GS

Fractured-porous media are exploited for a large variety of applications, like oil and gas extraction, CO2 sequestration, water supply or geothermy. The complex geometry is coupled with complex phenomena like multi-phase flows, hydraulic fracturing, solute transport... This minisymposium is concerned with some of the most recent methods, from both the point of view of mathematical modelling and numerical schemes to model and simulate these challenging applications, balancing accuracy and computational effort.

**Organizer: Géraldine Pichot** INRIA Rennes Bretagne Atlantique, France

**Organizer: Alessio Fumagalli** *Institut Français du Pétrole, France* 

**Organizer: Alessio Fumagalli** *Institut Français du Pétrole, France* 

#### 8:30-8:55 Numerical Simulation of Deformation and Flow in Fractured, Poroelastic Materials

Katja Hanowski and Oliver Sander, RWTH Aachen University, Germany

#### 9:00-9:25 Coupling Fluid Flow with Stresses Induced by Fracture Deformation in Discrete Fracture Networks

Mark McClure, University of Texas at Austin, USA

#### 9:30-9:55 Fracture Propagation in Porous Media Using Isogeometric Analysis

Trond Kvamsdal, SINTEF, Norway

#### 10:00-10:25 Numerical Assessment of the Risk of Rock Damage in the Vicinity of Salt Caverns for the Storage of Gaseous Matter at Cyclic Operation Conditions

Norbert Böttcher, Helmholtz - Centre for Environmental Research - UFZ, Germany

## MS63 Dynamical Models in Applied Mathematics

#### 8:30 AM-10:30 AM

Room:Red Lacquer - 4th Floor

Part of the SIAM Workshop Celebrating Diversity

Applied mathematics is both broad and far-reaching in its use of mathematics and the corresponding application. This minisymposium brings together a diversity of dynamic models from the population level down to that of mRNA. Whether studying the invasive Rasberry ant using cellular automata, photoreceptors using differential equations, or recurrent neural network models using bifurcation theory, dynamical models can be used to gain key insight into various systems. This collection of research talks will present a range of current applications and approaches within mathematical biology and dynamical modeling.

#### Organizer: Stephen Wirkus Arizona State University, USA

#### 8:30-8:55 Qualitative Inverse Problems Using Bifurcation Analysis in the Recurrent Neural Network Model

Stephen Wirkus, Erika T. Camacho, and Pamela Marshall, Arizona State University, USA

## 9:00-9:25 Mechanistic Models of Retinitis Pigmentosa

*Erika T. Camacho* and Stephen Wirkus, Arizona State University, USA

#### 9:30-9:55 Dynamics and Control of An Invasive Species: The Case of the Rasberry Crazy Ant Colonies

Luis Melara, Shippensburg University, USA; Victor Vidal, State University of New York, Stony Brook, USA; Valerie Cheathon, Arizona State University, USA; Agustin Flores, Northeastern Illinois University, USA; Octavius Talbot, Morehouse College, USA; Adrian Smith, Arizona State University, USA; Marta Sarzynska, University of Oxford, United Kingdom; Dustin Padilla, Arizona State University, USA

#### 10:00-10:25 Learning the Association of Multiple Inputs in Recurrent Networks

Jeannine Abiva and Rodica Curtu, University of Iowa, USA

### Wednesday, July 9

## MS64 Challenges in Nonlinear Models for Life Sciences: From Cells to Ecosystems

8:30 AM-10:30 AM

#### Room:Salon 2 - 3rd Floor

Nonlinearities pose challenges mathematically, but are often necessary to incorporate in order to capture important behaviors of biological systems, particularly when considering multiple scales. From cellular level immune dynamics to ecosystem-wide species distributions, incorporating and understanding the effects of nonlinearities is important. Progress has been made in theoretical analysis of and in computational methods for simulating biological systems, but there is still much to be done, particularly in understanding transient dynamics and basins of attraction, and in statistical models to incorporate data and make predictions. Speakers will highlight the latest methods and applications of nonlinear models for cellular, organism, population and ecosystem level biological systems.

#### Organizer: Carrie A. Manore Tulane University, USA

#### 8:30-8:55 The Breadth of Mathematical Modelling of Biological Systems: History and Opportunities

Mary Ann Horn, Vanderbilt University, USA and National Science Foundation, USA

#### 9:00-9:25 Variability in Species Abundance Distributions from Nonlinear Stochastic Competition Models

Rosalyn Rael, Rafael D'Andrea, György Barabás, and Annette Ostling, University of Michigan, USA

#### 9:30-9:55 Organism - Effects of Nonlinearities on Lamprey Locomotion

*Christina Hamlet*, Tulane University, USA; Eric Tytell, Tufts University, USA; Lisa J. Fauci, Tulane University, USA

#### 10:00-10:25 Cellular—Nonlinear Models for Predicting Immune Response Mechanisms

*Gesham Magombedze*, University of Tennessee, Knoxville, USA

### Wednesday, July 9

## **MS65**

## Advances in Krylov and Extended Krylov Subspace Methods- Part II of III

8:30 AM-10:30 AM

Room:Salon 7 - 3rd Floor

For Part 1 see MS50 For Part 3 see MS81 Organized by SIAG/ALA

Krylov Subspace methods have had a long illustrious history in numerical linear algebra. Acronyms like BiCG, BiCG-Stab, CG, GMRES, LSOR, MINRES, OMR, and IDR(s) have become part of the standard vocabulary of every numerical analyst. It is somewhat surprising that major advances are still being made to a subject so classical. This minisymposium will bring together researchers who have made recent major breakthroughs in the development of iterative methods built on Krylov subspaces and extended Krylov subspaces --- new algorithms that fill existing gaps, better convergence and stability analyses, and novel adaptations for efficiency under alternative measures of computational costs (such as communication complexity).

#### Organizer: Sou-Cheng T. Choi

University of Chicago and Argonne National Laboratory, USA

#### 8:30-8:55 Krylov Subspace Methods for Large Scale Matrix Equations

Valeria Simoncini, Universita' di Bologna, Italy

#### 9:00-9:25 Krylov Subspaces and Dense Eigenvalue Problems

David S. Watkins, Washington State University, USA

#### 9:30-9:55 Block Preconditioners for Saddle-Point Linear Systems

*Chen Greif*, University of British Columbia, Canada

#### 10:00-10:25 Computing Singular Values of Large Matrices with an Inverse Free Preconditioned Krylov Subspace Method

Qiao Liang and *Qiang Ye*, University of Kentucky, USA

## MS66 Mesoscale and Nonlocal

## Models of Materials with Microstructure - Part II of IV

8:30 AM-10:30 AM

Room:Wilson - 3rd Floor

#### For Part 1 see MS51 For Part 3 see MS82

This session will present recent developments concerning linking microand mesoscales in materials with complex behavior. It will focus on homogenization of partial differential equations with oscillatory coefficients, fine-scale stress concentration modeling, nonlocal continuum modeling, peridynamics, complexity reduction and multiscale computational modeling with applications to composites, suspensions, and biomaterials.

#### Organizer: Lyudmyla Barannyk University of Idaho, USA

Organizer: Yuliya Gorb University of Houston, USA

Organizer: Alexander Panchenko Washington State University, USA

#### Organizer: Alexandre Tartakovsky

Pacific Northwest National Laboratory, USA

#### 8:30-8:55 Kinetic Equation for Spatial Averages of Particle Dynamics

Alexander Panchenko, Washington State University, USA

#### 9:00-9:25 Forward and Inverse Homogenization of Maxwell's Equations in Time Domain

*Elena Cherkaev*, University of Utah, USA; Niklas Wellander, Swedish Defense Research Agency, Sweden; Dali Zhang, University of Calgary, Canada

#### 9:30-9:55 On Reconstruction of Dynamic Permeability and Tortuosity of Poroelastic Materials

Miao-Jung Y. Ou, University of Delaware, USA

#### 10:00-10:25 Closure-based Algorithms for Simulation of Mesoscale Evolution of Large ODE Systems

Lyudmyla Barannyk, University of Idaho, USA

Wednesday, July 9

## MS67 Equivariant Dynamics in Biological Systems

8:30 AM-10:30 AM

Room:Salon 1 - 3rd Floor

Organized by SIAG/DS

The use of symmetry methods is by now well-established in dynamical systems driven initially by applications in physics, especially fluid dynamics. More recently, symmetry has been a useful modelling and analytical tool for many problems in the biological sciences, namely: animal locomotion, visual hallucination patterns, animal aggregation models and in several aspects of neural modelling. The goal of this session is to showcase some of the recent applications of symmetry methods in biological modelling and analysis, including via coupled cell networks with the groupoid formalism.

### Organizer: Pietro-Luciano Buono

University of Ontario Institute of Technology, Canada

Organizer: Yunjiao Wang Texas Southern University, USA

## 8:30-8:55 Network Symmetry and Binocular Rivalry Experiments

*Casey Diekman*, New Jersey Institute of Technology, USA; Martin Golubitsky, The Ohio State University, USA

#### 9:00-9:25 On the Effect of Pinwheels Network Symmetries on Orientation Tuning in Primary Visual Cortex

Pascal Chossat, CNRS and University of Nice, France

#### 9:30-9:55 Spontaneous Symmetry-Breaking in Neural Morphology

Yuichi Sakumura, Aichi Prefectural University, Japan; Naoyuki Inagaki, Nara Institute of Science and Technology, Japan

#### 10:00-10:25 Symmetry and Bifurcations in First-order PDEs with Nonlocal Terms Modelling Animal Aggregation

*Pietro-Luciano Buono*, University of Ontario Institute of Technology, Canada; Raluca Eftimie, University of Dundee, Scotland Wednesday, July 9

## **MS68**

## Student Days: SIAM Student Chapter Presentations

8:30 AM-10:30 AM

Room:Salon 6 - 3rd Floor

For Part 1 see MS37 Organized by the SIAM Education Committee

SIAM Student Chapter presentations.

#### Organizer: Peter R. Turner

Clarkson University, USA

#### 8:30-8:45 Well-Balanced Positivity Preserving Central-Upwind Scheme for the Shallow Water System with Friction Terms

Shumo Cui, Tulane University, USA; Alina Chertock, North Carolina State University, USA; Alexander Kurganov and Tong Wu, Tulane University, USA

#### 8:50-9:05 Membrane Deformation by Protein Inclusions

Graham Hobbs, University of Warwick, United Kingdom

## 9:10-9:25 Stochastic Diffusion

Processes in Systems Biology Lina Meinecke and Per Lötstedt, Uppsala University, Sweden

#### 9:30-9:45 A Smoothing Trust Region Filter Algorithm for Nonsmooth Nonconvex Least Squares Problems

Yang Zhou and Xiaojun Chen, Hong Kong

Polytechnic University, China; Shouqiang Du, Qingdao University, China

#### 9:50-10:05 Modeling Feral Hogs in the Great Smoky Mountains National Park

Benjamin Levy, University of Tennessee, USA; Bill Stiver, Great Smoky Mountains National Park, USA; Rene Salinas, Appalachian State University, USA; Joseph Corn and Marguerite Madden, University of Georgia, USA; Charles Collins and Suzanne M. Lenhart, University of Tennessee, USA

#### 10:10-10:25 Mathematical Modelling of Wind Turbines

Andre Candido, State University of New York, New Paltz, USA

#### 66

## **MS69**

## Advances in High-order Computational Methods for Transport Phenomena -Part I of II

### 8:30 AM-10:30 AM

Room:Salon 10 - 3rd Floor

#### For Part 2 see MS85

The purpose of this minisymposium is to explore recent advances in the development of high-order numerical methods for a variety of application problems where transport phenomena play a critical role. Specific application areas that will be covered include geophysical fluid flows, neutron transport, and plasma physics. The presentations will cover a variety of numerical techniques, including discontinuous Galerkin, wave propagation, and lattice Boltzmann schemes, as well as high performance computing technologies, including adaptive mesh refinement and parallelization strategies.

#### Organizer: James A. Rossmanith Iowa State University, USA

Towa State Oniversity, OSA

#### Organizer: David C. Seal Michigan State University, USA

#### 8:30-8:55 Semi-Lagrangian Discontinuous Galerkin Schemes for the Relativistic Vlasov-Maxwell System

James A. Rossmanith, Iowa State University, USA

#### 9:00-9:25 Filtered Spectral Methods for Transport Problems

*Cory Hauck*, Oak Ridge National Laboratory, USA; Martin Frank and Kerstin Kuepper, RWTH - Aachen University of Technology, Germany

#### 9:30-9:55 Hybrid Algorithms for Hybrid Computers: Kinetic-Continuum Models of Transport Phenomena

Michael Malahe and Sorin Mitran, University of North Carolina, Chapel Hill, USA

#### 10:00-10:25 Hydraulic Modeling for Quantum Absorption Calculation in Plasmonics Based on High-Order Spectral Element Discontinuous Galerkin Approach

MiSun Min, Argonne National Laboratory, USA

### Wednesday, July 9

## MS70 Nonlinear Fluids - Part II of III

8:30 AM-10:30 AM

Room:Salon 5 - 3rd Floor

#### For Part 1 see MS55 For Part 3 see MS86

This minisymposium will be on analysis, numerics, and applications of fluid flows that exhibit non-linear behavior. Topics will be fluid flows with non-linear constitutive laws, such as non-Newtonian fluids, microstructural fluids, and multi-phase/multiphysics coupling including interfacial effects and ion transport.

#### Organizer: Abner J. Salgado University of Tennessee, USA

Organizer: Shawn W. Walker Louisiana State University, USA

8:30-8:55 Splitting for Variable Density Flows

Abner J. Salgado, University of Tennessee, USA

#### 9:00-9:25 Optimal Control of Free Boundary Problems with Surface Tension Effects

Harbir Antil, George Mason University, USA

#### 9:30-9:55 Numerical Investigations of Bouncing Jets

Andrea Bonito, Jean-Luc Guermond, and Sanghyun Lee, Texas A&M University, USA

#### 10:00-10:25 Modeling Viscoelastic Networks in Stokes Flow

Jacek K. Wrobel, Ricardo Cortez, Ricardo Cortez, and Lisa J. Fauci, Tulane University, USA

## Wednesday, July 9

## **MS71**

## Numerical Methods for Direct, Inverse and Optimal Design Problems in Wave Propagation - Part I of III

8:30 AM-10:30 AM

Room:Indiana - 3rd Floor

#### For Part 2 see MS87

Wave phenomena are ubiquitous in nature, and have found significant applications in science and engineering. The application of wave to specific instances poses significant analytical and computational challenges, due to the complexity of the models and the need to resolve the wave on the scale of their oscillations for forward modeling, and appropriate regularization techniques to mollify inherent ill-posedness for the inverse problems. This minisymposium seeks to bring together researchers to promote exchange of ideas, and present recent developments on the novel and efficient numerical methods for solving the direct, inverse and optimal design problems that arise in wave propagation.

#### Organizer: Junshan Lin Auburn University, USA

Organizer: Songting Luo Iowa State University, USA

#### 8:30-8:55 Layered Media Scattering: Fokas Integral Equations and Boundary Perturbation Methods

David P. Nicholls, University of Illinois, Chicago, USA

#### 9:00-9:25 Numerical Algorithms for Simultaneous Determination of Acoustic and Optical Coefficients in Photoacoustic Tomography

Kui Ren, University of Texas at Austin, USA

#### 9:30-9:55 Interferometric Waveform Inversion: Geophysics Meets Spectral Graph Theory

Laurent Demanet, Massachusetts Institute of Technology, USA

### 10:00-10:25 Inverse Born Series for the Radiative Transport Equation

Manabu Machida and John Schotland, University of Michigan, USA

## MS72 Swimming in Complex Fluids 8:30 AM-10:30 AM

#### Room:Kimball - 3rd Floor

Microorganisms commonly swim through biological fluids that exhibit complex responses to deformations, such as mucus, oceanic gels, and biofilms. In addition to viscous dissipation, biological fluid responses frequently include elastic and anisotropic effects. In this minisymposium, speakers will discuss recent theoretical and numerical studies of locomotion in complex environments. Topics will include the physics of helical and undulatory locomotion in viscoelastic fluids and liquid crystals, hydrodynamic interactions of microorganisms with each other and with surfaces, collective behavior and large-scale flows, and swimming through heterogeneous, filamentous networks. This minisymposium is part of a series on locomotion and fluidbody interactions.

#### Organizer: Saverio E. Spagnolie University of Wisconsin, USA

#### 8:30-8:55 Flagellar Locomotion in Viscoelastic and Anisotropic Environments

Saverio E. Spagnolie, University of Wisconsin, USA

#### 9:00-9:25 Mechanism of Microorganism Propulsion in Viscoelastic Fluids

Alexander Morozov, University of Edinburgh, United Kingdom

#### 9:30-9:55 Swimming Through Heterogeneous Networks *Henry Fu*, University of Nevada, Reno, USA

#### 10:00-10:25 Hydrodynamic Interaction of Swimming Microorganisms in Complex Fluids

Gaojin Li and Arezoo Ardekani, University of Notre Dame, USA

### Wednesday, July 9

## MS73 Applications in Nonlinear Dynamics with Chaos, Stochasticity, and Multiple

## Scales

## 8:30 AM-10:30 AM

#### Room:Logan - 3rd Floor

We discuss several interesting problems in the diverse area of nonlinear dynamics with chaos, stochastic noise, and multiple scales. Two presentations address averaged dynamics in two different set-ups: one for a toy model with energy-preserving coupling between multiple scales, and another for a more realistic ferromagnet with thermal noise. Two other presentations address statistical properties of complex dynamics, such as distributions of soliton solutions of an integrable system, and the response of the Lyapunov exponent to external perturbations.

Organizer: Rafail Abramov University of Illinois, Chicago, USA

Organizer: Gregor Kovacic Rensselaer Polytechnic Institute, USA

#### 8:30-8:55 Stochastic Mode-Reduction in Models with Conservative Fast Sub-Systems Ankita Jain, University of Notre Dame, USA

#### 9:00-9:25 Dynamics of Ferromagnets

*Katherine Newhall*, Courant Institute of Mathematical Sciences, New York University, USA

#### 9:30-9:55 Stochasticity in An Integrable System: Pulse Polarization Switching in An Active Optical Medium

*Gregor Kovacic*, Rensselaer Polytechnic Institute, USA

#### 10:00-10:25 The Response of the Lyapunov Exponent to External Perturbations

Rafail Abramov, University of Illinois, Chicago, USA

#### Wednesday, July 9

## **MS74**

## Expeditions in Training, Research, and Education for Mathematics and Statistics through Quantitative Explorations of Data

#### 8:30 AM-10:30 AM

Room:Madison - 3rd Floor

The new field of computational and dataenabled science and engineering (CDS&E) has emerged as a third pillar of scientific investigation that complements theory and experimentation. CDS&E is now clearly recognizable as a distinct intellectual and technological discipline lying at the intersection of applied mathematics, statistics, computer science, core science and engineering disciplines. This minisymposium will discuss the development of structures within some current U.S. education institutions to address the interdisciplinary demands of CDS&E training.

Organizer: Roummel F. Marcia University of California, Merced, USA

#### 8:30-8:55 Research and Training in Computational and Data-Enabled Science and Engineering for Undergraduates in the Mathematical Sciences at NJIT

David J. Horntrop, New Jersey Institute of Technology, USA

**9:00-9:25 Computational and Data-Enabled Training in William & Mary** *Gexin Yu*, College of William & Mary, USA

9:30-9:55 Data-Enabled Science and Computational Analysis Research, Training, and Education for Students (descartes) Program at UC Merced *Arnold D. Kim*, University of California,

Merced, USA

#### 10:00-10:25 Data Analytics Throughout Undergraduate Mathematics

Kristin Bennett and Bruce Piper, Rensselaer Polytechnic Institute, USA

## CP14 Life Sciences II

8:30 AM-10:30 AM

0.50 AIVI-10.50 AIV

Room:Salon 4 - 3rd Floor

Chair: Cammey Cole Manning, Meredith College, USA

#### 8:30-8:45 Connecting Motifs and Molecular Mechanisms Toward Control of Complex Networks

Aaron Oppenheimer and Neda Bagheri, Northwestern University, USA

## 8:50-9:05 Mathematical Modeling of the Antibiotic Ertapenem

*Cammey Cole Manning*, Meredith College, USA; Michele Joyner, East Tennessee State University, USA

#### 9:10-9:25 Moment Fitting for Parameter Inference in Repeatedly and Partially Observed Stochastic Biological Models

*Philipp Kuegler*, University of Hohenheim, Germany

#### 9:30-9:45 A Combined Method of Model Reduction for Biochemical Reaction Networks

*Tom J. Snowden* and Marcus Tindall, University of Reading, United Kingdom; Piet van Der Graaf, Universiteit Leiden, Netherlands

#### 9:50-10:05 Discovery of Multi-Dimensional Modules in Cancer Genomic Data

*Xianghong J. Zhou*, University of Southern California, USA

#### 10:10-10:25 Using Lasso Model to Predict Cell-Type-Specific Transcription Factors in Low Methylated Regions

*Hong Hu* and Yang Dai, University of Illinois, Chicago, USA

### Wednesday, July 9

## CP15 Numerical Methods in PDE II

8:30 AM-10:10 AM

Room:Salon 8 - 3rd Floor

Chair: Chad Westphal, Wabash College, USA

8:30-8:45 Advances in Adaptively Weighted Finite Element Methods *Chad Westphal*, Wabash College, USA

#### 8:50-9:05 Scalable High-Order Non Conforming Finite Element Methods For Time Domain Acoustic-Elastic Problems

Angel Rodriguez-Rozas and Julien Diaz, INRIA Bordeaux Sud-Ouest, France

9:10-9:25 High Order Parametrized Maximum-Principle-Preserving and Positivity-Preserving Weno Schemes on Unstructured Meshes

Yuan Liu, Michigan State University, USA

#### 9:30-9:45 Fourth Order Compact Simulation of the One Dimensional Euler Equations of Gas Dynamics *Jiten C. Kalita* and Bidyut Gogoi, Indian

Institute of Technology, Guwahati, India

9:50-10:05 Numerical Simulations of Bioresorbable Vascular Stent with Automatic Patient-Specific Geometry Construction and Adaptive Meshing Boyi Yang and Alessandro Veneziani, Emory University, USA

### **Coffee Break**

10:30 AM-11:00 AM Room:Exhibit Hall

## for Machine Learning

IC5

Room:Grand Ballroom - 4th Floor Chair: Stefan Wild, Argonne National Laboratory, USA

**Optimization Algorithms** 

Wednesday, July 9

The extraordinary success of search engines, recommendation systems, and speech and image recognition software suggests that future advances in these technologies could have a major impact in our lives. In this talk, we discuss modern intelligent-algorithmic systems based on sophisticated statistical learning models and powerful optimization techniques. One can envision new algorithms that operate in the stochastic or batch settings, and that take full advantage of parallelism. We review our remarkable understanding of classical stochastic approximation techniques, and pose some open questions. The lecture concludes with a discussion of modern neural nets and the demands they impose on optimization methods.

#### Jorge Nocedal

Northwestern University, USA

Wednesday

#### SIAM Presents Since 2008, SIAM has recorded many Invited Lectures, Prize Lectures, and selected Minisymposia from varie These are available by y



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Minisymposia from various conferences. These are available by visiting SIAM Presents (http://www.siam.org/meetings/ presents.php).

## IC6

## The Mathematical Problems of Isotropic-Nematic Interface

## 11:00 AM-11:45 AM

#### Room:Red Lacquer - 4th Floor

Chair: Fengyan Li, Rensselaer Polytechnic Institute, USA

Liquid crystals represent a vast and diverse class of anisotropic soft matter materials which are intermediate between isotropic liquids and crystalline solids. The various liquid crystal phases can be characterized by the type of ordering, one of the most common liquid crystal phases is the isotropic phase, another is the nematic phase. In this talk, a wide spectrum of mathematical problems of isotropic-nematic interface will be considered. One set of problems to be considered is the relationship between these different levels of modeling, for example how one can make a rigorous passage from molecular/statistical descriptions to continuum theories. Special consideration will be given to the existence, uniqueness and regularity of the solutions of the Landau-de Gennes theory.

#### **Pingwen Zhang**

Peking University, China

#### Wednesday, July 9

## Poster Blitz

11:50 AM-12:30 PM

*Room:Grand Ballroom - 4th Floor* This session is comprised of brief one to two minute oral presentations by participating

poster presenters.

## PP1



12:30 PM-2:00 PM

Room: Exhibit Hall

#### A New Test for Exclusion Algorithm to Find the Optimum Value of Function in Rn

\$19

Ibraheem Alolyan, King Saud University, Saudia Arabia

#### A Mesh Free Method for Numerical Simulation of Calcium Dynamics In Ventricular Myocytes

*Emmanuel O. Asante-Asamani*, Bruce Wade, and Zeyun Yu, University of Wisconsin, Milwaukee, USA

#### Gene Selection from Microarray Data : An Exploratory Approach

Sami Cheong, University of Wisconsin, Milwaukee, USA

#### Spatiotemporal Pattern of Temperature Change over US Using Bounded-Variation Segmentation

Mohammad Gorji Sefidmazgi, Abdollah Homaifar, and Mina Moradi Kordmahalleh, North Carolina A&T State University, USA

#### Multiscale Decomposition and Modeling of Complex Networks

Alexander Gutfraind, University of Illinois, Chicago, USA; Ilya Safro, Clemson University, USA; Lauren A. Meyers, University of Texas at Austin, USA

## Pathways to Type 2 Diabetes with a Mathematical Model

Joon Ha and Arthur S. Sherman, National Institutes of Health, USA

#### Bayesian Statistics and Uncertainty Quantification for Safety Boundary Analysis in Complex Systems

Yuning He, NASA Ames Research Center, USA

#### Which Conical Ant Mound is Optimal in Collection of Solar Beams From Transient Sun

Rouzalia Kasimova, German University of Technology in Oman, Oman; Denis Tishin and Yurii Obnosov, Kazan State University, Russia; Anvar Kacimov, Sultan Qaboos University, Oman

#### On a Method for Approximation of the Singularity Curve of a Piecewise Constant Function of Two Variables

George Kvernadze, Weber State University, USA

#### Stable Implementation of Complete Radiation Boundary Conditions in Finite Difference Time Domain Solvers for Maxwell's Equations

John Lagrone, Fritz Juhnke, and Thomas Hagstrom, Southern Methodist University, USA

#### Regression in High Dimensions Via Geometric Multi Resolution Analysis David Lawlor, Duke University, USA

#### Two Projection Methods for Regularized Total Least Squares Approximation

*Geunseop Lee* and Jesse L. Barlow, Pennsylvania State University, USA

#### Theoretical Analysis of Low-Energy Electron Diffraction: New Results for Real Systems and New Understanding for Model Ones

John F. Mcclain, University of New Hampshire, USA; Jiebing Sun, Michigan State University, USA; Karsten Pohl and Jian-Ming Tang, University of New Hampshire, USA

## Analysis of a Camera-Based Model of Bar Code Decoding

Madeline J. Schrier and Fadil Santosa, University of Minnesota, Twin Cities, USA

#### A Viscoelastic Model That Displays Thixotropic Yield Stress Fluid Behavior Yuriko Renardy, Virginia Tech, USA

#### Fully Nonlinear Model for Dispersive Wave Turbulence

Michael Schwarz, Rensselaer Polytechnic Institute, USA; David Cai, Courant Institute of Mathematical Sciences, New York University, USA; Gregor Kovacic and Peter R. Kramer, Rensselaer Polytechnic Institute, USA

#### **Ritz-Augmented Extended Krylov** Subspaces for Sequences of Lyapunov Equations

Stephen D. Shank, Temple University, USA

#### Numerical Investigation of Microfluidic Droplet Breakup Using **T-Junction Geometry**

Olabanji Y. Shonibare, Kathleen Feigl, and Franz Tanner, Michigan Technological University, USA

#### A Mathematical Model of Moisture Movement and Bacterial Growth in a **Two-Dimensional Porous Medium**

Rachel E. Tewinkel, University of Wisconsin, Milwaukee, USA

#### A Guaranteed, Adaptive, Automatic Algorithm For Univariate Function Minimization

Xin Tong, Illinois Institute of Technology, USA

#### Iterative Functional Modification Method for Solving a Transportation Problem

Vladimir I. Tsurkov, Computing Center of Russian Academy of Sciences, Russia; Alexander Tizik, Russian Academy of Sciences, Russia

A Multiscale Implementation for the Peridynamic Model of Mechanics Feifei Xu, Florida State University, USA

#### **Designing a Self-Propelled Hydrogel** Microswimmer

Peter Yeh, Svetoslav Nikolov, and Alexander Alexeev, Georgia Institute of Technology, USA

#### **Inverse Modeling and Prediction** Uncertainty Analysis of a Co2 Injection Pilot Test, Cranfield, Mississippi

Hongkyu Yoon, Sandia National Laboratories, USA; Reza Tavakoli, University of Texas at Austin, USA; Bill Arnold, Sandia National Laboratories, USA

#### A Spatio-Temporal Point Process Model for Ambulance Demand

Zhengyi Zhou, David Matteson, Dawn Woodard, and Shane Henderson, Cornell University, USA; Athanasios Micheas, University of Missouri, Columbia, USA

#### AWM Workshop: Fast Iterative Methods for The Variable Diffusion Coefficient Equation in a Unit Disk

Aditi Ghosh, Texas A&M University, USA

AWM Workshop: Confidence Sets for Geometric and Topological Distances Brittany Fasy, Tulane University, USA

AWM Workshop: The Asymptotic Analysis of a Thixotropic Yield Stress Fluid in Squeeze Flow

Holly Grant, Virginia Tech, USA

#### AWM Workshop: Traveling Fronts to the Combustion and the Generalized Fisher-Kpp Models

Tingting Huan, University of Connecticut, USA

AWM Workshop: Competitive Geometric Flow Of Network Morphologies Under The Functionalized Cahn-Hilliard (fch) Free Energy

Noa Kraitzman, Michigan State University, USA

#### AWM Workshop: Sexual Cannibalism As An Optimal Strategy in Fishing Spiders Sara Reynolds, University of Nebraska, Lincoln,

USA

AWM Workshop: Time-Delayed Pdes with Stochastic Boundary in Mathematical Modeling of Kidney Hwayeon Ryu, Duke University, USA

#### AWM Workshop: A Local Grid Mesh Reinement for a Nonlocal Model of **Mechanics**

Feifei Xu, Florida State University, USA

#### AWM Workshop: Three Model Problems for 1-D Particle Motion with the History Force in Viscous Fluids

Shujing Xu, Claremont Graduate University, USA

See poster addendum for additional posters.

### Wednesday, July 9

## IP4

## Scientific Computing in **Movies and Virtual Surgery** 2:00 PM-2:45 PM

Room: Grand Ballroom - 4th Floor

Chair: Stephen Wirkus, Arizona State University, USA

New applications of scientific computing for solid and fluid mechanics problems include simulation of virtual materials for movie special effects and virtual surgery. Both disciplines demand physically realistic dynamics for such materials as water, smoke, fire, and brittle and elastic objects. These demands are different than those traditionally encountered and new algorithms are required. This talk will address the simulation techniques needed in these fields and some recent results including: simulated surgical repair of biomechanical soft tissues, extreme deformation of elastic objects with contact, high resolution incompressible flow, clothing and hair dynamics. Also included is discussion of a new algorithm used for simulating the dynamics of snow in Disney's animated feature film, "Frozen".

#### Joseph Teran

University of California, Los Angeles, USA

#### Intermission

2:45 PM-3:00 PM

## SP3

## W. T. and Idalia Reid Prize in Mathematics Lecture: On the Master Equation in Mean Field Theory

### 3:00 PM-3:30 PM

#### Room: Grand Ballroom - 4th Floor

Chair: Irene Fonseca, Carnegie Mellon University, USA

One of the major founders of Mean Field Games, P.L. LIONS has introduced in his lectures at College de France the concept of Master Equation. It is obtained through a formal analogy with the set of partial differential equations derived for the Nash equilibrium of a differential game with a large number of players. The objective of this lecture is to explain its derivation, not by analogy, but through its interpretation. We do that for both Mean Field Type Control and Mean Field Games. We obtain complete solutions in the linear quadratic case. We analyze the connection with Nash equilibrium.

#### Alain Bensoussan

The University of Texas at Dallas and City University of Hong Kong, Hong Kong

## Coffee Break

3:30 PM-4:00 PM

Room: Exhibit Hall

Wednesday, July 9

## MS75 Mathematics of Power Grid -Part III of III

### 4:00 PM-6:00 PM

Room: Grand Ballroom - 4th Floor

#### For Part 2 see MS59

The power grid is a complex physical system that exhibits huge dimensionalities, multi-scale spatio-temporal behavior, complex network topologies, and high levels of uncertainty originating from cascading failures and interdependencies with climate and infrastructures such as natural gas networks. Understanding and predicting the behavior of the next-generation power grid requires of new advances in mathematics. In this minisymposium, we seek to motivate such advances by bringing together application domain experts and mathematicians.

#### Organizer: Victor Zavala Argonne National Laboratory, USA

#### Organizer: Mahantesh Halappanavar

Pacific Northwest National Laboratory, USA

Organizer: Shrirang Abhyankar Argonne National Laboratory, USA

#### 4:00-4:25 Exploiting Large-Scale Natural Gas Storage to Mitigate Power Grid Uncertainty

Victor Zavala, Argonne National Laboratory, USA

#### 4:30-4:55 Uncertainty Analysis of Wind Power Plant Dynamic Model

*Guang Lin*, Marcelo Elizondo, Shuai Lu, and Shaobu Wang, Pacific Northwest National Laboratory, USA

#### 5:00-5:25 A Stochastic-Oriented NLP Relaxation for Integer Programming

John Birge, University of Chicago, USA; Mihai Anitescu and Cosmin G. Petra, Argonne National Laboratory, USA

5:30-5:55 Global Optimization of Large Optimal Power Flow Problems Lorenz T. Biegler, Carnegie Mellon University, USA Wednesday, July 9

## MS76 Mathematical Challenges in the Geosciences

4:00 PM-6:00 PM

Room:Red Lacquer - 4th Floor

Organized by SIAG/GS

Significant challenges in the geosciences require the development and application of relevant mathematical, statistical, and computational techniques. In this minisymposium, topics in geodynamics, climate, and natural disasters will be described in context of current mathematical techniques, and challenges that prevent the science from moving forward. This is part of a greater effort of the Consortium for Mathematics in the Geosciences (CMG++) http://cmg.boisestate.edu.

### Organizer: Jodi Mead

Boise State University, USA

Organizer: Grady B. Wright Boise State University, USA

4:00-4:25 Promoting the Development and Application of Mathematics, Statistics and Computational Science in the Geosciences

Jodi Mead, Boise State University, USA

#### 4:30-4:55 Computational Challenges in High-Resolution, Experimentally-Constrained Non-Newtonian Subduction Modeling Margarete A. Jadamec, Brown University,

USA

#### 5:00-5:25 Mathematical Models and Computational Software for Hazardous Earth-Surface Flows: from Tsunamis to Landslides

David George, USGS Cascades Volcano Observatory, USA

#### 5:30-5:55 Dynamically and Kinematically Consistent Global Ocean State Estimation for Climate Research

Patrick Heimbach, Massachusetts Institute of Technology, USA

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# **MS77**

# Wave Propagation and Imaging in Random Media -Part II of II

### 4:00 PM-6:00 PM

Room: Crystal - 3rd Floor

#### For Part 1 see MS61

Concomitant advances in sensing technologies and a wide range of remote sensing applications have sparked significant advances in the applied mathematics field of wave propagation and imaging in random media. When waves travel deep in complex media cumulative scattering effects by microstructure build up and coherency is partially lost. The microstructure cannot be inferred in imaging because data is band limited, so it is described with stochastic processes. This minisymposium seeks to be a forum for the exchange of novel theoretical and computational results in wave propagation in random media and their application to the development of robust imaging algorithms.

Organizer: Liliana Borcea University of Michigan, USA

#### Organizer: Chrysoula Tsogka University of Crete, Greece

4:00-4:25 Signal to Noise Ratio Analysis in Virtual Source Array Imaging

Chrysoula Tsogka, University of Crete, Greece

#### 4:30-4:55 Connecting the Dots: from Homogenization to Radiative Transport Lenya Ryzhik, Stanford University, USA

5:00-5:25 Imaging of Sparse Scatterers Alexei Novikov, Pennsylvania State University, USA

#### 5:30-5:55 Imaging of Extended Reflectors in Two-Dimensional Waveguides

Chrysoula Tsogka, University of Crete, Greece; *Dimitrios Mitsoudis*, Institute of Applied and Computational Math, Crete; Symeon Papadimitropoulos, University of Crete, Greece

### Wednesday, July 9

# MS78 The Mechanics of Flagellar Locomotion

# 4:00 PM-6:00 PM

Room:Salon 3 - 3rd Floor

Flagella are a ubiquitous means of propulsion for single swimming cells, enabling phytoplankton to navigate marine habitats, spermatozoa to seek out eggs for reproduction, and bacteria to find hosts for infection. Determining how hydrodynamic interactions mediate the mechanics of actuated flagellar appendages is crucial to understanding locomotor utility for diverse cell types swimming in highly-variable physical environments including marine, viscous, and viscoelastic media. This symposium will include equal contributions from current experiments and simulations aimed at elucidating the role of hydrodynamic interactions of flagella with their environment and with each other in both sperm and multiflagellated swimming cells.

#### Organizer: Jeffrey Guasto Tufts University, USA

#### 4:00-4:25 The Phylogeny of Sperm Swimming Kinematics

Jeffrey Guasto, Tufts University, USA; Lisa Burton and Filippo Menolascina, Massachusetts Institute of Technology, USA; Richard Zimmer, University of California, Los Angeles, USA; Anette Hosoi and Roman Stocker, Massachusetts Institute of Technology, USA

#### 4:30-4:55 The Dynamics of Sperm Detachment from Epithelium in a Coupled Fluid-Biochemical Model of Hyperactivated Motility

*Lisa J. Fauci* and Julie Simons, Tulane University, USA; Sarah D. Olson, Worcester Polytechnic Institute, USA; Ricardo Cortez and Ricardo Cortez, Tulane University, USA

#### 5:00-5:25 Flagellar Kinematics of Algal Cells in Viscoelastic Fluids

Paulo E. Arratia, University of Pennsylvania, USA

### 5:30-5:55 Flagellar Bundling and Unbundling in E. Coli

Sookkyung Lim, University of Cincinnati, USA

# Wednesday, July 9

# **MS79**

# Theoretical and Numerical Results in Dynamical Systems

4:00 PM-6:00 PM

Room:Salon 12 - 3rd Floor

Part of the SIAM Workshop Celebrating Diversity

Many real-life phenomena are modeled by dynamical systems. This session highlights research on a range of topics from population dynamics to fluid flow to the flight patterns of mosquitos. Complex models of all of these applications can lead to unexpected and somewhat unpredictable solutions. One of the fundamental tools used in dynamical systems (analysis of system stability) is to better quantify the impact the initial data will have on the solution path allowing us to gain insight into the solution dynamics. This session will examine stability and other properties of the dynamical systems modeled.

Organizer: Susan E. Minkoff

University of Texas at Dallas, USA

Organizer: Cristina Villalobos University of Texas - Pan American, USA

#### Organizer: Stephen Wirkus Arizona State University, USA

#### 4:00-4:25 Unifying the Equations of Life: Time Scale Calculus and Evolutionary Dynamics

Dashiell Fryer, Pomona College, USA; Marc Harper, University of California, Los Angeles, USA

#### 4:30-4:55 Flight Stability of Mosquitoes using a Reduced Model

Sarah Iams, Northwestern University, USA

#### 5:00-5:25 On a Non-Linear Investigation of An Electrospinning Model under Combined Space and Time Evolving Instabilities

Saulo Orizaga, Iowa State University, USA

5:30-5:55 Analyzing Coherent Structure in Signals and Fluid Flows Sherry Scott, Marquette University, USA

# **MS80**

# Algorithms, Applications and Analysis of Fractional PDEs and Nonlocal Problems-Part I of II

4:00 PM-6:00 PM

Room:Salon 2 - 3rd Floor

#### For Part 2 see MS96

Fractional Partial Differential Equations (FPDEs) and related nonlocal problems are emerging as a new powerful tool for modeling difficult types of complex systems, which cannot be modeled accurately by integer-order differential equations. However, these problems raise new modeling, computational, mathematical, and numerical difficulties that have not been encountered in the context of integer-order differential equations. The aim of this minisymposium is to cover the recent development in mathematical and numerical analysis, computational algorithms, modeling and applications in this field.

#### Organizer: Hong Wang

University of South Carolina, USA

#### Organizer: Mohsen Zayernouri Brown University, USA

#### Organizer: George E. Karniadakis

Brown University, USA

#### 4:00-4:25 Modeling Anomalous Diffusion Using the Fractional Bloch-Torrey Equation

Richard Magin, University of Illinois, Chicago, USA

# 4:30-4:55 Analysis and Approximation of Finite-Range Jump Processes

Marta D'Elia, Florida State University, USA; Qiang Du, Pennsylvania State University, USA; Max Gunzburger, Florida State University, USA; *Richard B. Lehoucq*, Sandia National Laboratories, USA

#### 5:00-5:25 Asymptotically Compatible Schemes for Robust Discretization of Nonlocal Models

*Qiang Du* and Xiaochuan Tian, Pennsylvania State University, USA

#### 5:30-5:55 Fractional PDEs: Numerical Methods and Mathematical Analysis

Hong Wang, University of South Carolina, USA

### Wednesday, July 9

# **MS8**1

# Advances in Krylov and Extended Krylov Subspace Methods- Part III of III

4:00 PM-6:00 PM

Room:Salon 7 - 3rd Floor

#### For Part 2 see MS65 Organized by SIAG/ALA

Krylov Subspace methods have had a long illustrious history in numerical linear algebra. Acronyms like BiCG, BiCG-Stab, CG, GMRES, LSQR, MINRES, QMR, and IDR(s) have become part of the standard vocabulary of every numerical analyst. It is somewhat surprising that major advances are still being made to a subject so classical. This minisymposium will bring together researchers who have made recent major breakthroughs in the development of iterative methods built on Krylov subspaces and extended Krylov subspaces --- new algorithms that fill existing gaps, better convergence and stability analyses, and novel adaptations for efficiency under alternative measures of computational costs (such as communication complexity).

#### Organizer: Sou-Cheng T. Choi

University of Chicago and Argonne National Laboratory, USA

#### 4:00-4:25 BANDITS: A Matlab Package of Band Krylov Subspace Iterations

*Roland W. Freund*, University of California, Davis, USA

#### 4:30-4:55 Hierarchical Krylov and Nested Krylov Methods Using PETSc for Extreme-Scale Computing

Hong Zhang, Argonne National Laboratory, USA

5:00-5:25 The Lanczos Algorithm and Extensions for Quaternionic Matrices Gerhard Opfer, Universitat Hamburg, Germany

#### 5:30-5:55 Newton-Krylov Method for Problems with Embedded Monte Carlo Simulations

Carl T. Kelley, North Carolina State University, USA; Jeffrey Willert, Los Alamos National Laboratory, USA; Xiaojun Chen, Hong Kong Polytechnic University, China

#### Wednesday, July 9

# **MS82**

# Mesoscale and Nonlocal Models of Materials with Microstructure - Part III of IV

4:00 PM-6:00 PM

Room: Wilson - 3rd Floor

#### For Part 2 see MS66 For Part 4 see MS98

This session will present recent developments concerning linking micro- and mesoscales in materials with complex behavior. The session will focus on homogenization of partial differential equations with oscillatory coefficients, fine-scale stress concentration modeling, nonlocal continuum modeling, peridynamics, complexity reduction and multiscale computational modeling with applications to composites, suspensions, and biomaterials.

#### Organizer: Lyudmyla Barannyk University of Idaho, USA

Organizer: Yuliya Gorb University of Houston, USA

Organizer: Alexander Panchenko Washington State University, USA

#### Organizer: Alexandre Tartakovsky Pacific Northwest National Laboratory, USA

# 4:00-4:25 Hybrid Models and Interfaces

Timothy Costa and *Malgorzata Peszynska*, Oregon State University, USA

#### 4:30-4:55 Information Theoretic Projection of Cytoskeleton Dynamics onto Surrogate Cellular Motility Models *Sorin Mitran*, University of North Carolina,

Chapel Hill, USA

#### 5:00-5:25 Modeling Nanoscale Fluid-Solid Interfaces

Nikolaos Voulgarakis, Washington State University, USA

#### 5:30-5:55 Lagrangian Particle Methods for Multiphase Flows

Alexandre Tartakovsky, University of South Florida, USA; Alexander Panchenko, Washington State University, USA

# **MS83**

# Application of Topological Ideas for Understanding Complex Dynamics

4:00 PM-6:00 PM

Room:Salon 1 - 3rd Floor

#### Organized by SIAG/DS

In recent studies of dynamics of complex and large degrees of freedom systems, new ideas and tools from Topology play important roles. For instance, the theory of persistence topology has been used to study dynamics of patterns and protein structure analysis; the notion of feedback vertex set in the graph theory helps extracting an essential information in very complex gene regulatory networks; structurally stable vortex flows in multiply connected domains can be analyzed by the streamline topologies and their word representations, just to give a few. We aim to give an overview of some of recent results in this direction, and discuss possibility of future development.

#### Organizer: Hiroshi Kokubu Kyoto University, Japan

Kyolo University, Japan

#### Organizer: Konstantin Mischaikow

Rutgers University, USA

#### 4:00-4:25 Reconstructing Manifolds and Functions from Point Samples

*Vidit Nanda*, University of Pennsylvania, USA

#### 4:30-4:55 Word Representations of Structurally Stable Hamiltonian Flows in Multiply Connected Domains and its Applications

Takashi Sakajo and Tomoo Yokoyama, Kyoto University, Japan

#### 5:00-5:25 Persistence Modules and their Applications to Material Sciences

Yasuaki Hiraoka, Kyushu University, Japan

#### 5:30-5:55 Analyzing the Dynamics of Pattern Formation in the Space of Persistence Diagrams

Miroslav Kramar and Konstantin Mischaikow, Rutgers University, USA; Mark Paul, Virginia Tech, USA; Michael F. Schatz and Jeffrey Tithof, Georgia Institute of Technology, USA; Mu Xu, Virginia Tech, USA

### Wednesday, July 9

# **MS84**

## Student Days: SIAM Award in the Mathematical Contest in Modeling (MCM) Prize Winner Presentations

4:00 PM-5:00 PM

Room:Salon 6 - 3rd Floor

#### For Part 2 see MS90

Organized by the SIAM Education Committee

SIAM Award in the MCM The SIAM Award in the Mathematical Contest in Modeling (MCM), established in 1988, is awarded to two of the teams judged "Outstanding" in the annual MCM administered by COMAP. One winning team of students is chosen for each of the two problems posed in the MCM. Problem A, The Continuous Problem: "The-Keep-Right-Except-to-Pass Rule" Solution: "The-Keep-Right-Except-To-Pass-Rule" Zhejiang University Department of Mathematics, College of Science Hangzhou, Zhejiang Province, P. R. China Students: Yuan Gong, Shu Liu and Yandi Shen Faculty Advisor: Professor Jianxin Zhu Problem B, The Discrete Problem: "College Coaching Legends" Solution: "Finding Out the Best All-Time College Coach" Southwest University for Nationalities College of Computer Science and Technology Chengdu, Sichuan Province, P. R. China Students: Yiping Liu, Yongyi Xie, and Yao Zhang Faculty Advisor: Professor Gaoping Li See MS90 for Student Paper Prize (SPP) presentations.

#### Organizer: Peter R. Turner Clarkson University, USA

# 4:00-4:25 Problem A, The Continuous Problem

Yuan Gong, Shu Liu, and Yandi Shen, Zhejiang University, P.R. China

#### 4:30-4:55 Problem B, The Discrete Problem

Yiping Liu, Yongyi Xie, and Yao Zhang, Southwest University for Nationalities College of Computer Science, P.R. China

# Wednesday, July 9

# **MS85**

# Advances in High-order Computational Methods for Transport Phenomena-Part II of II

# 4:00 PM-6:00 PM

Room:Salon 10 - 3rd Floor

#### For Part 1 see MS69

The purpose of this minisymposium is to explore recent advances in the development of high-order numerical methods for a variety of application problems where transport phenomena play a critical role. Specific application areas that will be covered include geophysical fluid flows, neutron transport, and plasma physics. The presentations will cover a variety of numerical techniques, including discontinuous Galerkin, wave propagation, and lattice Boltzmann schemes, as well as high performance computing technologies, including adaptive mesh refinement and parallelization strategies.

Organizer: James A. Rossmanith Iowa State University, USA

#### Organizer: David C. Seal Michigan State University, USA

4:00-4:25 Semi-Lagrangian

#### Discontinuous Galerkin Schemes for the 2+2 Vlasov-Poisson System on Unstructured Meshes

James A. Rossmanith, Iowa State University, USA; *David C. Seal* and Andrew J. Christlieb, Michigan State University, USA

#### 4:30-4:55 Evaluation of Discrete and Continuous Adjoint Approaches for Sensitivity Analysis and Error Estimations for Numerical Approximations of Hyperbolic Pdes with Shocks

*Tim Wildey*, John N. Shadid, and Eric C. Cyr, Sandia National Laboratories, USA

#### 5:00-5:25 High-Order Numerical Methods for Fractional PDEs in Water Wave Propagation

*David Prigge*, Sean Carney, and Smadar Karni, University of Michigan, USA; Remi Abgrall, INRIA Bordeaux Sud-Ouest, France

#### 5:30-5:55 High-Order Algorithms for Compressible Reacting Flow with Complex Chemistry

Matthew Emmett, Weiqun Zhang, and John B. Bell, Lawrence Berkeley National Laboratory, USA

# MS86 Nonlinear Fluids -Part III of III

4:00 PM-5:30 PM

Room:Salon 5 - 3rd Floor

#### For Part 2 see MS70

This minisymposium will be on analysis, numerics, and applications of fluid flows that exhibit non-linear behavior. Topics will be fluid flows with non-linear constitutive laws, such as non-Newtonian fluids, microstructural fluids, and multi-phase/multiphysics coupling including interfacial effects and ion transport.

#### Organizer: Abner J. Salgado

University of Tennessee, USA

#### Organizer: Shawn W. Walker Louisiana State University, USA

#### 4:00-4:25 From Micropolar Navier Stokes to Ferrofluids, Analysis and Numerics

*Ignacio Tomas*, University of Maryland, College Park, USA

#### 4:30-4:55 Optimal Energy Norm Error Estimates for a Mixed FEM for a Cahn-Hilliard-Stokes System

Steven M. Wise, University of Tennessee, USA

#### 5:00-5:25 Energetic Variational Approaches in Ion Transport

Chun Liu, Pennsylvania State University, USA

#### Wednesday, July 9

# MS87 Numerical Methods for Direct, Inverse and Optimal Design Problems in Wave Propagation - Part II of III

4:00 PM-6:00 PM

#### Room:Indiana - 3rd Floor

#### For Part 1 see MS71 For Part 3 see MS103

Wave phenomena are ubiquitous in nature, and have found significant applications in science and engineering. The application of wave to specific instances poses significant analytical and computational challenges. due to the complexity of the models and the need to resolve the wave on the scale of their oscillations for forward modeling, and appropriate regularization techniques to mollify inherent ill-posedness for the inverse problems. This minisymposium seeks to bring together researchers to promote exchange of ideas, and present recent developments on the novel and efficient numerical methods for solving the direct, inverse and optimal design problems that arise in wave propagation.

#### **Organizer: Junshan Lin** *Auburn University, USA*

#### **Organizer: Songting Luo**

Iowa State University, USA

#### 4:00-4:25 Maximal Laplace-Beltrami Eigenvalues on Compact Riemannian Surfaces

*Chiu-Yen Kao*, Claremont McKenna College, USA; Rongjie Lai, University of Southern California, USA; Braxton Osting, University of California, Los Angeles, USA

#### 4:30-4:55 Fast Matrix-free Direct Solution and Selected Inversion for Seismic Imaging Problems

Jianlin Xia, Maarten de Hoop, Xiao Liu, and Yuanzhe Xi, Purdue University, USA

continued in next column

#### 5:00-5:25 Generalized Multiscale Finite Element Methods for Wave Propagation in Heterogeneous Media

*Eric Chung*, Chinese University of Hong Kong, Hong Kong; Yalchin Efendiev and Wing Tat Leung, Texas A&M University, USA

#### 5:30-5:55 A Level Set-Adjoint State Method for the Joint Transmission-Reflection First Arrival Traveltime Tomography

Wenbin Li and *Shingyu Leung*, Hong Kong University of Science and Technology, Hong Kong; Jianliang Qian, Michigan State University, USA

# MS88 Reliable Computational Science Part I of II

### 4:00 PM-6:00 PM

Room:Logan - 3rd Floor

#### For Part 2 see MS104

The Sleipnir oil rig collapse and the Ariane~5 rocket explosion were horrific engineering catastrophes whose causes were traced back to modeling and computational failures. To guard against similar failures in the future requires more robust scientific software and more dependable computational practices. This minisymposium explores how to establish and advance reliable computational science through diverse strategies including, but not limited to: theoretical guarantees of success for automatic algorithms; an emphasis on reproducible computational research via open data and source; more secure coding; efficacious strategies for engineering and maintenance of mathematical software libraries, and proactive educational initiatives.

#### Organizer: Fred J. Hickernell

Illinois Institute of Technology, USA

#### Organizer: Sou-Cheng T. Choi

University of Chicago and Argonne National Laboratory, USA

### 4:00-4:25 A Survey of Issues in

Reliable Computational Science Fred J. Hickernell, Illinois Institute of Technology, USA

#### 4:30-4:55 The Scholarly Work of Reliable and Well-Designed Mathematical Software

*Timothy A. Davis*, Texas A&M University, USA

#### 5:00-5:25 Generation of Appropriate Publication Citations by Numerical Software Libraries

Barry F. Smith, Argonne National Laboratory, USA

#### 5:30-5:55 A Deterministic Guaranteed Automatic Algorithm for Univariate Function Approximation

*Yuhan Ding* and Fred J. Hickernell, Illinois Institute of Technology, USA

### Wednesday, July 9

# MS89 Linear-Complexity Dense Linear Algebra: Methodologies and Applications

4:00 PM-6:00 PM

#### Room:Madison - 3rd Floor

This minisymposium presents latest advances in algorithms and applications of dense matrices with an off-diagonal low-rank structure. Traditionally entailing a cubic cost in factorizations and linear system solutions, dense matrices face a serious challenge in applications where the problem size easily scales. The low-rank structure has been found to be particularly useful in approximating a dense matrix defined from kernels, yielding linear or nearly linear time algorithms. We bring together researchers who study these matrices based on different methodologies, including FMM, treecode, hierarchical, and HSS matrices, and initiate an effort to assemble the different ideas to define a unified framework.

#### Organizer: Jie Chen

Argonne National Laboratory, USA

# 4:00-4:25 Hierarchical Interpolative Factorization

Kenneth L. Ho, Stanford University, USA

#### 4:30-4:55 Randomized Methods for Accelerating Structured Matrix Computations

Gunnar Martinsson, University of Colorado Boulder, USA

5:00-5:25 Parallel Structured Direct Solvers for Nonsymmetric and Indefinite Sparse Matrices

Zixing Xin, Purdue University, USA

#### 5:30-5:55 The Inverse Fast Multipole Method

Sivaram Ambikasaran, Courant Institute of Mathematical Sciences, New York University, USA; Eric F. Darve, Stanford University, USA

### Wednesday, July 9

# **MS90**

# Student Days: SIAM Student Paper Prize Winners

4:00 PM-6:00 PM

Room:Salon 6 - 3rd Floor

#### For Part 1 see MS84 Organized by the SIAM Education Committee

SIAM Student Paper Prize (SPP) presentations.

Organizer: Peter R. Turner Clarkson University, USA

Prize Winners To Be Announced

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—David E. Keyes, Dean of the Division of Mathematics and Computer Sciences and Engineering, KAUST, Saudi Arabia





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Konstantin E. Avrachenkov, Jerzy A. Filar, and Phil G. Howlett

This new text includes a comprehensive treatment of analytic perturbations of matrices, linear operators, and polynomial systems, particularly the singular perturbation of inverses and generalized inverses; original applications in Markov chains, Markov decision processes, optimization, and applications to Google PageRank™ and the Hamiltonian cycle problem.



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Bruce Finlayson Classics in Applied Mathematics 73

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#### The Radon Transform and Medical Imaging Peter Kuchment

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This book surveys the main mathematical ideas and techniques behind some well established imaging modalities such as X-ray CT and emission tomography, as well as a variety of newly developing coupled-physics or hybrid techniques, including thermoacoustic tomography. It also explains important concepts concerning inversion, stability, and incomplete data effects.

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#### Semi-Lagrangian Approximation Schemes for Linear and Hamilton-Jacobi Equations Maurizio Falcone and Roberto Ferretti

This largely self-contained book provides a unified framework of semi-Lagrangian strategy for the approximation of hyperbolic PDEs, with a special focus on Hamilton-Jacobi equations. The authors provide a rigorous discussion of the theory of viscosity solutions and the concepts underlying the construction and analysis of difference schemes; they then proceed to high-order semi-Lagrangian schemes and their applications. 2013 • xii + 319 pages • Softcover • 978-1-611973-04-4 List \$99.00 • SIAM Member \$69.30 • OT133

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#### Nonlinear Time Scale Systems in Standard and Nonstandard Forms: Analysis and Control Anshu Narang-Siddarth and John Valasek

Advances in Design and Control 26

This book introduces key concepts for systematically controlling engineering systems that possess interacting phenomena occurring at widely different speeds. The aim is to present the reader with control techniques that extend the benefits of model reduction of singular perturbation theory to a larger class of nonlinear dynamical systems. 2014 • xvi + 219 pages • Hardcover • 978-1-611973-33-4 List \$94.00 • SIAM Member \$65.80 • DC26

#### **Practical Augmented Lagrangian Methods** for Constrained Optimization

Ernesto G. Birgin and José Mario Martínez Fundamentals of Algorithms 10

This book focuses on Augmented Lagrangian techniques for solving practical constrained optimization problems. The authors rigorously delineate mathematical convergence theory based on sequential optimality conditions and novel constraint qualifications.

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# CP16 Life Sciences III

4:00 PM-5:40 PM

Room:Salon 4 - 3rd Floor

Chair: Bradford J. Lapsansky, Pennsylvania State University, USA

#### 4:00-4:15 Simulation of Calcium Waves in a Heart Cell on Modern Parallel Architectures

*Xuan Huang*, Matthias K. Gobbert, and Bradford E. Peercy, University of Maryland, Baltimore County, USA

#### 4:20-4:35 The Influence of Stochastic Parameters on Calcium Waves in a Heart Cell

Matthew W. Brewster, Xuan Huang, Matthias K. Gobbert, and Bradford E. Peercy, University of Maryland, Baltimore County, USA; Padmanabhan Seshaiyer, George Mason University, USA

#### 4:40-4:55 Stochastic Homogenization of the One-Dimensional Keller-Segel Chemotaxis System

Anastasios Matzavinos, Brown University, USA; Mariya Ptashnyk, University of Dundee, Scotland

#### 5:00-5:15 Neural Implementation of Shape-Invariant Touch Counter Based on Euler Calculus

*Keiji Miura*, Tohoku University, Japan; Kazuki Nakada, University of Electro-Communications, Japan

#### 5:20-5:35 A Model of Brain Neuro-Mechanics

Bradford J. Lapsansky and Corina Drapaca, Pennsylvania State University, USA Wednesday, July 9

# CP17 Numerical Methods in PDE III

4:00 PM-5:40 PM

Room:Salon 8 - 3rd Floor

Chair: Yingwei Wang, Purdue University, USA

4:00-4:15 A Hybrid Fd-Fv Method for First-Order Hyperbolic Systems *Xianyi Zeng*, Duke University, USA

#### 4:20-4:35 Redefining a Mimetic Curl Operator Using Gauss' Theorem with Applications in Computational Climate and Weather Modeling

*Eduardo J. Sanchez*, Guillermo Miranda, and Jose Castillo, San Diego State University, USA

#### 4:40-4:55 Field-split Preconditioned Inexact Newton Algorithms

Lulu Liu and David E. Keyes, King Abdullah University of Science & Technology (KAUST), Saudi Arabia

#### 5:00-5:15 Fast Structured Direct Spectral Methods for Differential Equations with Variable Coefficients

*Yingwei Wang*, Jie Shen, and Jianlin Xia, Purdue University, USA

#### 5:20-5:35 A Dual Iterative Substructuring Method with An Optimized Penalty Parameter

*Eun-Hee Park*, Kangwon National University, Korea; Chang-Ock Lee, Korea Advanced Institute of Science and Technology, Korea Wednesday, July 9

# CP18

Linear Algebra

4:00 PM-6:00 PM

Room:Kimball - 3rd Floor

Chair: Donald A. Drew, Rensselaer Polytechnic Institute, USA

### 4:00-4:15 A Model for Tempo

Synchronization in Music Performance Donald A. Drew, Rensselaer Polytechnic Institute, USA

#### 4:20-4:35 Symmetric Tensor Decompositions

*Tamara G. Kolda*, Sandia National Laboratories, USA

#### 4:40-4:55 Indefinite Preconditioning of the Coupled Stokes-Darcy System

Scott Ladenheim, Temple University, USA; Princ Chidyagwai, Loyola University, USA; Daniel B. Szyld, Temple University, USA

#### 5:00-5:15 Recycling and Updating Preconditioners for Sequences of Linear Systems

Arielle K. Grim Mcnally, Li Ming, and Eric De Sturler, Virginia Tech, USA

#### 5:20-5:35 Sensitivity of Leverage Scores to Perturbations

John Holodnak and Ilse Ipsen, North Carolina State University, USA

#### 5:40-5:55 Block Preconditioners for Biot's Equations

*Geoffrey Dillon* and Victoria Howle, Texas Tech University, USA; Rob Kirby, Baylor University, USA

# Intermission

6:00 PM-6:15 PM

# SP4

# I.E. Block Community Lecture: Search and **Discovery in Human Networks**

6:15 PM-7:15 PM

Room: Grand Ballroom - 4th Floor Chair: To Be Determined

In the past few years, we have seen a tremendous growth in public human communication and self-expression, through blogs, microblogs, and social networks. In addition, we are beginning to see the emergence of a social technology stack on the web, where profile and relationship information gathered by some applications can be used by other applications. This technology shift, and the cultural shift that has accompanied it, offers a great opportunity for computer scientists, artists, and sociologists to study (and organize) people at scale. In this talk I will discuss how the changing web suggests new paradigms for search and discovery. I will discuss some recent projects that use web search to study human nature, and use human nature to improve web search. I will describe the underlying principles behind these projects and suggest how they might inform future work in search, data mining, and social computing.

#### Sep Kamvar

Massachusetts Institute of Technology, USA

#### **Community Reception**

7:15 PM-8:15 PM Room: Empire - Lobby Level

# Workshop Celebrating **Diversity (WCD) Continues**

8:15 PM-9:15 PM Room:Salon 12 - 3rd Floor



# Thursday, July 10

# **Education Committee Breakfast Meeting**

7:00 AM-8:30 AM Room:Price - 5th Floor

# **Membership Committee Breakfast Meeting**

7:00 AM-8:30 AM Room: Congress - 3rd Floor

# Industry Committee **Breakfast Meeting** 7:00 AM-8:30 AM

Room:Buckingham - 5th Floor

#### **Registration**

8:00 AM-4:30 PM Room:State - 4th Floor

# Thursday, July 10

# **MS91**

# Numerical Methods for **Power Grid Simulation**

8:30 AM-10:30 AM

Room: Grand Ballroom - 4th Floor

Simulation of power grid dynamics requires solution of large, sparse systems of differential-algebraic equations. Previously, these systems have been solved with constant step time integrators capable of resolving the dynamics only over a single time-scale. Recently, more renewable technologies have entered the market, and their effects must be included more accurately. For example, wind energy adds a slower time scale to the system than has been modeled with typical generators. Furthermore, increasing connectivity between local and regional grids is giving rise to larger models. In this minisymposium we will discuss new methods and software for use in grid simulations to help address these issues.

**Organizer: Carol S. Woodward** Lawrence Livermore National Laboratory,

USA

Organizer: Shrirang Abhyankar Argonne National Laboratory, USA

8:30-8:55 Power Grid Simulation: Needs, State of the Art, Challenges Patrick Panciatici, RTE, France

#### 9:00-9:25 Experiences with Time Integration Algorithms in a Time **Domain Simulation Code**

Carol S. Woodward, Lawrence Livermore National Laboratory, USA; Chaoyang Jing, eMIT, USA; Liang Min and Steve G. Smith, Lawrence Livermore National Laboratory, USA

9:30-9:55 A Fully Implicit Approach for the Solution of Temporal Multiscale Problems with Application to Power Grid

Shrirang Abhyankar, Argonne National Laboratory, USA; Alexander J. Flueck and Xu Zhang, Illinois Institute of Technology, USA

10:00-10:25 Gridpack<sup>™</sup> Toolkit for **Developing Power Grid Simulations** on High Performance Computing Platforms

Bruce Palmer, William Perkins, Kevin Glass, Yousu Chen, Shuangshuang Jin, Ruisheng Diao, Mark Rice, David Callahan, Steve Elbert, and Zenyu Huang, Pacific Northwest National Laboratory, USA



# MS92 Mathematics and Science Policy: Some SIAM Perspectives

### 8:30 AM-10:30 AM

Room:Red Lacquer - 4th Floor

This panel will consider how SIAM members contribute to policy discussions, advocate for funding, and promote the visibility of the mathematics community. It will discuss interactions with the White House (OSTP, OMB), Congress, funding agencies (NSF, DoE, DoD, NIH), advisory committees (NAS, PCAST), and other organizations and stakeholders. It will also explain the current central role of STEM education issues in these interactions. Finally, it will reveal the need for mathematicians to be at the table to discuss a breadth of issues if we want to have our voice heard on particular topics.

Organizer: Rosalie Belanger-Rioux

Massachusetts Institute of Technology, USA

Organizer: C. David Levermore University of Maryland, College Park, USA 8:30-8:55 Mathematics and Science Policy: Some Perspectives from SIAM?

Policy: Some Perspectives from SIAM's President

Irene Fonseca, Carnegie Mellon University, USA

#### 9:00-9:25 Mathematics Research: Support, Stakeholders, Accountability

Douglas N. Arnold, University of Minnesota, USA

#### 9:30-9:55 SIAM's Initiatives and Activities in STEM Education

Peter R. Turner, Clarkson University, USA

10:00-10:25 Building Support, Building Budgets for the Mathematical Sciences

Peter March, The Ohio State University, USA

Thursday, July 10

# MS93 The Mathematics of Sustainability

8:30 AM-10:30 AM

Room: Crystal - 3rd Floor

Organized by SIAG/GS

As world populations continue to grow, the availability of natural resources is reduced. Our ability to support existing and future populations is dependent on our ability to sustain, and even supplement, these resources. Solutions to these problems require new interdisciplinary advances in modeling, simulation, and optimization. In this minisymposium, we discuss mathematical approaches for resolving a variety of sustainability problems in the geosciences.

Organizer: Lea Jenkins Clemson University, USA

Organizer: Kathleen Fowler Clarkson University, USA

8:30-8:55 Analysis of a Managed Aquifer Recharge System Lea Jenkins, Clemson University, USA

9:00-9:25 Crop Rotation Modeling and Optimization for Sustainable Water Use

Kathleen Fowler, Clarkson University, USA

9:30-9:55 Modeling Impacts of Water Level Control Procedures on Water Quality of the St Lawrence River Joseph Skufca, Clarkson University, USA

10:00-10:25 Estimating Uncertainty in Annual Energy Production Genetha Gray, Sandia National Laboratories,

USA

# Thursday, July 10

# **MS94**

# Discovery from Data I: Mathematical Patterns in Nature

8:30 AM-10:30 AM Room:Salon 3 - 3rd Floor

# For Part 2 see MS108

The interplay between mathematical modeling and experimental measurement is at the basis of the "effectiveness of mathematics" in physics [Wigner (1960) Commun. Pure Appl. Math. 13:1–14]. Could this effectiveness be extended to all natural phenomena? In the three sessions of this minisymposium on "Discovery from Data" we will present recent studies illustrating how the mathematical modeling of measured data can give insights into and lead to the discovery, and ultimately also control, of natural phenomena in such diverse areas as cancer genetics, cell biology, and geophysics.

Organizer: Orly Alter

University of Utah, USA

#### 8:30-8:55 Discovery of Principles of Nature from Matrix and Tensor Modeling of Large-Scale Molecular Biological Data

Orly Alter, University of Utah, USA

#### 9:00-9:25 Deconvolution of the Mammalian Cell Cycle Metabolome

Anneleen Daemen, Christopher Delnagro, Jonathan Choi, Peter Jackson, Thomas O'Brien, and *Matthew Brauer*, Genentech, Inc., USA

#### 9:30-9:55 Tensor Completion Methods in Seismology: Reconstruction, Denoising and Un-Mixing Seismic Sources

Mauricio D. Sacchi, University of Alberta, Canada

10:00-10:25 Coherent Pattern Detection in Tensor Data

Hongya Zhao and *Hong Yan*, City University of Hong Kong, Hong Kong

# MS95

# Analysis and Applications of Optimization

8:30 AM-10:30 AM

Room:Salon 12 - 3rd Floor

Part of the SIAM Workshop Celebrating Diversity

This session highlights theoretical results and current applications of optimization found in various fields. The underpinnings of solving nonconvex optimization problems through a relaxation technique, and through regularization methods to solve problems in image processing will be discussed. In addition, a heuristic model that reduces load shed recovery for transmission networks will be presented and finally a model of a truckload border crossing process with Coxian k-phased distributions will be discussed.

Organizer: Cristina Villalobos

University of Texas - Pan American, USA

**Organizer: Sue Minkoff** University of Texas at Dallas, USA

#### **Organizer: Stephen Wirkus**

Arizona State University, USA

#### 8:30-8:55 Exploiting Nonlinear

Structure for Nonconvex Optimization Sven Leyffer, Argonne National Laboratory, USA

#### 9:00-9:25 A Spectral Analysis for Regularization and Image Processing Applications

Jorge A. Castanon, Rice University, USA

#### 9:30-9:55 Topology Control for Load Shed Recovery

Erick Moreno-Centeno, Texas A&M University, USA

#### 10:00-10:25 A Coxian-Phased Approximation for Border Crossing Service Times of Commercial Trucks *Hiram Moya*, University of Texas - Pan

American, USA

# Thursday, July 10

# **MS96**

### Algorithms, Applications and Analysis of Fractional PDEs and Nonlocal Problems- Part II of II

# 8:30 AM-10:30 AM

Room:Salon 2 - 3rd Floor

#### For Part 1 see MS80

Fractional Partial Differential Equations (FPDEs) and related nonlocal problems are emerging as a new powerful tool for modeling difficult types of complex systems, which cannot be modeled accurately by integerorder differential equations. However, these problems raise new modeling, computational, mathematical, and numerical difficulties that have not been encountered in the context of integer-order differential equations. The aim of this minisymposium is to cover the recent development in mathematical and numerical analysis, computational algorithms, modeling and applications in this field.

#### Organizer: Hong Wang

University of South Carolina, USA

Organizer: Mohsen Zayernouri Brown University, USA

#### Organizer: George E. Karniadakis Brown University, USA

8:30-8:55 High Order Scheme for Caputo Derivative and Its Application to Caputo Type Advection-Dispersion Equation

Jianxiong Cao and *Changpin Li*, Shanghai University, China; YangQuan Chen, University of California, Merced, USA

#### 9:00-9:25 Variational Formulation of Problems Involving Fractional Order Differential Operators

Bangti Jin, University of California, Riverside, USA

#### 9:30-9:55 A Fast Finite-Volume Eulerian-Lagrangian Localized Adjoint Method for Space-Fractional Advection-Diffusion Equations

Mohamed Al-Lawati, Sultan Qaboos University, Oman

#### 10:00-10:25 Fractional Sturm-Liouville Theory for Spectral and Spectral Element Methods

Mohsen Zayernouri and George E. Karniadakis, Brown University, USA

# Thursday, July 10

# **MS97**

# Numerical Methods for Eigenvalue Problems - Part I of III

8:30 AM-10:30 AM

# Room:Salon 7 - 3rd Floor For Part 2 see MS111

Organized by SIAG/ALA

Eigenvalue problems arise in a variety of science and engineering applications. This minisymposium features the latest progress on developing efficient algorithms for solving large-scale linear and nonlinear eigenvalue problems and their applications in several different and important scientific areas. The presenters will discuss a number of important issues such as structure preservation, scalability, convergence acceleration through preconditioning and complexity reduction through domain decomposition etc.

#### Organizer: Chao Yang

Lawrence Berkeley National Laboratory, USA

#### 8:30-8:55 Improved Convergence and Parallel Performances for the FEAST Eigensolver

Eric Polizzi, University of Massachusetts, Amherst, USA

#### 9:00-9:25 z-Pares: A Complex Moment Based Hierarchical Parallel Eigensolver Package

Yasunori Futamura and Tetsuya Sakurai, University of Tsukuba, Japan

#### 9:30-9:55 Preconditioning Subspace Iteration for Large Eigenvalue Problems with Automated Multi-Level Sub-Structuring

Heinrich Voss, Hamburg University of Technology, Germany

#### 10:00-10:25 Compact Rational Krylov Methods for Solving Nonlinear Eigenvalue Problems

Roel Van Beeumen, Karl Meerbergen, and Wim Michiels, Katholieke Universiteit Leuven, Belgium

# MS98

### Mesoscale and Nonlocal Models of Materials with Microstructure – Part IV of IV

8:30 AM-10:30 AM

Room:Wilson - 3rd Floor

#### For Part 3 see MS82

This session will present recent developments concerning linking micro- and mesoscales in materials with complex behavior. The session will focus on homogenization of partial differential equations with oscillatory coefficients, fine-scale stress concentration modeling, nonlocal continuum modeling, peridynamics, complexity reduction and multiscale computational modeling with applications to composites, suspensions, and biomaterials.

Organizer: Lyudmyla Barannyk University of Idaho, USA

Organizer: Yuliya Gorb University of Houston, USA

Organizer: Alexander Panchenko Washington State University, USA

Organizer: Alexandre Tartakovsky Pacific Northwest National Laboratory, USA

8:30-8:55 On Global Microchannel Configurations for Liquid-Cooled Electronics Applications with Large Power Densities

*Burt S. Tilley*, Worcester Polytechnic Institute, USA

9:00-9:25 Homogenization for Sea Ice *Kenneth M. Golden*, University of Utah, USA

#### 9:30-9:55 Transport Properties of Periodic Metamaterials

*Yuri Godin*, University of North Carolina, Charlotte, USA

#### 10:00-10:25 Review of Network Methods for Study of Singular Phenomena in Heterogeneous Media Yuliya Gorb, University of Houston, USA

Thursday, July 10

# MS99 Stochastic Dynamical Systems and their Applications

8:30 AM-10:30 AM

Room:Salon 1 - 3rd Floor

Organized by SIAG/DS

Dynamical systems arising in engineering and science are often subject to random influences. In this minisymposium we will present recent theoretical and numerical models and techniques for investigating stochastic dynamical systems, such as stochastic partial/ordinary differential equations with Gaussian/non-Gaussian noises, escape probability describing transitions between dynamical regimes, etc. In particular, applications in chemical reaction networks will be presented.

Organizer: Xingye Kan University of Minnesota, USA

**Organizer: Jinqiao Duan** *Illinois Institute of Technology, USA* 

8:30-8:55 A Multi-Time-Scale Analysis of Stochastic Chemical Reaction Network

Xingye Kan, University of Minnesota, USA

9:00-9:25 Deterministic Quantities for Understanding Stochastic Dynamics Jingiao Duan, Illinois Institute of

Technology, USA

#### 9:30-9:55 Fokker-Planck Equations for Stochastic Dynamical Systems with Symmetric Lévy Motions

Xiaofan Li, Illinois Institute of Technology, USA

10:00-10:25 DiPaola-Falsone Formula and Marcus Integral for Stochastic Dynamical Systems under non-Gaussian White Noise

Xu Sun, Huazhong University of Science & Technology, China

#### Thursday, July 10

# **MS100**

# Boundary Integral Equations and Their Applications - Part I of IV

8:30 AM-10:30 AM

Room:Salon 6 - 3rd Floor

#### For Part 2 see MS114

The number of applications in science and engineering that can be modeled computationally is growing with the development of boundary integral equation solution techniques (fast solvers, highorder quadratures, etc.). However, there are still many problems that can benefit from efficient and highly accurate solution techniques. This minisymposium will present recent developments that address open issues and expand on the use of boundary integral equations to model physical phenomena.

#### Organizer: Bryan D. Quaife

University of Texas at Austin, USA

Organizer: Min Hyung Cho Dartmouth College, USA

**Organizer: Adrianna Gillman** *Dartmouth College, USA* 

8:30-8:55 Spectral Deferred Correction Methods for Vesicle Suspensions

Bryan D. Quaife, University of Texas at Austin, USA

#### 9:00-9:25 Boundary Integral Methods for General Elliptic Problems

John A. Strain, University of California, Berkeley, USA

#### 9:30-9:55 Volume Integral Equation Approaches for Fast Field Analysis in Inhomogeneous Media, with applications to MR Imaging and Induction Power Couplers

Athanasios Polimeridis, Richard Zhang, and Jacob White, Massachusetts Institute of Technology, USA

#### 10:00-10:25 Stable, Accurate, and Efficient Schemes for Parabolic Problems using the Method of Lines Transpose

Matthew F. Causley and Andrew J. Christlieb, Michigan State University, USA

# MS101 Recent Advances in

# Interfacial Dynamics and its Applications – Part I of IV

8:30 AM-10:30 AM

Room:Salon 10 - 3rd Floor

#### For Part 2 see MS115

Many physical and biological problems involve interfaces separating different domains. Examples include multiphase flow in fluid mechanics, tumor growth, epitaxial thin films, bio-membrane related problems, etc. While modeling, numerical computation and analysis become important and efficient tools for investigating the interface phenomena, characterizing the dynamics of complex interfaces remains a challenging research topic. The aim of this mini-symposium is to bring together scientists in the field to exchange their recent research discoveries and future directions, to stimulate novel ideas, and to nurture collaborations.

#### Organizer: Xiaofan Li

Illinois Institute of Technology, USA

#### Organizer: Shuwang Li

Illinois Institute of Technology, USA 8:30-8:55 Computing Singular and

#### Nearly Singular Integrals

J. Thomas Beale, Duke University, USA; Wenjun Ying, Shanghai Jiao Tong University, China

#### 9:00-9:25 An Overlapping Patch Boundary Integral Method for Dynamic Interface Problems

Michael Siegel, New Jersey Institute of Technology, USA

#### 9:30-9:55 A Kernel-Free Boundary Integral Method for Moving Interface and Free Boundary Problems

Wenjun Ying, Shanghai Jiao Tong University, China

# 10:00-10:25 An Interface Problem for Biomolecules

*Li-Tien Cheng* and Bo Li, University of California, San Diego, USA

# Thursday, July 10

# MS102 Modeling of Fluid-structure Interactions Inspired by Organism Motion

8:30 AM-10:30 AM

#### Room:Salon 5 - 3rd Floor

Fluid-structure interactions are ubiquitous in animal motion.Understanding the complexity of these interactions is vital to understanding why organisms behave as observed. In this minisymposium, presenters will discuss modeling of fluid-structure interactions inspired by animal motion and relevant results. Presenters will further discuss the benefits of such motions. This minisymposium is part of a series on locomotion and flow-body interactions.

#### Organizer: Shilpa Khatri

University of North Carolina at Chapel Hill, USA

#### 8:30-8:55 Simulations of Pulsating Sessile Coral and the Resulting Fluid Flow

Shilpa Khatri, University of North Carolina at Chapel Hill, USA

#### 9:00-9:25 Elastic Structure Coupled with the Air/water Interface, Inspired by Diving Birds

Sunghwan Jung, Virginia Tech, USA

#### 9:30-9:55 Simulation of a 3D Viscous Flow Past a Deformable Thin-Walled Circular Disk Tethered at Its Center by An IB Method

RuNan Hua and Xiyun Lu, University of Science and Technology of China, China; *Luoding Zhu*, Indiana University - Purdue University Indianapolis, USA

#### 10:00-10:25 Performance of Vortex-Based Propulsion on a Jellyfish-Like Swimmer

Jifeng Peng, University of Alaska, USA

# Thursday, July 10

# MS103

Numerical Methods for Direct, Inverse and Optimal Design Problems in Wave Propagation: Part III of III

8:30 AM-10:30 AM

Room:Indiana - 3rd Floor

#### For Part 2 see MS87

Wave phenomena are ubiquitous in nature, and have found significant applications in science and engineering. The application of wave to specific instances poses significant analytical and computational challenges, due to the complexity of the models and the need to resolve the wave on the scale of their oscillations for forward modeling. and appropriate regularization techniques to mollify inherent ill-posedness for the inverse problems. This minisymposium seeks to bring together researchers to promote exchange of ideas, and present recent developments on the novel and efficient numerical methods for solving the direct, inverse and optimal design problems that arise in wave propagation.

#### Organizer: Junshan Lin Auburn University, USA

Organizer: Songting Luo Iowa State University, USA

#### 8:30-8:55 Multiple Scattering Using the Generalized Foldy-Lax Formulation

*Kai Huang*, Florida International University, USA; Peijun Li, Purdue University, USA; Hongkai Zhao, University of California, Irvine, USA

#### 9:00-9:25 Surface Plasmon Enhancement in Nano Dielectric Layer

Yannan Shen, University of Texas at Dallas, USA

#### 9:30-9:55 Fast Solver for Multi-Particle Scattering in a Layered Medium

Jun Lai, Courant Institute of Mathematical Sciences, New York University, USA

#### 10:00-10:25 The Factorization Method for a Cavity in An Inhomogeneous Medium

Shixu Meng, University of Delaware, USA; Houssem Haddar, CMAP, Ecole Polytechnique, France; Fioralba Cakoni, University of Delaware, USA

# MS104 Reliable Computational Science Part II of II

8:30 AM-10:30 AM

#### Room:Logan - 3rd Floor

#### For Part 1 see MS88

Causes of accidents such as the Sleipnir oil rig collapse and the Ariane 5 rocket explosion can be traced back to failures in computational modeling and simulation. As computational science plays an increasing role in research and development, algorithms and practices from reliable computational science will play an increasing role in preventing such failures from occurring in the future. This minisymposium discusses how to advance the state-of-the-art of through through better algorithm design and implementation, reproducibility of computational research, theoretical justification for automatic algorithms, and creation and maintenance of software libraries.

**Organizer: Fred J. Hickernell** *Illinois Institute of Technology, USA* 

# Organizer: Sou-Cheng T. Choi

University of Chicago and Argonne National Laboratory, USA

#### 8:30-8:55 Towards Verifiable Publications

Tanu Malik, University of Chicago, USA

#### 9:00-9:25 Improving Computing Skills of STEM Graduates

Lorena A. Barba, George Washington University, USA

#### 9:30-9:55 Constructing Guaranteed Automatic Numerical Algorithms for Univariate Integration

Yizhi Zhang, Illinois Institute of Technology, USA

#### 10:00-10:25 What Is Worth Reproducing in Computational Science?

William J. Rider, Sandia National Laboratories, USA

### Thursday, July 10

# CP19 Numerical Optimization 8:30 AM-10:10 AM

0:50 AIVI-10:10 AIVI

Room:Kimball - 3rd Floor

Chair: Haopeng Zhang, Texas Tech University, USA

#### 8:30-8:45 A Primal-Dual Simplex Algorithm to Enumerate the Mixed Cells of a Polynomial System

*Tsung-Lin Lee*, National Sun Yat-sen University, Taiwan; Tien-Yien Li, Michigan State University, USA

#### 8:50-9:05 Coupled Spring Forced Multiagent Coordination Optimization for Mixed-Binary Nonlinear Programming

Haopeng Zhang and Qing Hui, Texas Tech University, USA

#### 9:10-9:25 A Block-Coordinate Descent Approach for Large-Scale Sparse Inverse Covariance Estimation

*Eran Treister*, Javier Turek, and Irad Yavneh, Technion - Israel Institute of Technology, Israel

#### 9:30-9:45 Fitting a Straight Line in Three-Dimensional Space by Total Least-Squares Adjustment

*Kyle B. Snow* and Burkhard Schaffrin, The Ohio State University, USA

#### 9:50-10:05 Optimisation and Conditioning in Variational Data Assimilation

Adam El-Said, Nancy K. Nichols, and Amos Lawless, University of Reading, United Kingdom

### Thursday, July 10

# CP20 Computational Science

8:30 AM-10:30 AM

Room:Madison - 3rd Floor

Chair: Irina Demeshko, Sandia National Laboratories, USA

#### 8:30-8:45 Effective Parallel Preconditioners for CFL Application

*Katarzyna Swirydowicz*, Eric De Sturler, Xiao Xu, and Christopher J Roy, Virginia Tech, USA

8:50-9:05 Parallel Techniques for the Incomplete-LU Factorization Maxim Naumov, NVIDIA, USA

#### 9:10-9:25 A Performance-Portable Implementation of the Albany Ice Sheet Model: Kokkos Approach

*Irina Demeshko*, H. Carter Edwards, Michael A. Heroux, ERIC T. Phipps, and ANDREW G. Salinger, Sandia National Laboratories, USA

#### 9:30-9:45 Modeling Accidental Explosions and Detonations

Jacqueline Beckvermit, Todd Harman, Andrew Bezdjian, Qingyu Meng, Alan Humprey, John Schmidt, and Martin Berzins, University of Utah, USA; Chuck Wight, Weber State University, USA

#### 9:50-10:05 Finite Elements in Flux Coordinates in Gyrokinetic Turbulence Simulation

Jin Chen, Princeton Plasma Physics Laboratory, USA

#### 10:10-10:25 Matrix-Free Krylov Subspace Methods on Modern CPUs and Many-Core Processors

Samuel Khuvis and Matthias K. Gobbert, University of Maryland, Baltimore County, USA; Andreas Meister, University of Kassel, Germany

# CP21

# Life Sciences IV

8:30 AM-9:50 AM

Room:Salon 4 - 3rd Floor

Chair: Aisa Biria, McGill University, Canada

#### 8:30-8:45 Mathematical Model and Simulation of Particle Flow Around Choanoflagellates Using the Method of Regularized Stokeslets

Hoa Nguyen and Niti Nararidh, Trinity University, USA

#### 8:50-9:05 Swimming Efficiently: An Analytical Demonstration of Optimal Strouhal Number in Fish

Alexander J. Wiens and Anette Hosoi, Massachusetts Institute of Technology, USA

#### 9:10-9:25 Swimming and Pumping of Helical Bodies in Viscous Fluids

Lei Li and Saverio Spagnolie, University of Wisconsin, Madison, USA

#### 9:30-9:45 Equilibrium and Bifurcation Analysis of Discoidal Lipoproteins

Aisa Biria, McGill University, Canada; Eliot Fried, Okinawa Institute of Science and Technology, Japan Thursday, July 10

# CP22 Numerical Methods in PDE IV

8:30 AM-10:30 AM

Room:Salon 8 - 3rd Floor

Chair: Anna Lischke, Iowa State University, USA

#### 8:30-8:45 Asymptotic-Preserving Semi-Lagrangian Discontinuous Galerkin Schemes for a Class of Relaxation Systems

Anna Lischke and James A. Rossmanith, Iowa State University, USA

8:50-9:05 Analysis of a Large Time Step and Overlapping Grids Method for Hyperbolic Conservation Laws *Ilija Jegdic*, University of Houston, USA

# 9:10-9:25 Filtered Positive $\mathsf{P}_N$ Closure for Kinetic Transport Equations

Ming Tse P. Laiu, University of Maryland, College Park, USA; Cory Hauck, Oak Ridge National Laboratory, USA; Dianne P. O'Leary and André Tits, University of Maryland, College Park, USA

#### 9:30-9:45 Positivity-Preserving WENO Schemes with Constrained Transport for Ideal MHD

*Qi Tang*, Andrew J. Christlieb, and Yuan Liu, Michigan State University, USA; Zhengfu Xu, Michigan Technological University, USA

#### 9:50-10:05 Partially Penalized Immersed Finite Element Methods for Elliptic Interface Problems

Xu Zhang, Purdue University, USA

#### 10:30-10:45 Unconditionally Optimal Error Estimates of Fully Discrete Fems for Parabolic Equations

Buyang Li, Nanjing University, China

# **Coffee Break**

Room:Exhibit Hall

10:30 AM-11:00 AM



Thursday, July 10

IP5

# **Big Data Visual Analysis** 11:00 AM-11:45 AM

Room:Grand Ballroom - 4th Floor

Chair: Michael Miksis, Northwestern University, USA

We live in an era in which the creation of new data is growing exponentially such that every two days we create as much new data as we did from the beginning of mankind until the year 2003. One of the greatest scientific challenges of the 21st century is to effectively understand and make use of the vast amount of information being produced. Visual data analysis will be among our most important tools to understand such large and often complex data. In this talk, I will present state-of-the-art visualization techniques, including ways to visually characterize associated error and uncertainty, applied to Big Data problems in science, engineering, and medicine.

Christopher Johnson University of Utah, USA

# IP6 Virtual Electrophysiology Laboratory

11:50 AM-12:35 PM

Room:Grand Ballroom - 4th Floor Chair: Margot Gerritsen, Stanford University,

We present the development of a highly innovative patient-specific MRI-based heart modeling environment that represents cardiac functions from molecular processes to electrophysiological and electromechanical interactions at the organ level. This environment is termed "virtual electrophysiology lab". We present our attempts to translate this environment into the clinic and apply it to the non-invasive diagnosis and treatment of heart rhythm and contractile disorders in patients with structural heart disease. This pioneering effort offers to integrate, for the first time, computational modeling of the heart, traditionally a basicscience discipline, within the milieu of contemporary patient care. The robust and inexpensive non-invasive approaches for individualized arrhythmia risk stratification and guidance of electrophysiological therapies presented here are expected to lead to optimized therapy delivery and reduction in health care costs.

Natalia A. Trayanova Johns Hopkins University, USA

Lunch Break 12:35 PM-2:00 PM Attendees on their own Thursday, July 10 **SIAG Chairs Lunch Meeting** 12:35 PM-2:00 PM Room:Price - 5th Floor

Book Editorial Lunch Meeting 12:35 PM-2:00 PM

Room:Buckingham - 5th Floor

# Workshop Celebrating Diversity (WCD) Luncheon (by invitation only)

12:35 PM-2:00 PM Room:Empire Room- Lobby Level Thursday, July 10

# IP7

# Unilever, Science and eScience: The Challenges Ahead

2:00 PM-2:45 PM

Room: Grand Ballroom - 4th Floor

Chair: Kirk E. Jordan, IBM T.J. Watson Research Center, USA

Unilever is a large multinational and a market leader in the fast moving consumer goods business, with well known products in the sectors of home care, personal care, refreshments and foods. We are embracing new ways of doing R&D to deliver bigger, better, faster innovations to market. The digital revolution, eScience, is already permeating everything we do at home: how could we pay our bills without eBanking, connect with our friends without Facebook, or find our way around without SatNav? The same revolution is helping us move faster at work. But how can we make this digital eScience revolution work for us?

Massimo Noro Unilever, United Kingdom

Intermission 2:45 PM-3:00 PM

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USA

# SP5

# Julian Cole Lecture: Growth, Patterning, and Control in Nonequilibrium Systems

#### 3:00 PM-3:30 PM

Room:Grand Ballroom - 4th Floor

#### Chair: Irene Fonseca, Carnegie Mellon University, USA

Dense-branching morphologies are among the most common forms of microstructural patterning in systems driven out of equilibrium. Prediction and control of the emergent patterns are difficult due to nonlocality, nonlinearity and spatial heterogeneity. Focusing on viscous fingering in a circular Hele-Shaw cell as a paradigm for such phenomena, we use theory and numerics to demonstrate that by controlling the injection rate of the less viscous fluid, we can precisely suppress the evolving interfacial instabilities and control the shape of growing bubbles. Experiments confirm the feasibility of the control strategy. Extensions to other pattern-forming systems will be discussed.

#### John Lowengrub

University of California, Irvine, USA

LR

# Coffee Break

3:30 PM-4:00 PM

Room: Exhibit Hall - 4th Floor

Thursday, July 10

# MS105

## Inverse Problems for Coastal Engineering and Subsurface Flow

# 4:00 PM-6:00 PM

Room: Grand Ballroom - 4th Floor

#### Organized by SIAG/CSE

This subject of this minisymposia is state-ofthe-art solution of stochastic inverse problems for determining parameters in physics-based models. The models arise in the applications of coastal engineering and subsurface flow. The focus is on applications involving complex models and actual physical data. Presentations discussing aspects of uncertainty quantification, including the effects of model error and finite sampling to approximate probability distributions, will be emphasized.

# Organizer: Donald Estep

Colorado State University, USA

#### 4:00-4:25 A Practical Guide to Measure-Theoretic Inversion: Algorithms and Error Estimation

*Troy Butler*, University of Colorado, Denver, USA; Don Estep and Simon Tavener, Colorado State University, USA

#### 4:30-4:55 Uncertainty Quantification and Parameter Estimation for Groundwater Contaminant Transport

Steven Mattis and Clint Dawson, University of Texas at Austin, USA; Troy Butler and Donald Estep, Colorado State University, USA

#### 5:00-5:25 Spatially Heterogeneous Parameter Estimation Within the Advanced Circulation (ADCIRC) Model

Lindley Graham, University of Texas at Austin, USA; Troy Butler, University of Colorado, Denver, USA; Clint Dawson, University of Texas at Austin, USA; Donald Estep, Colorado State University, USA; Joannes Westerink, University of Notre Dame, USA

#### 5:30-5:55 Advanced Coastal/ Subsurface Models and a Measure-Theoretic Uq Framework Using Real Data

Nishant Panda, University of Texas at Austin, USA

# Thursday, July 10

# **MS106**

# Applications of Data-driven Models from Scientific Research to Public Health Issues

# 4:00 PM-6:00 PM

#### Room:Red Lacquer - 4th Floor

Complex patterns are seen in networks sciences (e.g., scientific collaborations) to health sciences (e.g. designing public health interventions), challenging researchers to extract mechanisms that drives the patterns by linking models to observational and experimental data. Experimental studies often have been found to be logistically or ethically infeasible, while observational data although being cheaper and more readily available are often plagued by a variety of biases. This minisymposium will present recent advances in understanding the underlying mechanisms of systems through the models guided by data with the focus being on explaining the data and identifying the processes affecting it.

#### Organizer: Abhishek Pandey Clemson University, USA

Organizer: Kamal Barley Arizona State University, USA

Organizer: Jan Medlock Oregon State University, USA

#### Organizer: Anuj Mubayi

Northeastern Illinois University, USA

4:00-4:25 Novelty, Convention and Scientific Impact

Satyam Mukherjee, Northwestern University, USA

#### 4:30-4:55 Controllability Of Infections In Models Exhibiting Multiple Endemic Equilibria

Muntaser Safan, Arizona State University, USA

#### 5:00-5:25 Modeling the Transmission Dynamics of H7N9 Avian Influenza Outbreak: Poultry Markets

Sherry Towers, Arizona State University, USA

#### 5:30-5:55 Modeling the Dynamics of Vector-Host Interaction of Easter Equine Encephalitis

Timothy Muller, Oregon State University, USA

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3/14



Thursday, July 10 MS107 Session Cancelled 4:00 PM-6:00 PM Thursday, July 10

# MS108 Discovery from Data II: Cancer Genomic Signals and Systems

4:00 PM-6:00 PM

Room:Salon 3 - 3rd Floor

#### For Part 1 see MS94 For Part 3 see MS123

The interplay between mathematical modeling and experimental measurement is at the basis of the "effectiveness of mathematics" in physics [Wigner (1960) Commun. Pure Appl. Math. 13:1–14]. Could this effectiveness be extended to all natural phenomena? In the three sessions of this minisymposium on "Discovery from Data" we will present recent studies illustrating how the mathematical modeling of measured data can give insights into and lead to the discovery, and ultimately also control, of natural phenomena in such diverse areas as cancer genetics, cell biology, and geophysics.

Organizer: Orly Alter University of Utah, USA

Organizer: Katherine A. Aiello University of Utah, USA

4:00-4:25 Comparison and Integration of Genomic Profiles Predict Brain Cancer Survival and Drug Targets *Katherine A. Aiello* and Orly Alter,

University of Utah, USA

#### 4:30-4:55 Network-Based Methods for Understanding Disease and Predicting Therapy

Kimberly Glass and John Quackenbush, Harvard School of Public Health, USA

5:00-5:25 Variant Prioritization by Genomic Data Fusion

*Yves Moreau*, Katholieke Universiteit Leuven, Belgium

5:30-5:55 Discovery of Multidimensional Modules in Cancer Genomic Data

*Xianghong J. Zhou*, University of Southern California, USA

Thursday, July 10

# MS109 Modeling and Algorithm Development for Mathematical Geosciences

4:00 PM-6:00 PM

Room:Salon 12 - 3rd Floor

Organized by SIAG/GS and the Workshop Celebrating Diversity

Mathematical modeling of geoscience problems is in ever increasing demand as the world's traditional energy supplies become more complicated to harnass and increasing attention is paid to the ways in which fossil fuel emissions impact our climate. This session will highlight modeling and algorithm development for these challenging and complex physical problems. One central process in earth science modeling is inversion to non-destructively uncover information about the earth. Speakers will highlight developments in efficient and accurate solution of both forward and inverse problems to recover earth properties useful for traditional oil and gas exploration, earthquake prediction, and climate change. ~

**Organizer: Susan E. Minkoff** *University of Texas at Dallas, USA* 

**Organizer: Cristina Villalobos** University of Texas - Pan American, USA

Organizer: Stephen Wirkus Arizona State University, USA

#### 4:00-4:25 Reverse Time Migration Via a Multiscale Wave Propagation Model

Susan E. Minkoff, University of Texas at Dallas, USA

#### 4:30-4:55 Uncertainty Quantification for Large-Scale Bayesian Inverse Problems with Application to Ice Sheet Models

*Noemi Petra*, Tobin Isaac, Georg Stadler, and Omar Ghattas, University of Texas at Austin, USA

5:00-5:25 A Fast Algorithm for 3D Azimuthally Anisotropic Velocity Scan Jingwei Hu and Sergey Fomel, University

of Texas at Austin, USA; Lexing Ying, Stanford University, USA

5:30-5:55 The Role of Numerical Boundary Procedures in the Stability of Perfectly Matched Layers *Kenneth Duru*, Stanford University, USA

# **MS110** The Role of Functional Surfaces on Animal Locomotion

### 4:00 PM-6:00 PM

#### Room:Salon 2 - 3rd Floor

Interactions of animals with their surrounding environment in swimming, flying, and terrestrial locomotion have been widely studied for many years. However, the functional properties of interfacial surfaces in such interactions are usually ignored in many of these studies. In this minisymposium, we would like to explore the remarkable role of snake scales, fish skin, and butterfly scales on the effective interactions these species make with their surrounding media. We will then discuss the physics and applications of bioinspired skins.

#### Organizer: Hamidreza Marvi

Carnegie Mellon University, USA

#### 4:00-4:25 Friction Enhancement in **Snake Locomotion**

Hamidreza Marvi, Carnegie Mellon University, USA; Jeffrey Streator and David Hu, Georgia Institute of Technology, USA

#### 4:30-4:55 Sharks and Butterflies: Micro-Sized Scales Have Macro **Effects**

Amy Lang, University of Alabama, USA

#### 5:00-5:25 Bio-inspired Wing Design for Flying Micro Robots

Mirko Kovac, Imperial College London, United Kingdom

#### 5:30-5:55 Bioinspired Transformative Skins: From Fundamental Physics to **Applications**

Xuanhe Zhao, Duke University, USA

# Thursday, July 10

# MS111 Numerical Methods for **Eigenvalue Problems -**Part II of III

4:00 PM-6:00 PM

Room:Salon 7 - 3rd Floor For Part 1 see MS97 For Part 3 see MS126

Organized by SIAG/ALA

Eigenvalue problems arise in a variety of science and engineering applications. This minisymposium features the latest progress on developing efficient algorithms for solving large-scale linear and nonlinear eigenvalue problems and their applications in several different and important scientific areas. The presenters will discuss a number of important issues such as structure preservation, scalability, convergence acceleration through preconditioning and complexity reduction through domain decomposition etc.

#### Organizer: Zhaojun Bai University of California, Davis, USA

#### Organizer: Chao Yang

Lawrence Berkeley National Laboratory, USA

4:00-4:25 An Indefinite Variant of LOBPCG for Definite Matrix Pencils Meivue Shao, EPFL, Switzerland

#### 4:30-4:55 A Nonlinear QR Algorithm for Unstructurally Banded Nonlinear **Eigenvalue Problems**

Charles K. Garrett, Oak Ridge National Laboratory, USA; Zhaojun Bai, University of California, Davis, USA; Ren-Cang Li, University of Texas at Arlington, USA

#### 5:00-5:25 Preconditioned Locally Minimal Residual Methods for Large-Scale Eigenproblems

Fei Xue, University of Louisiana, Lafayette, USA

#### 5:30-5:55 High-Performance Algorithms for Computing Pseudospectra

Jack Poulson, Georgia Institute of Technology, USA; Greg Henry, Intel Corporation, USA

# Thursday, July 10

# **MS112 Dynamics of Biological** Membranes - Part I of III 4:00 PM-6:00 PM

Room: Wilson - 3rd Floor

#### For Part 2 see MS127

Living cells are complex objects. Common to all cells and the internal organelles are lipid bilayer membranes. The most obvious is the plasma membrane which encloses the cell and the internal organelles. This mini symposium will focus on the dynamics of these complex biological membranes from models that incorporate the salient biological features. Recent work in this area has focused on the dynamics and mechanics of vesicles, blood cells, and more complex compound structures. The presentations will discuss modeling approaches plus numerical and analytical techniques to solve these challenging moving boundary problems in applied flows and/or when there are applied force fields, e.g., electric fields.

**Organizer: Michael Miksis** Northwestern University, USA

#### Organizer: Yuan-Nan Young

New Jersey Institute of Technology, USA

#### 4:00-4:25 Long-Wave Dynamics of An Inextensible Plannar Membrane in An **Electric Field**

Yuan-Nan Young, New Jersey Institute of Technology, USA; Shravan Veerapaneni, University of Michigan, USA; Michael Miksis, Northwestern University, USA

#### 4:30-4:55 Multiscale 3D Simulation of Whole Blood in Complex Geometry

Prosenjit Bagchi, Koohyar Vahidkhah, Peter Balogh, and Daniel Cordasco, Rutgers University, USA

#### 5:00-5:25 Extensional Dynamics of Vesicles: Asymmetric Rayleigh-Plateau, Burst, and Pearling

Eric S. Shaqfeh, Stanford University, USA

#### 5:30-5:55 Simulation of Cellular Blood Flow in Microvessels

Jonathan B. Freund, University of Illinois at Urbana-Champaign, USA



# MS113 Engineering Applications of Mathematics

# 4:00 PM-6:00 PM

#### Room:Salon 1 - 3rd Floor

This session will bring together experts involved in cutting-edge interdisciplinary research on the frontier of Engineering and Mathematics. This minisymposium is intended to serve as a learning forum for both faculty members and students (both graduate and undergraduate) who wish to get involved in interdisciplinary research in the fascinating realm of real-world engineering applications of mathematics. It will hopefully provide them with the necessary impetus to start working on open problems in this very current and necessary area of research.

#### Organizer: Sukanya Basu

Wentworth Institute of Technology, USA

#### 4:00-4:25 Solving Linear Differential Equations and Inverting Matrices: Key Formulas

Gilbert Strang, Massachusetts Institute of Technology, USA

#### 4:30-4:55 Predictor-Based Tracking for Neuromuscular Electrical Stimulation *Michael Malisoff*, Louisiana State

University, USA

#### 5:00-5:25 From Billiard Dynamics to Thermodynamics

Scott Cook, Swarthmore College, USA; Tim Chumley, Iowa State University, USA; Renato Feres, Washington University in St. Louis, USA

#### 5:30-5:55 A Difference Equations Approach to Studying Oscillations in a Suspension Bridge involving a Nonlinear Cable Function

Sukanya Basu, Wentworth Institute of Technology, USA

### Thursday, July 10

# MS114 Boundary Integral Equations and Their Applications -Part II of IV

4:00 PM-6:00 PM

Room:Salon 6 - 3rd Floor

#### For Part 1 see MS100 For Part 3 see MS128

The number of applications in science and engineering that can be modeled computationally is growing with the development of boundary integral equation solution techniques (fast solvers, high-order quadratures, etc.). However, there are still many problems that can benefit from efficient and highly accurate solution techniques. This minisymposium will present recent developments that address open issues and expand on the use of boundary integral equations to model physical phenomena.

#### Organizer: Bryan D. Quaife University of Texas at Austin, USA

Organizer: Min Hyung Cho Dartmouth College, USA

#### Organizer: Adrianna Gillman Dartmouth College, USA

4:00-4:25 Boundary Integral Equation for an Ion Channel in Electrolyte Media *Min Hyung Cho*, Dartmouth College, USA

# 4:30-4:55 Life after Sweeping: Hopping for the Helmholtz Equation

Laurent Demanet, Massachusetts Institute of Technology, USA

#### 5:00-5:25 A Robust Maxwell Solver in Axisymmetric Geometries

Michael O'Neil, Courant Institute of Mathematical Sciences, New York University, USA

#### 5:30-5:55 Scalable Quasi-direct Solvers for 3D Elliptic Problems

Jack Poulson, Georgia Institute of Technology, USA; Austin Benson, Kenneth L. Ho, Yingzhou Li, and Lexing Ying, Stanford University, USA

#### Thursday, July 10

# MS115

# Recent Advances in Interfacial Dynamics and its Applications – Part II of IV

4:00 PM-6:00 PM

Room:Salon 10 - 3rd Floor

#### For Part 1 see MS101 For Part 3 see MS129

Many physical and biological problems involve interfaces separating different domains. Examples include multiphase flow in fluid mechanics, tumor growth, epitaxial thin films, bio-membrane related problems, etc. While modeling, numerical computation and analysis become important and efficient tools for investigating the interface phenomena, characterizing the dynamics of complex interfaces remains a challenging research topic. The aim of this mini-symposium is to bring together scientists in the field to exchange their recent research discoveries and future directions, to stimulate novel ideas, and to nurture collaborations.

Organizer: Xiaofan Li

Illinois Institute of Technology, USA

Organizer: Shuwang Li Illinois Institute of Technology, USA

4:00-4:25 Recent Developments of Grid Based Particle Method

Hongkai Zhao, University of California, Irvine, USA

#### 4:30-4:55 A Hybrid Immersed Boundary and Immersed Interface Method for Two-Phase Electrohydrodynamic Simulations

Ming-Chih Lai, National Chiao Tung University, Taiwan

#### 5:00-5:25 A Treecode-Accelerated Boundary Integral Poisson-Boltzmann Solver for Solvated Proteins

Robert Krasny, University of Michigan, Ann Arbor, USA; Weihua Geng, Southern Methodist University, USA

# 5:30-5:55 Electro-Hydrodynamics of Vesicle Suspensions

Shravan Veerapaneni, University of Michigan, USA

# MS116

# Advances in Kernel Methods for Analysis and Statistics- Part I of III

4:00 PM-5:30 PM

### Room:Salon 5 - 3rd Floor

#### For Part 2 see MS130

Kernel and RBF methods are popular because of their flexible meshfree nature and potential for high degree of accuracy. They have uses in function approximation, boundary value problems, spatial statistics, design of experiments, machine learning and other applications that generate higher dimensional problems. This minisymposium addresses progress in both the numerical and statistical kernel settings, as well as connections between the two. Issues such as efficiency, stability, optimal parameterization and error analysis are discussed, and new techniques are presented. The related session 'Radial basis functions (RBF-FD) for geoscience and combustion modeling' presents kernel method applications.

#### **Organizer: Michael McCourt**

University of Colorado, Denver, USA

#### Organizer: Greg Fasshauer Illinois Institute of Technology, USA

4:00-4:25 Model Selections for

Polynomial Kernel Regressions Xingping Sun, Missouri State University, USA

# 4:30-4:55 Multiscale RBF Interpolation and Collocation

Holger Wendland, University of Bayreuth, Germany

#### 5:00-5:25 Ten Good Reasons for using Kernel Reconstructions in Adaptive Finite Volume Particle Methods

Armin Iske, University of Hamburg, Germany

### Thursday, July 10

# MS117 Mathematics of Information and Low Dimensional Models - Part I of III

4:00 PM-6:00 PM

#### Room:Indiana - 3rd Floor

#### For Part 2 see MS131

This minsymposium considers a variety of ill-posed inverse problems associated with information theory, signal processing, and image processing. By exploiting low dimensional structure, such as in compressed sensing and low rank matrix completion, tractable algorithms permit construction of accurate approximate solutions and low dimensional representations. The minisymposium will include state-of-the-art work on algorithms, theoretical analysis, and relationships with high dimensional geometry from researchers at all stages of their careers.

#### Organizer: Jeffrey D. Blanchard Grinnell College, USA

**Organizer: Deanna Needell** *Claremont McKenna College, USA* 

#### 4:00-4:25 Conjugate Gradient Iterative Hard Thesholding

*Jeffrey D. Blanchard*, Grinnell College, USA; Jared Tanner and Ke Wei, University of Oxford, United Kingdom

#### 4:30-4:55 Modal Analysis with Compressive Measurements

Jae Young Park, University of Michigan, USA; *Michael B. Wakin*, Colorado School of Mines, USA; Anna Gilbert, University of Michigan, USA

#### 5:00-5:25 Frontiers of Atomic Norm Minimization

*Ben Recht*, University of California, Berkeley, USA

#### 5:30-5:55 Denoising Simultaneously Structured Signals

Maryam Fazel, University of Washington, USA; Samet Oymak, California Institute of Technology, USA; Amin Jalali, University of Washington, USA; Babak Hassibi, California Institute of Technology, USA

# Thursday, July 10 MS118 The Universe Geometry 4:00 PM-5:30 PM

Room:Kimball - 3rd Floor

This minisymposium addresses the simulation that has proven the validity of a theory that was proposed 40 years ago for the evolution of the universe. It will shed light on how this topic was approached historically, scientifically and philosophically, and will be followed by a consideration of the latest theories in this field. The major emphasis will be on the mathematical models and the huge computations used for understanding these phenomena.

#### Organizer: Samar A. Aseeri

KAUST Supercomputing Laboratory, Saudi Arabia

# 4:00-4:25 Talk title: Creating a Virtual Universe

Mark Vogelsberger, Massachusetts Institute of Technology, USA

#### 4:30-4:55 Universe Geometry

Samar A. Aseeri, KAUST Supercomputing Laboratory, Saudi Arabia

# 5:00-5:25 Understanding the Universe with Petascale Simulations - the Enzo Cosmology Code

Brian O'Shea, Michigan State University, USA

Thursday

# MS119

# Developments in Optimization Methods and Their Applications in Image Analysis

# 4:00 PM-6:00 PM

#### Room:Logan - 3rd Floor

There has been numerous challenges in solving distinct physical models and inverse problems concerning image acquisition and reconstruction. The aim of this minisymposium is on fast optimization methods and their applications in improving the efficiency and accuracy of image acquisition and reconstruction. The discussion will address mathematical modelling, numerical analysis, optimization algorithms arising in the study of these problems.

#### Organizer: Yuyuan Ouyang University of Florida, USA

#### 4:00-4:25 Accelerated First-Order Method for Convex Composite Optimization and the Applications in Image Analysis

*Yuyuan Ouyang*, Yunmei Chen, and Guanghui Lan, University of Florida, USA; Eduardo Pasiliao Jr., Air Force Research Laboratory, USA

#### 4:30-4:55 Accelerated Bregman Operator Splitting with Variable Stepsizes

Xianqi Li, Yunmei Chen, and Yuyuan Ouyang, University of Florida, USA

#### 5:00-5:25 Irregular Polyomino Tiling via Integer Programming with Application in Phased Array Antenna Design

Serdar Karademir, University of Florida, USA; Oleg A. Prokopyev, University of Pittsburgh, USA

#### 5:30-5:55 Image Reconstruction for Dynamic Cone Beam Computed Tomography

Hao Zhang and Yunmei Chen, University of Florida, USA

Thursday, July 10

# CP23 Computational Fluid Dynamics

4:00 PM-6:00 PM

Room: Madison - 3rd Floor

Chair: Brandon A. Lieberthal, University of Illinois at Urbana-Champaign, USA

#### 4:00-4:15 Continuum Boundary Force Method for Multiscale Modeling of Flows Subject to Slip Boundary Conditions

Wenxiao Pan, Pacific Northwest National Laboratory, USA; Alexandre Tartakovsky, University of South Florida, USA; Nathan Baker, Pacific Northwest National Laboratory, USA

# 4:20-4:35 Numerical Derivation of a D-D- $_{\rm K}$ Relation for An Expanding Detonation Wave in the Mie-Gruneisen Equation of State

*Brandon A. Lieberthal* and D. Scott Stewart, University of Illinois at Urbana-Champaign, USA

### 4:40-4:55 Lagrangian Particle Methods for Global Atmospheric Flow

Peter A. Bosler, University of Michigan, USA

#### 5:00-5:15 Hydrodynamic Calculations Using Reale: An Arbitrary-Lagrangian-Eulerian Framework with Mesh Reconnection

David Starinshak, John Owen, and Douglas Miller, Lawrence Livermore National Laboratory, USA

#### 5:20-5:35 Turbulent Mix in Numerical Simulations for ICF Capsules

Hyunkyung Lim, State University of New York, Stony Brook, USA; Jeremy Melvin and Verinder Rana, Stony Brook University, USA; James Glimm, State University of New York, Stony Brook, USA; Baolian Cheng and David Sharp, Los Alamos National Laboratory, USA

#### 5:40-5:55 A Smoothed Particle Hydrodynamics Model for Electrokinetic Flows

Wenxiao Pan, Pacific Northwest National Laboratory, USA; *Hongxuan Zhang*, Xiaozhe Hu, and Jinchao Xu, Pennsylvania State University, USA Thursday, July 10

# CP24 Life Sciences V

4:00 PM-6:00 PM

Room:Salon 4 - 3rd Floor

Chair: Marc Harper, University of California, Los Angeles, USA

#### 4:00-4:15 Quantifying the Relationships among Natural Selection, Mutation, and Stochastic Drift in Multidimensional Finite Populations

Marc Harper, University of California, Los Angeles, USA

#### 4:20-4:35 Competition Between Oysters and Invasive Mussels in the Presence of Water Releases

Daniel L. Kern, Florida Gulf Coast University, USA

#### 4:40-4:55 Mutational History Dominates Clonal Selection Within Evolving Tumors

*Scott T. Bickel*, Joseph Juliano, and John D. Nagy, Arizona State University, USA

#### 5:00-5:15 Modeling the Progression and Development to Hepatocellular Carcinoma for Hepatitis C Virus Infection

Siddhartha P. Chakrabarty, Indian Institute of Technology Guwahati, India; John Murray, University of New South Wales, Australia

#### 5:20-5:35 A Mixed-Strategy Game Theoretical Approach for Infectious Disease Prevention by Social Distancing

Jing Li, California State University, Northridge, USA; Timothy Reluga, Pennsylvania State University, USA

#### 5:40-5:55 Traveling Wave Fronts in Population and Disease Models with Nonlocal Reaction and Delay

Peter Y. Pang, National University of Singapore, Republic of Singapore

# **CP25**

# Numerical Methods in PDE V

4:00 PM-5:40 PM

Room:Salon 8 - 3rd Floor

Chair: Eric Wolf, Michigan State University, USA

#### 4:00-4:15 A Particle-In-Cell Method Based on An Implicit Wave Solver Eric Wolf, Michigan State University, USA

#### 4:20-4:35 A Q2- iso-Q1/Q2 Immersed Finite Element for Stokes Interface **Problems**

Nabil Chaabane, Slimane Adjerid, and Tao Lin, Virginia Tech, USA

#### 4:40-4:55 Flow Control by Adjoints and Sensitivities

Vani Cheruvu, University of Toledo, USA

#### 5:00-5:15 A Realizability Preserving **Discontinuous Galerkin Method for** the M<sub>1</sub> Model for Radiative Transfter in 2D

Prince Chidyagwai, Loyola University, USA; Martin Frank, RWTH - Aachen University of Technology, Germany; Florian Schneid, Technische Universität Kaiserslautern, Germany; Benjamin Seibold, Temple University, USA

#### 5:20-5:35 Optimal Error Estimates of a Linearized Backward Euler Galerkin Fem for the Landau-Lifshitz Equation Huadong Gao, City University of Hong

Kong, Hong Kong

# SIAM Council Meeting

4:00 PM-10:00 PM Room: Chicago - 5th Floor

# Intermission

6:00 PM-6:15 PM

# Thursday, July 10

# PD **Professional Development Evening -- Writing for** Success: Applying for Jobs

6:15 PM-7:15 PM

#### Room:Red Lacquer - 4th Floor

Chair: Cammey Cole Manning, Meredith College, USA

Join us for an evening devoted to developing a successful career in the mathematical sciences. Several professionals from academia, government, and industry will share their work experiences and give advice on how to develop a career in the mathematical sciences. The target audience for this event includes early career professionals (i.e., less than five years past last degree), postdocs, and students. However, we are also encouraging participation from the senior professional community during the networking session.

#### Hannah Callender

University of Portland, USA

John David Virginia Military Institute, USA

**Paul Hovland** Argonne National Laboratory, USA

**Angela Shiftlet** Wofford College, USA

# **Professional Development Evening -- Networking with** Reception 7:15 PM-8:15 PM

Room:Red Lacquer - 4th Floor

#### **SIAM** Presents Since 2008, SIAM has recorded many Invited Lectures, Prize Lectures, and selected



These are available by visiting SIAM Presents (http://www.siam.org/meetings/ presents.php).

# Thursday, July 10

# PD

# **Professional Development Evening -- Writing for** Success: Applying for Funding

8:15 PM-9:15 PM

Room:Red Lacquer - 4th Floor

Chair: Cammey Cole Manning, Meredith College, USA

Join us for an evening devoted to developing a successful career in the mathematical sciences. Several professionals from academia, government, and industry will share their work experiences and give advice on how to develop a career in the mathematical sciences. The target audience for this event includes early career professionals (i.e., less than five years past last degree), postdocs, and students. However, we are also encouraging participation from the senior professional community during the networking session.

#### Mary Ann Horn

Vanderbilt University, USA and National Science Foundation, USA

Lea Jenkins Clemson University, USA

**Sven Leyffer** Argonne National Laboratory, USA

Virginia Pasour US Army Research Office, USA

Mathematics in Industry Book Series Breakfast Meeting

7:00 AM-8:30 AM Room:Buckingham - 5th Floor

# Diversity Advisory Committee Breakfast Meeting 7:00 AM-8:30 AM

Room: Chicago - 5th Floor

# Registration

8:00 AM-4:30 PM Room:State - 4th Floor

# Compensation Committee Breakfast Meeting

8:00 AM-11:00 AM Room:Prize - 5th Floor

### Friday, July 11

**MS120** 

Recent Advances in Mathematical Epidemiology, Ecology and Population Dynamics - Part I of II

8:30 AM-10:30 AM

Room: Grand Ballroom - 4th Floor

For Part 2 see MS133 Organized by SIAG/LS

This minisymposium aims to bring together young researchers working in different fields of mathematical biology in order to ensure that ideas developed by different researchers can be exchanged rapidly. The field of mathematical biology is spreading to more and more branches of biology, and continuously presenting new challenges in applied mathematics. Using applied mathematical tools and techniques in understanding and finding answers of problems in epidemiology, ecology and immunology has become increasingly important. The main goal of this special session is to provide a platform for discussion on current advances in mathematical methods for problems arising in epidemiology, ecology and population dynamics.

Organizer: Necibe Tuncer University of Tulsa, USA

Organizer: Maia Martcheva University of Florida, USA

8:30-8:55 Modeling Avian Influenza and Implications for Control *Maia Martcheva*, University of Florida, USA

9:00-9:25 Qualitative Assessment of the Role of Climate Change on Malaria Transmission Dynamics

Folashade Agusto, Austin Peay State University, USA

9:30-9:55 Evaluation of Malaria Vaccines as a Control Strategy in a Region with Naturally Acquired Immunity

*Olivia Prosper*, Dartmouth College, USA; Nick Ruktanonchai and Maia Martcheva, University of Florida, USA

10:00-10:25 A Structured Avian Influenza Model with Imperfect Vaccination

Hayriye Gulbudak and Maia Martcheva, University of Florida, USA

# Friday, July 11

# MS121 SIAM-NSF Minisymposium on Modeling Across the Curriculum

8:30 AM-10:30 AM

Room:Red Lacquer - 4th Floor

The second SIAM-NSF Workshop on Modeling across the curriculum (January, 2014) will be described, and an introduction to the report will be presented, together with some more recent progress. The meeting represented a more focused follow up to the 2012 workshop. The primary themes related to developing courses, programs, curricula, materials and training for a stronger emphasis on modeling and applied and computational mathematics in the early grades, middle and high school, and undergraduate programs.

#### Organizer: Peter R. Turner

Clarkson University, USA

8:30-8:55 SIAM-NSF Modeling across the Curriculum initiative and Workshops: Introduction

Peter R. Turner, Clarkson University, USA

9:00-9:25 Modeling in the Early Grades

Rachel Levy, Harvey Mudd College, USA

9:30-9:55 Mathematical Modeling in High School

Katherine Socha, Math for America, USA

10:00-10:25 Undergraduate Modeling Curricula

*Jeff Humpherys*, Brigham Young University, USA

# **MS122**

# Advances in the Analysis and Computation of Fluid Problems- Part I of II

8:30 AM-10:30 AM

Room: Crystal - 3rd Floor

#### For Part 2 see MS135

Computation has become an indispensable tool in the study of fluids. Recent years has seen a proliferation of advanced techniques in this broad field, whether it is a novel numerical scheme, a smart turbulence closure, or a robust meshing technique. This mini-symposium seeks to bring together experts working in diverse but related fields of classical, geophysical, and non-Newtonian fluid dynamics. Participants working in one area can learn about exciting problems from the other related areas. Most importantly, they will be able to adapt techniques that were created in the other areas into their own field.

### Organizer: Qingshan Chen

Clemson University, USA

#### 8:30-8:55 Greenland Ice-sheet Initialization: Optimal Control and Bayesian Calibration Approaches

Michael S. Eldred, John D. Jakeman, Irina Kalashnikova, and *Mauro Perego*, Sandia National Laboratories, USA; Stephen Price, Los Alamos National Laboratory, USA; Andrew Salinger, Sandia National Laboratories, USA; Georg Stadler, University of Texas at Austin, USA

#### 9:00-9:25 Fluid-Structure Interaction Decoupling by Optimization

Paul A. Kuberry and Hyesuk Lee, Clemson University, USA

9:30-9:55 Reduced Order Modeling of the Quasi-Geostrophic Equations *Traian Iliescu*, Virginia Tech, USA

#### 10:00-10:25 Numerical Approximation of Non-Newtonian Fluid - Structure Interaction Problems

*Hyesuk Lee* and Shuhan Xu, Clemson University, USA

# Friday, July 11

# MS123 Discovery from Data III: Decompositions for Big Data Applications

8:30 AM-10:30 AM

Room:Salon 3 - 3rd Floor

#### For Part 2 see MS108

The interplay between mathematical modeling and experimental measurement is at the basis of the "effectiveness of mathematics" in physics [Wigner (1960) Commun. Pure Appl. Math. 13:1–14]. Could this effectiveness be extended to all natural phenomena? In the three sessions of this minisymposium on "Discovery from Data" we will present recent studies illustrating how the mathematical modeling of measured data can give insights into and lead to the discovery, and ultimately also control, of natural phenomena in such diverse areas as cancer genetics, cell biology, and geophysics.

#### Organizer: Orly Alter University of Utah, USA

Organizer: Theodore E. Schomay University of Utah, USA

#### 8:30-8:55 Tensor GSVD for Comparison of Two Column-Matched and Row-Independent Large-Scale Biomedical Datasets

*Theodore E. Schomay*, Preethi Sankaranarayanan, and Orly Alter, University of Utah, USA

#### 9:00-9:25 Optimal Shrinkage of Singular Values

Matan Gavish and David L. Donoho, Stanford University, USA

#### 9:30-9:55 Pattern Discovery and Cancer Gene Identification in Integrated Cancer Genomic Data

Ronglai Shen, Memorial Sloan-Kettering Cancer Center, USA

#### 10:00-10:25 Breaking the Curse of Dimensionality Using Decompositions of Incomplete Tensors

*Nico Vervliet*, Otto Debals, Laurent Sorber, and Lieven De Lathauwer, Katholieke Universiteit Leuven, Belgium

# Friday, July 11

# MS124

# High Order Numerical Methods for System of Partial Differential Equations with application - Part I of II

99

8:30 AM-10:30 AM

Room:Salon 12 - 3rd Floor

#### For Part 2 see MS137

Numerical methods for coupled system of partial differential equations have been attracted a lot of attention. They have made important roles in many real-life applications such as, just to cite a few, optimization process governed by partial differential equations, the filtration of fluids through porous media etc. We propose a minisymposium to present and discuss about recent progress in this important area of research. Special attention will be given to the numerical methods for higher-order convergence on unstructured meshes.

**Organizer: Jaeun Ku** Oklahoma State University, USA

#### Organizer: Abdul Khaliq

Middle Tennessee State University, USA

8:30-8:55 Div First-Order System LL\* for Elliptic Systems

Zhiqiang Cai, Purdue University, USA

#### 9:00-9:25 An Asymptotic Splitting Approximation for Highly Accurate Numerical Solutions of Differential Equations

*Qin Sheng*, Baylor University, USA; Hai-Wei Sun, University of Macau, Macao SAR, China

#### 9:30-9:55 Compact Implicit Integration Factor Method for High Order Differential Equations

*Xingfeng Liu*, University of South Carolina, USA

#### 10:00-10:25 What Kinds of Singularities can we Deduce from the Corner Singularity Theory of the Compressible Viscous Stokes Flows?

Jae Ryong Kweon, Pohang University of Science and Technology, Korea

# MS125 Computational Dynamical Systems Analysis

### 8:30 AM-10:30 AM

Room:Salon 2 - 3rd Floor

#### Organized by SIAG/DS

The purpose of this meeting is to present the latest on bifurcation analysis of ODEs with an emphasis on the use of new features and functionalities in advanced software, recent applications and an outlook to future developments and extensions like PDEs, delay and non-smooth systems.

#### **Organizer: Willy Govaerts** *Ghent University, Belgium*

#### 8:30-8:55 Recent Progress in MatCont Development

*Iourii Kouznetsov*, Utrecht University, The Netherlands

#### 9:00-9:25 (Parallel) Auto and Applications: Past, Present and Future *Bart E. Oldeman*, McGill University, Canada

#### 9:30-9:55 Numerical Analysis of Travelling Waves in Neural Fields *Hil Meijer*, Twente University, Netherlands

#### 10:00-10:25 Analysis of Nonsmooth Systems: Perspectives and Directions

Petri T. Piiroinen, National University of Ireland, Galway, Ireland

### Friday, July 11

# MS126

# Numerical Methods for Eigenvalue Problems - Part III of III

8:30 AM-10:30 AM

### Room:Salon 7 - 3rd Floor

For Part 2 see MS111 Organized by SIAG/ALA

Eigenvalue problems arise in a variety of science and engineering applications. This minisymposium features the latest progress on developing efficient algorithms for solving large-scale linear and nonlinear eigenvalue problems and their applications in several different and important scientific areas. The presenters will discuss a number of important issues such as structure preservation, scalability, convergence acceleration through preconditioning and complexity reduction through domain decomposition etc.

#### **Organizer: Zhaojun Bai** University of California, Davis, USA

Organizer: Chao Yang Lawrence Berkeley National Laboratory, USA

#### 8:30-8:55 Fast Spectral Computations for Quasiperiodic Schroedinger Operators

*Mark Embree*, Virginia Tech, USA; Charles Puelz, Rice University, USA

#### 9:00-9:25 Structured Eigensolvers for the Analysis of Symmetry-Breaking in Next Generation Gyroscopes

*David Bindel* and Erdal Yilmaz, Cornell University, USA

#### 9:30-9:55 A Locally Accelerated Block Preconditioned Steepest Descent Method for III-conditioned Generalized Hermitian Eigenvalue Problems

*Zhaojun Bai*, University of California, Davis, USA; Yunfeng Cai, Peking University, China; John Pask, Lawrence Livermore National Laboratory, USA; N. Sukumar, University of California, Davis, USA

# 10:00-10:25 Eigenvalue Problems in Electron Excitation

*Chao Yang*, Lawrence Berkeley National Laboratory, USA; Fang Liu, Central University of Finance and Economics, China; Lin Lin and Alexander Kemper, Lawrence Berkeley National Laboratory, USA

### Friday, July 11

# MS127 Dynamics of Biological Membranes- Part II of III

8:30 AM-10:30 AM

Room:Wilson - 3rd Floor

#### For Part 1 see MS112 For Part 3 see MS140

Living cells are complex objects. Common to all cells and the internal organelles are lipid bilayer membranes. The most obvious is the plasma membrane which encloses the cell and the internal organelles. This mini symposium will focus on the dynamics of these complex biological membranes from models that incorporate the salient biological features. Recent work in this area has focused on the dynamics and mechanics of vesicles, blood cells, and more complex compound structures. The presentations will discuss modeling approaches plus numerical and analytical techniques to solve these challenging moving boundary problems in applied flows and/ or when there are applied force fields, e.g., electric fields.

#### Organizer: Yuan-Nan Young

New Jersey Institute of Technology, USA

#### Organizer: Michael Miksis Northwestern University, USA

#### 8:30-8:55 Rheology of Sickle Cell Anemia: Effects of Heterogeneous RBC Shapes

*Xuejin Li*, Brown University, USA; Huan Lei, Pacific Northwest National Laboratory, USA; E Du and Ming Dao, Massachusetts Institute of Technology, USA; George E. Karniadakis, Brown University, USA

#### 9:00-9:25 A Hybrid Numerical Method for Electro-Kinetic Flow with Deformable Membranes

Michael Siegel, New Jersey Institute of Technology, USA

#### 9:30-9:55 Lipid Bilayer and Cytoskeletal Interactions in a Red Blood Cell

Zhangli Peng, Massachusetts Institute of Technology, USA

#### 10:00-10:25 Three-Dimensional Vesicle Electrohydrodynamics: A Level Set Method

*David Salac*, State University of New York at Buffalo, USA; Mohammad Kolahdouz, University of Buffalo, SUNY, USA

# MS128 Boundary Integral Equations and Their

# Applications -Part III of IV

8:30 AM-10:30 AM

Room:Salon 6 - 3rd Floor

#### For Part 2 see MS114 For Part 4 see MS142

The number of applications in science and engineering that can be modeled computationally is growing with the development of boundary integral equation solution techniques (fast solvers, high-order quadratures, etc.). However, there are still many problems that can benefit from efficient and highly accurate solution techniques. This minisymposium will present recent developments that address open issues and expand on the use of boundary integral equations to model physical phenomena.

Organizer: Bryan D. Quaife University of Texas at Austin, USA

Organizer: Min Hyung Cho Dartmouth College, USA

**Organizer: Adrianna Gillman** *Dartmouth College, USA* 

8:30-8:55 Integral Equation Techniques for Solving Elliptic Problems with Mixed Boundary Conditions

Adrianna Gillman, Dartmouth College, USA

9:00-9:25 Practical and Efficient Direct Solvers for BIEs

Gunnar Martinsson, University of Colorado Boulder, USA

# 9:30-9:55 Integral Equations on Domains with Edges

James Bremer, University of California, Davis, USA

#### 10:00-10:25 Updating Techniques for Hierarchical Factorizations *Victor Minden*, Stanford University, USA

Friday, July 11

# MS129

# Recent Advances in Interfacial Dynamics and its Applications – Part III of IV

8:30 AM-10:30 AM

Room:Salon 10 - 3rd Floor

#### For Part 2 see MS115 For Part 4 see MS143

Many physical and biological problems involve interfaces separating different domains. Examples include multiphase flow in fluid mechanics, tumor growth, epitaxial thin films, bio-membrane related problems, etc. While modeling, numerical computation and analysis become important and efficient tools for investigating the interface phenomena, characterizing the dynamics of complex interfaces remains a challenging research topic. The aim of this mini-symposium is to bring together scientists in the field to exchange their recent research discoveries and future directions, to stimulate novel ideas, and to nurture collaborations.

Organizer: Xiaofan Li Illinois Institute of Technology, USA

#### Organizer: Shuwang Li

Illinois Institute of Technology, USA

8:30-8:55 Diffusion-Limited Growth and Decay of 2D Epitaxial Nanoclusters: Atomistic and Coarse-Grained Modeling

Jim W. Evans and Yong Han, Iowa State University, USA

9:00-9:25 Continuum Framework for Dislocation Structure, Energy and Dynamics of Dislocation Arrays and Low Angle Grain Boundaries

*Yang Xiang*, Hong Kong University of Science and Technology, Hong Kong; Xiaohong Zhu, Jinan University, China

#### 9:30-9:55 Stable and Convergent Numerical Schemes for Phase Field Crystal Models

Steven M. Wise, University of Tennessee, USA

#### 10:00-10:25 Efficient Numerical Methods for Molecular Beam Epitaxial Growth Zhonghua Qiao, Hong Kong Polytechnic University, China

Friday, July 11

# **MS130**

# Advances in Kernel Methods for Analysis and Statistics-Part II of III

8:30 AM-10:30 AM

Room:Salon 5 - 3rd Floor For Part 1 see MS116

# For Part 3 see MS144

Kernel and RBF methods are popular because of their flexible meshfree nature and potential for high degree of accuracy. They have uses in function approximation, boundary value problems, spatial statistics, design of experiments, machine learning and other applications that generate higher dimensional problems. This minisymposium addresses progress in both the numerical and statistical kernel settings, as well as connections between the two. Issues such as efficiency, stability, optimal parameterization and error analysis are discussed, and new techniques are presented. The related session 'Radial basis functions (RBF-FD) for geoscience and combustion modeling' presents kernel method applications.

#### **Organizer: Michael McCourt**

University of Colorado, Denver, USA

**Organizer: Greg Fasshauer** *Illinois Institute of Technology, USA* 

8:30-8:55 Recurrence Operators for Zonal Basis Functions on the Sphere

Wolfgang zu Castell, Helmholtz Zentrum München, Germany

#### 9:00-9:25 Matrix-Valued Kernels Associated to Vector-Valued Random Fields with Correlated Components Emilia Research University E. Santa Maria

*Emilio Porcu*, University F. Santa Maria, Chile

#### 9:30-9:55 Improved Exponential Convergence Rates for Regularized Approximation by Oversampling Near the Boundary

Barbara Zwicknagl, University of Bonn, Germany

#### 10:00-10:25 An Adaptive RBF-WENO Method for Hyperbolic Problems

Jae-Hun Jung, State University of New York at Buffalo, USA

# MS131 Mathematics of Information and Low Dimensional Models- Part II of III

8:30 AM-10:30 AM

Room:Indiana - 3rd Floor

#### For Part 1 see MS117 For Part 3 see MS145

This minsymposium considers a variety of ill-posed inverse problems associated with information theory, signal processing, and image processing. By exploiting low dimensional structure, such as in compressed sensing and low rank matrix completion, tractable algorithms permit construction of accurate approximate solutions and low dimensional representations. The minisymposium will include state-of-the-art work on algorithms, theoretical analysis, and relationships with high dimensional geometry from researchers at all stages of their careers.

**Organizer: Jeffrey D. Blanchard** *Grinnell College, USA* 

Organizer: Deanna Needell Claremont McKenna College, USA

#### 8:30-8:55 Adaptively Sensing in Compressive Sensing Applications

Deanna Needell, Claremont McKenna College, USA

#### 9:00-9:25 Intrinsic Volumes of Convex Cones: Theory and Applications

Martin Lotz, University of Manchester, United Kingdom

### 9:30-9:55 The Achievable

**Performance of Demixing** *Michael B. McCoy* and Joel A. Tropp, California Institute of Technology, USA

#### 10:00-10:25 Tracking a Low-Dimensional Vector Via Quantized Measurements Or Pairwise Comparisons

Mark Davenport, Georgia Institute of Technology, USA

Friday, July 11

# MS132

# Mori-Zwanzig Formulation and Applications -Part I of II

8:30 AM-10:30 AM

Room:Kimball - 3rd Floor

#### For Part 2 see MS146

The Mori-Zwanzig formalism (Mori 1965 and Zwanzig 1973) allows reducing the number of variables in large systems of coupled equations. For differential equations, the reduced equations model the effect of the unresolved variables, leading to a Markovian, memory and fluctuating term. This formalism can be a starting point for multiscale and meso-scale modeling, based on first principles calculations. We will investigate recent mathematical developments as well as applications to materials, soft matter, and bio-molecules.

#### Organizer: Eric F. Darve Stanford University, USA

Organizer: Panos Stinis University of Minnesota, USA

#### 8:30-8:55 Stochastic Modeling Through the Mori-Zwanzig Formalism

Alexander J. Chorin, University of California, Berkeley, USA; *Kevin K. Lin*, University of Arizona, USA

#### 9:00-9:25 MZ-PDF Methods for Stochastic Analysis in Nonlinear Dynamical Systems

Daniele Venturi, Brown University, USA

#### 9:30-9:55 Building Meso-Scale Stochastic Models Using the Mori-Zwanzig Formalism

Hee Sun Lee and Surl-Hee Ahn, Stanford University, USA

#### 10:00-10:25 The Reduction of Molecular Dynamics Models Using Mori-Zwanzig Projection Formalism

Xiantao Li, Pennsylvania State University, USA

Friday, July 11

# CP26 Real and Complex Analysis

8:30 AM-10:10 AM

Room:Logan - 3rd Floor

Chair: Martha Razo, Illinois Institute of Technology, USA

#### 8:30-8:45 Generalization of Pade Approximation from Rational Functions to Arbitrary Analytic Functions - Theory

*Evren Yarman*, WesternGeco-Schlumberger, United Kingdom; Garret Flagg, Schlumberger-Doll Research, USA

#### 8:50-9:05 Generalization of Pade Approximation from Rational Functions to Arbitrary Analytic Functions -Applications

Evren Yarman, WesternGeco-Schlumberger, United Kingdom; *Garret Flagg*, Schlumberger-Doll Research, USA

#### 9:10-9:25 Unexpected Fooling

Functions

Martha Razo, Illinois Institute of Technology, USA

#### 9:30-9:45 Juxtaposition of Evaporation, Gravity and Darcian Resistance in Seepage Through a Silt Block Adjacent to a Coarse Sand Compartment: Solutions Based on Theory of Holomorphic Functions and Computer Algebra

Anvar Kacimov, Sultan Qaboos University, Oman; Yurii Obnosov, Kazan State University, Russia; Dani Or, Eidgenössische Technische Hochschule Zürich, Switzerland

#### 9:50-10:05 Analysis of a Singular Integral Equation Modeling Waves Propagating in a Fusion Plasma

*Lise-Marie Imbert-Gérard*, Courant Institute of Mathematical Sciences, New York University, USA; Bruno Després, UPMC, France; Ricardo Weder, Universidad Nacional Autónoma de México, Mexico

# **CP27**

# Geosciences

#### 8:30 AM-10:30 AM

Room:Madison - 3rd Floor

Chair: Ivan A. Sudakov, University of Utah, USA

#### 8:30-8:45 Modeling of Arctic Melt Ponds and Sea-Ice Albedo-Feedback

*Ivan A. Sudakov*, University of Utah, USA; Sergey Vakulenko, Russian Academy of Sciences, Russia

#### 8:50-9:05 A Higher-Order Robert-Asselin Type Time Filter

*Yong Li* and Catalin S. Trenchea, University of Pittsburgh, USA

#### 9:10-9:25 Rate-Limited Sorption in Production Transport Codes

David L. Coulliette and Kenneth Rietz, Asbury College, USA; Edward Heyse, Parsons Corporation, USA

#### 9:30-9:45 Coupled Multi-Physics Analysis of Caprock Integrity and Joint Reactivation During Co<sub>2</sub> Sequestration

Pania Newell, Mario, J. Martinez, and JOSEPH, E. Bishop, Sandia National Laboratories, USA

# 9:50-10:05 Iterative Algorithms for Geosounding Inversion

Hugo Hidalgo and Enrique Gomez-Trevino, CICESE, Mexico

# 10:10-10:25 Fingering Instability in the Presence of Visco-elasticity

Prabir Daripa, Texas A&M University, USA Friday, July 11

# CP28

# Computer Science and Applications

8:30 AM-10:50 AM

Room:Salon 4 - 3rd Floor

Chair: Martin A. Dillon, Illinois Institute of Technology, USA

#### 8:30-8:45 Tractability of Function Approximation Problems with General Kernels

*Xuan Zhou* and Fred J. Hickernell, Illinois Institute of Technology, USA

#### 8:50-9:05 Interpolation Using the Min Kernel

Martin A. Dillon, Illinois Institute of Technology, USA

#### 9:10-9:25 Multi-Echelon Supply Chain Inventory Optimization: An Industrial Perspective

Anshul Agarwal and John Wassick, The Dow Chemical Company, USA

#### 9:30-9:45 Computing Spectra of Laplace Beltrami Operator Using Cylindrical Radial Basis Functions

*Emmanuel O. Asante-Asamani*, Zeyun Yu, and Lei Wang, University of Wisconsin, Milwaukee, USA

#### 9:50-10:05 Sub-Linear Sparse Fourier Algorithm for High Dimensional Data

*Bosu Choi*, Andrew J. Christlieb, and Yang Wang, Michigan State University, USA

#### 10:10-10:25 Single Machine Scheduling Problem with Interval Processing Times

Ali Allahverdi, Kuwait University, Kuwait; Harun Aydilek and Asiye Aydilek, Gulf University for Science and Technology, Kuwait

# 10:30-10:45 On the Entringer and Slater Problem

Chunhui Lai, Minnan Normal University, China Friday, July 11

# **CP29**

# Numerical Methods in PDE VI

8:30 AM-10:30 AM

Room:Salon 8 - 3rd Floor

Chair: Jason F. Hammond, Air Force Research Laboratory, USA

#### 8:30-8:45 Solutions of Boltzmann Equation for Simulation of Particle Distributions in Plasmas

Jason F. Hammond, Air Force Research Laboratory, USA

#### 8:50-9:05 Are Spectrally-Accurate Radial Basis Functions Obsolete? Gaussian-Mollified Polynomial Interpolation

John P. Boyd, University of Michigan, Ann Arbor, USA

#### 9:10-9:25 A New Optimal Error Analysis of Characteristics-Mixed Fems for Miscible Displacement in Porous Media

Jilu Wang, City University of Hong Kong, Hong Kong; Zhiyong Si, Henan Polytechnic University, China; Weiwei Sun, City University of Hong Kong, Hong Kong

#### 9:30-9:45 Coupled Orbital And Thermal Evolution of Major Uranian Satellites

Attique Ur Rehman, University of Auckland, New Zealand

#### 9:50-10:05 Investigation and Numerical Solution of Initial-Boundary Value Problem to One Nonlinear Parabolic Equation

Mikheil Tutberidze, Ilia State University, Georgia

#### 10:10-10:25 An Adaptive Mesh Strategy for Convection Diffusion Problems

*Vivek K. Aggarwal*, Delhi Technological University, India; Balaji Srinivasan, Indian Institute of Technology, Delhi, India

# **Coffee Break**

10:30 AM-11:00 AM Room:Exhibit Hall



# Systems Oversight Committee Meeting

11:00 AM-12:00 PM

Room: Buckingham - 5th Floor

103

# IC7 The Statistics Behind the Discovery of the Higgs Boson

# 11:00 AM-11:45 AM

Room: Grand Ballroom - 4th Floor

Chair: Esmond G. Ng, Lawrence Berkeley National Laboratory, USA

The standard model of particle physics is a wildly successful theory of fundamental particles and their interactions. The Higgs boson is a particle that was predicted nearly 50 years ago to address a serious theoretical consistency issue in the Standard Model of particle physics, but it has never been observed. The Large Hadron Collider is a multi-national, multi-billion dollar experiment to search for the Higgs boson and other new phenomena. I will discuss the statistical aspects of the recent discovery of the Higgs boson, including the collaborative statistical modeling of the data and the statistical procedures we employ. With multi-petabyte datasets and complex statistical models, we are arguably pushing a frontier of statistical analysis and quickly outstripping our most advanced tools.

#### Kyle Cranmer

New York University, USA

#### Friday, July 11

# IC8 Random Braids

11:00 AM-11:45 AM

Room:Red Lacquer - 4th Floor

Chair: Shi Jin, Shanghai Jiao Tong University, China and the University of Wisconsin-Madison, USA

Braids are mathematical objects closely related to knots. They consist of a set of strings embedded in three dimensions, anchored at both ends. Plotted in a spacetime diagram, trajectories of two-dimensional systems naturally form braids. When the trajectories correspond to periodic orbits they form closed braids, and there are powerful mathematical techniques available to analyze the dynamics. If the trajectories are chaotic, then the analysis is not so simple. I will describe the types of braids that arise when dealing with chaotic orbits, and discuss their connection to surface dynamics. I will also discuss applications to sparse trajectory datasets.

Jean-Luc Thiffeault University of Wisconsin, Madison, USA

# Friday, July 11

# IP8

# Evolutionary or Revolutionary? Applied Mathematics for Exascale Computing

### 11:50 AM-12:35 PM

Room: Grand Ballroom - 4th Floor

Chair: Esmond G. Ng, Lawrence Berkeley National Laboratory, USA

The move to exascale computing is expected to be disruptive due to significant changes in computer architectures. Advances in applied mathematics will be necessary to realize the full potential of these supercomputers, but will these advances be incremental changes to existing methods or will exascale computing require a substantial rethinking of how we compute? To answer this question, the DOE Advanced Scientific Computing Research Program chartered a working group, which Dr. Hittinger co-chaired. In this talk, he will discuss the findings of the working group: the opportunities for new applied mathematics research that will enable exascale computing. This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-645318.

#### Jeffrey A. Hittinger

Lawrence Livermore National Laboratory, USA

#### FMC/SOC Lunch Meeting

12:00 PM-1:00 PM Room:Price - 5th Floor

#### Lunch Break

12:35 PM-2:00 PM

Attendees on their own

# Financial Management Committee Meeting

1:00 PM-4:00 PM Room:Buckingham - 5th Floor

# IP9

# Physics-based Animation Sound: Progress and Challenges

### 2:00 PM-2:45 PM

Room: Grand Ballroom - 4th Floor

#### Chair: Margot Gerritsen, Stanford University, USA

Decades of advances in computer graphics have made it possible to convincingly animate a wide range of physical phenomena, such as fracturing solids and splashing water. Unfortunately, our visual simulations are essentially "silent movies" with sound added as an afterthought. In this talk, I will describe recent progress on physics-based sound synthesis algorithms that can help simulate rich multi-sensory experiences where graphics, motion, and sound are synchronized and highly engaging. I will describe work on specific sound phenomena, and highlight the important roles played by precomputation techniques, and reduced-order models for vibration, radiation, and collision processing.

Doug L. James Cornell University, USA

### Intermission 2:45 PM-3:00 PM

### Friday, July 11

# SP6

# Theodore Von Karman Prize Lecture: Materials from Mathematics

3:00 PM-3:30 PM

Room:Grand Ballroom - 4th Floor

Chair: Irene Fonseca, Carnegie Mellon University, USA

We present examples of new materials whose synthesis was guided by some essentially mathematical ideas from pde and the calculus of variations. These materials undergo phase transformations from one crystal structure to another, without diffusion. The underlying mathematical theory was designed to identify alloys that show exceptional reversibility of the transformation. The new alloys do show unprecedented reversibility, but raise fundamental new questions for theory. Some of these alloys convert heat to electricity (without a separate electrical generator), and provide an interesting possible route to recover the vast amounts of energy stored on earth at small temperature difference. The lecture will be mathematically/experimentally nontechnical and suitable for a broad audience. (http://www.aem.umn.edu/~james/research/

#### **Richard James**

University of Minnesota, USA

# Coffee Break

Room: Exhibit Hall

3:30 PM-4:00 PM



# Friday, July 11

# MS133

Recent Advances in Mathematical Epidemiology, Ecology and Population Dynamics -Part II of II

4:00 PM-6:00 PM

Room:Grand Ballroom - 4th Floor For Part 1 see MS120

Organized by SIAG/LS

This minisymposium aims to bring together young researchers working in different fields of mathematical biology in order to ensure that ideas developed by different researchers can be exchanged rapidly. The field of mathematical biology is spreading to more and more branches of biology, and continuously presenting new challenges in applied mathematics. Using applied mathematical tools and techniques in understanding and finding answers of problems in epidemiology, ecology and immunology has become increasingly important. The main goal of this special session is to provide a platform for discussion on current advances in mathematical methods for problems arising in epidemiology, ecology and population dynamics.

### Organizer: Necibe Tuncer

University of Tulsa, USA

Organizer: Maia Martcheva University of Florida, USA

4:00-4:25 Dyanamics of Low and High Pathogenic Avian Influenza in Wild and Domestic Bird Populations

*Necibe Tuncer*, University of Tulsa, USA; Maia Martcheva and Juan Torres, University of Florida, USA

#### 4:30-4:55 Model of Spontaneous HIV Infection Control Following Cessation of Antiretroviral Therapy

Jessica M. Conway and Alan S. Perelson, Los Alamos National Laboratory, USA

5:00-5:25 Modeling the Spread of Bacterial Infections in a Hospital with Environmental Contamination

Cameron Browne, Vanderbilt University, USA

5:30-5:55 A Predator-prey-disease Model with Immune Response in Infected-prey

Souvik Bhattacharya, University of Trento, Italy

# MS134 Computational Methods for Inverse Problems in Imaging

# 4:00 PM-6:00 PM

Room:Red Lacquer - 4th Floor

#### Organized by SIAG/ALA

Computing solutions to inverse problems is a notoriously difficult problem, especially in imaging where the problems are very large. This minisymposium will focus on recent advances in numerical and computational methods for solving inverse problems in various imaging applications such as image deconvolution and radar imaging. Numerical linear algebra, optimization, machine learning, and statistics continue to play an ever-present role in the development of these methods.

#### Organizer: Julianne Chung Virginia Tech, USA

#### 4:00-4:25 Improved Image Reconstruction by Statistically Estimating Near-Optimal Parameters for Spectral Filters

Victoria Taroudaki, University of Maryland, USA; Dianne P. O'Leary, University of Maryland, College Park, USA

#### 4:30-4:55 Optimal Filters for General-Form Tikhonov Regularization

*Julianne Chung,* Virginia Tech, USA; Malena I. Espanol, University of Akron, USA

#### 5:00-5:25 Inverting for Maritime Environments Using Empirical Eigenfunction Bases from Radar Imagery

Vasileios Fountoulakis and *Christopher J. Earls*, Cornell University, USA

#### 5:30-5:55 Reproducible Kernel Hilbert Space Modeling and Computing in Imaging

Weihong Guo, Case Western Reserve University, USA; Liangjian Deng and Si Wang, University of Electronic Science and Technology of China, China

### Friday, July 11

# MS135

# Advances in the Analysis and Computation of Fluid Problems- Part II of II

4:00 PM-6:00 PM

Room: Crystal - 3rd Floor

#### For Part 1 see MS122

Computation has become an indispensable tool in the study of fluids. Recent years has seen a proliferation of advanced techniques in this broad field, whether it is a novel numerical scheme, a smart turbulence closure, or a robust meshing technique. This mini-symposium seeks to bring together experts working in diverse but related fields of classical, geophysical, and non-Newtonian fluid dynamics. Participants working in one area can learn about exciting problems from the other related areas. Most importantly, they will be able to adapt techniques that were created in the other areas into their own field.

#### Organizer: Qingshan Chen Clemson University, USA

4:00-4:25 Finite Volume Approximation of the Inviscid Primitive Equations in a Complex Domain

Gung-Min Gie, Indiana University, USA

4:30-4:55 POD Reduced-order Models of Complex Fluid Flows Zhu Wang, University of Minnesota, USA

#### 5:00-5:25 Approximation of the Singularly Perturbed Equations of Parabolic Type in a Circular Domain YoungJoon Hong, Indiana University, USA

5:30-5:55 Considerations in the Design of Numerical Schemes for Geophysical Flows

Qingshan Chen, Clemson University, USA

# Friday, July 11

# MS136 Experimental Nonlinear Dynamics - Part II of II

4:00 PM-6:00 PM

Room:Salon 3 - 3rd Floor For Part 1 see MS36

Organized by SIAG/DS

This minisymposium brings together reports on experimental investigations.

#### Organizer: Eberhard Bodenschatz

Max-Planck-Institute for Dynamics and Self-Organization, Germany

4:00-4:25 Micro-robotic and Biological Studies of Insect-scale Flapping Wing Aerodynamics

Nick Gravish, Harvard University, USA

#### 4:30-4:55 To Be Announced

*Eberhard Bodenschatz*, Max-Planck-Institute for Dynamics and Self-Organization, Germany

#### 5:00-5:25 Propagating Waves Structure Spatiotemporal Activity in Visual Cortex of the Awake Monkey

*Lyle Muller*, Unité de Neurosciences, Information et Complexité (UNIC), CNRS

Gif-sur-Yvette Gif-sur-Yvette de la Timone, CNRS & Aix-Marseille Université, Marseille, France; Alain Destexhe, Unité de Neurosciences, Information et Complexité (UNIC), CNRS Gif-sur-Yvette

#### 5:30-5:55 Distribution of Directional Change as a Signature for Biophysical Dynamics

Stas Burov, University of Chicago, USA

Fridau

# **MS137**

# **High Order Numerical** Methods for System of **Partial Differential Equations** with application - Part II of II

### 4:00 PM-6:00 PM

Room:Salon 12 - 3rd Floor

#### For Part 1 see MS124

Numerical methods for coupled system of partial differential equations have been attracted a lot of attention. They have made important roles in many real-life applications such as, just to cite a few, optimization process governed by partial differential equations, the filtration of fluids through porous media etc. We propose a minisymposium to present and discuss about recent progress in this important area of research. Special attention will be given to the numerical methods for higher-order convergence on unstructured meshes.

Organizer: Jaeun Ku Oklahoma State University, USA

#### Organizer: Abdul Khalig

#### Middle Tennessee State University, USA 4:00-4:25 Application of the Laplace Transform Method to Solving Evolution **Problems**

Dongwoo Sheen, Seoul National University, Korea

#### 4:30-4:55 A New Family of **Discontinuous Galerkin Methods** for Linear and Nonlinear Partial **Differential Equations**

Michael J. Neilan, University of Pittsburgh, USA

#### 5:00-5:25 Local Discontinuous Galerkin Method with a Fourth Order Exponential Time Differencina Scheme for System of Nonlinear **Schrodinger Equations**

Xiao Liang, Middle Tennessee State University, USA

#### 5:30-5:55 A Novel Higher Order ETD Scheme for System of Coupled Semilinear PDEs

Harish Bhatt, Middle Tennessee State University, USA

Friday, July 11

# **MS138 Educational Innovations in** CSE

### 4:00 PM-6:00 PM

#### Room:Salon 2 - 3rd Floor

Computational science and engineering education is being transformed through a range of novel approaches. This minisymposium will comprise reports on some of these innovations, from MOOCs to workforce development to new topics for the undergraduate classroom.

Organizer: Angela B. Shiflet Wofford College, USA

**Organizer: Hong Liu** Embry-Riddle Aeronautical University, USA

# 4:00-4:25 Undergraduate Exploration of

**Agent-Based Modeling** Angela B. Shiflet and George W. Shiflet, Wofford College, USA

#### 4:30-4:55 The Ingenious Project and **Other Initiatives**

Peter R. Turner, Clarkson University, USA

#### 5:00-5:25 Uncover Deep Learning: Assess Online Learners' Cognitive Presence in Mooc

Ye Chin, Syracuse University, USA

#### 5:30-5:55 Coalition for Undergraduate **Computational Science & Engineering** Education - Proof of Concept Hong Liu, Embry-Riddle Aeronautical

University, USA

# Friday, July 11

# **MS139 Opportunities in Applied** Mathematics Research for **Exascale** Computing

4:00 PM-6:00 PM

Room:Salon 7 - 3rd Floor Organized by SIAG/CSE

The move to exascale computing is expected to be disruptive due to significant changes in computer architectures, and advances in applied mathematics will be necessary to realize the full potential of these supercomputers. Expounding on the topics addressed in the overview plenary talk on the DOE ASCR Exascale Mathematics Working Group report, members of the working group will present more detailed discussions of the challenges and research opportunities in several areas of computational mathematics including uncertainty quantification, mathematical model formulation and discretization, numerical solvers, and resilient algorithms.

#### Organizer: Jeffrey A. Hittinger

Lawrence Livermore National Laboratory, USA

Oraanizer: Karen I. Pao

Organizer: Jack J. Dongarra

University of Tennessee, Knoxville, USA

#### 4:00-4:25 Hierarchical Multilevel Methods for Exascale Uncertainty Quantification and Optimization

Clayton G. Webster, Oak Ridge National Laboratory, USA; Stefan Wild, Argonne National Laboratory, USA

#### 4:30-4:55 Mathematical Modeling and **Discretization for Exascale Simulation**

Luis Chacon, Los Alamos National Laboratory, USA

#### 5:00-5:25 Discrete Solvers at the Frascale

Esmond G. Ng, Lawrence Berkeley National Laboratory, USA

5:30-5:55 Resilient Algorithms and **Computing Models** 

Michael A. Heroux, Sandia National Laboratories, USA

U.S. Department of Energy, USA

# MS140 Dynamics of Biological Membranes- Part III of III

4:00 PM-6:00 PM

Room: Wilson - 3rd Floor

#### For Part 2 see MS127

Living cells are complex objects. Common to all cells and the internal organelles are lipid bilayer membranes. The most obvious is the plasma membrane which encloses the cell and the internal organelles. This mini symposium will focus on the dynamics of these complex biological membranes from models that incorporate the salient biological features. Recent work in this area has focused on the dynamics and mechanics of vesicles, blood cells, and more complex compound structures. The presentations will discuss modeling approaches plus numerical and analytical techniques to solve these challenging moving boundary problems in applied flows and/or when there are applied force fields, e.g., electric fields.

#### **Organizer: Yuan-Nan Young** *New Jersey Institute of Technology, USA*

#### **Organizer: Michael Miksis**

Northwestern University, USA

# 4:00-4:25 Deformation and Stability of Vesicles in Dc Electric Pulses

*Paul Salipante*, National Institute of Standards and Technology, USA; Petia Vlahovska, Brown University, USA

#### 4:30-4:55 The Behavior of a Quasi-Circular Vesicle During Drying Processes

Maurice J. Blount, Cardiff University, United Kingdom; Stephen H. Davis and Michael J. Miksis, Northwestern University, USA

#### 5:00-5:25 Field Theoretic Approaches for Non-Spontaneous Deformation of Bilayers under Surface Director Energies

*Rolf Ryham*, Fordham University, USA; Fredric Cohen, Rush University, USA; Bob Eisenberg, Rush University Medical Center, USA

#### 5:30-5:55 Electrohydrodynamics of Lipid Bilayer Vesicles in AC and DC Fields

Lane McConnell, University of New Mexico, USA

# Friday, July 11

# MS142

# Boundary Integral Equations and Their Applications -Part IV of IV

4:00 PM-6:00 PM

Room:Salon 6 - 3rd Floor

#### For Part 3 see MS128

The number of applications in science and engineering that can be modeled computationally is growing with the development of boundary integral equation solution techniques (fast solvers, high-order quadratures, etc.). However, there are still many problems that can benefit from efficient and highly accurate solution techniques. This minisymposium will present recent developments that address open issues and expand on the use of boundary integral equations to model physical phenomena.

### Organizer: Bryan D. Quaife

University of Texas at Austin, USA

Organizer: Min Hyung Cho Dartmouth College, USA

#### Organizer: Adrianna Gillman Dartmouth College, USA

4:00-4:25 Fast Algorithms for the Evaluation of Layer Potentials using 'Quadrature by Expansion' Andreas Kloeckner, University of Illinois at

Urbana-Champaign, USA

#### 4:30-4:55 Subspace Iteration Randomization and Low-rank Approximation

Ming Gu, University of California, Berkeley, USA

#### 5:00-5:25 Stability and Accuracy of Structured Direct Solvers

Jianlin Xia and Yuanzhe Xi, Purdue University, USA

#### 5:30-5:55 Fast Iterative Methods for The Variable Diffusion Coefficient Equation in a Disk

Aditi Ghosh, JoungDong Kim, and Prabir Daripa, Texas A&M University, USA

# Friday, July 11

# MS143 Recent Advances in Interfacial Dynamics and its Applications – Part IV of IV

4:00 PM-6:00 PM

Room:Salon 10 - 3rd Floor

#### For Part 3 see MS129

Many physical and biological problems involve interfaces separating different domains. Examples include multiphase flow in fluid mechanics, tumor growth, epitaxial thin films, bio-membrane related problems, etc. While modeling, numerical computation and analysis become important and efficient tools for investigating the interface phenomena, characterizing the dynamics of complex interfaces remains a challenging research topic. The aim of this mini-symposium is to bring together scientists in the field to exchange their recent research discoveries and future directions, to stimulate novel ideas, and to nurture collaborations.

Organizer: Xiaofan Li

Illinois Institute of Technology, USA

Organizer: Shuwang Li Illinois Institute of Technology, USA

#### 4:00-4:25 Fictitious Domain Method with a Hybrid Cell Model for Simulating Motion of Cells in Fluid Flow *Wenrui Hao*, The Ohio State University, USA

*Wenrui Hao*, The Onio State University, USA

#### 4:30-4:55 Solving Interface Problems to High-order on a Regular Cartesian Grid

Jean-Christophe Nave, McGill University, Canada

#### 5:00-5:25 Modeling and Computation of a Precipitate in Inhomogeneous Elastic Media

Shuwang Li, Illinois Institute of Technology, USA

#### 5:30-5:55 A Boundary Integral Method for Particles Moving in Viscoelastic Fluids

Xiaofan Li, Illinois Institute of Technology, USA
### Friday, July 11

# **MS144**

### Advances in Kernel Methods for Analysis and Statistics- Part III of III

4:00 PM-6:00 PM

Room:Salon 5 - 3rd Floor

### For Part 2 see MS130

Kernel and RBF methods are popular because of their flexible meshfree nature and potential for high degree of accuracy. They have uses in function approximation, boundary value problems, spatial statistics, design of experiments, machine learning and other applications that generate higher dimensional problems. This minisymposium addresses progress in both the numerical and statistical kernel settings, as well as connections between the two. Issues such as efficiency, stability, optimal parameterization and error analysis are discussed, and new techniques are presented. The related session 'Radial basis functions (RBF-FD) for geoscience and combustion modeling' presents kernel method applications.

### Organizer: Michael McCourt

University of Colorado, Denver, USA

Organizer: Greg Fasshauer Illinois Institute of Technology, USA

### 4:00-4:25 Radial Basis Function Collocation Method in Block Pseudospectral Mode

Alfa Heryudono, University of Massachusetts, Dartmouth, USA

### 4:30-4:55 Adaptive Trial Subspace Selection for III-Conditioned Kernel Collocation

Ling Leevan, Hong Kong Baptist University, Hong Kong

### 5:00-5:25 A Novel Radial Basis Function (RBF) Method for Solving Partial Differential Equations (PDEs) on Large Point Clouds

Lei Wang, Zeyun Yu, and Emmanuel O. Asante-Asamani, University of Wisconsin, Milwaukee, USA

#### 5:30-5:55 Reproducing Kernel Hilbert Spaces Related to Parametric Partial Differential Equations

Christian Rieger, Universität Bonn, Germany

### Friday, July 11

# MS145 Mathematics of Information and Low Dimensional Models- Part III of III 4:00 PM-6:00 PM

Room:Indiana - 3rd Floor

#### For Part 2 see MS131

This minsymposium considers a variety of ill-posed inverse problems associated with information theory, signal processing, and image processing. By exploiting low dimensional structure, such as in compressed sensing and low rank matrix completion, tractable algorithms permit construction of accurate approximate solutions and low dimensional representations. The minisymposium will include state-of-the-art work on algorithms, theoretical analysis, and relationships with high dimensional geometry from researchers at all stages of their careers.

**Organizer: Jeffrey D. Blanchard** *Grinnell College, USA* 

**Organizer: Deanna Needell** *Claremont McKenna College, USA* 

#### 4:00-4:25 Compressed Subspace Matching on the Continuum

Justin Romberg, Georgia Institute of Technology, USA

#### 4:30-4:55 Exponentially Decaying Error Rate in One-Bit Compressive Sensing

Richard G. Baraniuk, Rice University, USA; Simon Foucart, University of Georgia, USA; Deanna Needell, Claremont McKenna College, USA; Yaniv Plan and Mary Wootters, University of Michigan, USA

#### 5:00-5:25 Constructing Matrices with Optimal Block Coherence

Andrew J. Thompson and Robert Calderbank, Duke University, USA; Yao Xie, Georgia Institute of Technology, USA

#### 5:30-5:55 Compressed Sensing and Sigma-Delta Quantization: Decoding Via Convex Optimization

*Ozgur Yilmaz* and Rongrong Wang, University of British Columbia, Canada

# Friday, July 11

# MS146 Mori-Zwanzig Formulation and Applications -Part II of II

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4:00 PM-5:30 PM

## Room:Kimball - 3rd Floor

### For Part 1 see MS132

The Mori-Zwanzig formalism (Mori 1965 and Zwanzig 1973) allows reducing the number of variables in large systems of coupled equations. For differential equations, the reduced equations model the effect of the unresolved variables, leading to a Markovian, memory and fluctuating term. This formalism can be a starting point for multiscale and meso-scale modeling, based on first principles calculations. We will investigate recent mathematical developments as well as applications to materials, soft matter, and bio-molecules.

### Organizer: Eric F. Darve

Stanford University, USA

Organizer: Panos Stinis University of Minnesota, USA

4:00-4:25 Scale Dependence and Renormalization in Model Reduction *Panos Stinis*, University of Minnesota, USA

#### 4:30-4:55 Mori-Zwanzig Analysis of Brownian Motion in a Confined Molecular System

*Changho Kim* and George E. Karniadakis, Brown University, USA

#### 5:00-5:25 Mori-Zwanzig and Adaptive Mesh Refinement for Uncertainty Quantification

Jing Li, University of Minnesota, USA

Friday, July 11

# CP30 Optimization

### 4:00 PM-6:00 PM

Room:Madison - 3rd Floor

Chair: Thomas A. Frewen, United Technologies Research Center, USA

### 4:00-4:15 The Heuristic Static Load-Balancing Algorithm Applied to the Community Earth System Model

Yuri Alexeev, Argonne National Laboratory, USA

#### 4:20-4:35 Optimal Control Approach and Numerical Methods for Constrained Smoothing Splines

*Teresa Lebair* and Jinglai Shen, University of Maryland, Baltimore County, USA

#### 4:40-4:55 Roadmapping An Obstacle Forest

Thomas A. Frewen, United Technologies Research Center, USA

# 5:00-5:15 A Cut Approach for Solving the Single-Row Machine Layout

Problem Shine-Der Lee, National Cheng Kung University, Taiwan

#### 5:20-5:35 Real-Time Power Dispatch with Renewables Using Stochastic Admm

*Yu Zhang* and Georgios Giannakis, University of Minnesota, USA

#### 5:40-5:55 Study of Weak Stationarity for a Class of Stochastic Mpcc Problems

Arnab Sur, Indian Institute of Technology-Bombay, India

# CP31 Numerical Methods in PDE VII

4:00 PM-6:00 PM

Room:Salon 8 - 3rd Floor

Chair: Debojyoti Ghosh, Argonne National Laboratory, USA

#### 4:00-4:15 High-Order L-Stable Schemes for the Nonlinear Parabolic Equation Using Successive Convolution

Hana Cho, Andrew Chrislieb, David C. Seal, and Matthew F. Causley, Michigan State University, USA

### 4:20-4:35 A Scalable, Parallel Implementation of Weighted, Non-Linear Compact Schemes

Debojyoti Ghosh and Emil M. Constantinescu, Argonne National Laboratory, USA; Jed Brown, Argonne National Laboratory, USA and University of Colorado Boulder, USA

### 4:40-4:55 Pointwise Estimate for Elliptic Equations in Periodic Perforated Domains

Li-Ming Yeh, National Chiao Tung University, Taiwan

### 5:00-5:15 Multilevel Monte Carlo Finite Element Method for Time-Dependent Wave Equation

*Imbo Sim* and Myoungnyoun Kim, National Institute for Mathematical Sciences, Korea

#### 5:20-5:35 Robust Design of Boundary Conditions for Stochastic Incompletely Parabolic Systems of Equations

Jan Nordstrom and Markus Wahlsten, Linköping University, Sweden

### 5:40-5:55 On the Existence of Classical Solutions for a Two-Point Boundary Value Problem for the Navier-Stokes Equations

*Bhagya U. Athukorallage* and Ram Iyer, Texas Tech University, USA

### Friday, July 11

Board of Trustees Executive Session 4:00 PM-7:15 PM Room:Chicago - 5th Floor

### **Board Dinner**

7:30 PM-10:00 PM Off site

# Saturday, July 12

### **Regular Session of the Board**

8:30 AM-4:00 PM

Room: Chicago - 5th Floor

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Shiflet, Angela B., MS138, 4:00 Fri Shiflet, Angela B., MS138, 4:00 Fri Shiftlet, Angela, PD0, 6:15 Thu Shiu, Anne, MS5, 12:10 Mon Shonibare, Olabanji Y., PP1, 12:30 Wed Siefert, Christopher, CP11, 5:00 Tue Siegel, Michael, MS101, 9:00 Thu Siegel, Michael, MS127, 9:00 Fri Sikorski, Kajetan M., MS42, 8:30 Tue Sikorski, Kajetan M., MS42, 10:00 Tue Silber, Mary, MS5, 11:45 Mon Silling, Stewart, CP10, 8:50 Tue Silling, Stewart, MS51, 5:00 Tue Sim, Imbo, CP31, 5:00 Fri Simoncini, Valeria, MS65, 8:30 Wed Skufca, Joseph, MS93, 9:30 Thu Smith, Barry F., MS88, 5:00 Wed Snow, Kyle B., CP19, 9:30 Thu Snowden, Tom J., CP14, 9:30 Wed Socha, Katherine, MS121, 9:30 Fri Sofroniou, Mark, MS18, 5:00 Mon Sohn, Eunju, CP13, 4:00 Tue Solla, Sara A., MS41, 10:00 Tue Sonneveld, Peter, MS50, 4:30 Tue Sorenson, William E., MS25, 5:00 Mon Spagnolie, Saverio E., MS72, 8:30 Wed Spagnolie, Saverio E., MS72, 8:30 Wed St. Thomas, Brian, MS2, 10:30 Mon Starinshak, David, CP23, 5:00 Thu Stinchcombe, Adam, MS56, 5:30 Tue Stinis, Panos, MS132, 8:30 Fri Stinis, Panos, MS146, 4:00 Fri Stinis, Panos, MS146, 4:00 Fri Stoll, Martin, MS6, 10:30 Mon Strain, John A., MS100, 9:00 Thu Strait, Melissa, MS55, 4:30 Tue Strang, Gilbert, MS113, 4:00 Thu Sudakov, Ivan A., CP27, 8:30 Fri Sun, Xingping, MS116, 4:00 Thu Sun, Xu, MS99, 10:00 Thu Superfine, Richard, MS12, 11:30 Mon Sur, Arnab, CP30, 5:40 Fri Swirydowicz, Katarzyna, CP20, 8:30 Thu Szyld, Daniel B., MS50, 5:00 Tue

# T

Takac, Martin, MS2, 11:30 Mon Takacs, Stefan, MS6, 12:00 Mon Tamellini, Lorenzo, CP8, 4:20 Mon Tang, Qi, CP22, 9:30 Thu Tang, Xiaocheng, MS2, 11:00 Mon Tania, Nessy, MS57, 5:00 Tue Taroudaki, Victoria, MS134, 4:00 Fri Tartakovsky, Alexandre, MS51, 4:00 Tue Tartakovsky, Alexandre, MS66, 8:30 Wed Tartakovsky, Alexandre, MS82, 4:00 Wed Tartakovsky, Alexandre, MS82, 5:30 Wed Tartakovsky, Alexandre, MS98, 8:30 Thu Tay, Serap, CP5, 4:20 Mon Taylor, Stephanie, MS35, 9:00 Tue Taylor, Steve, CP6, 4:40 Mon Teran, Joseph, IP4, 2:00 Wed Tewinkel, Rachel E., PP1, 12:30 Wed Thiffeault, Jean-Luc, IC8, 11:00 Fri Thomas, Evelyn, MS49, 5:30 Tue Thomases, Becca, MS42, 9:30 Tue Thompson, Andrew J., MS145, 5:00 Fri Thul, Ruediger, MS24, 5:00 Mon Tiller, Michael, MS43, 9:00 Tue Tilley, Burt S., MS98, 8:30 Thu Tokman, Mayya, MS46, 5:00 Tue Toledo, Sivan A., IC4, 11:00 Tue Toledo, Sivan A., MS46, 4:00 Tue Toledo, Sivan A., MS46, 5:30 Tue Tomas, Ignacio, MS86, 4:00 Wed Tomioko, Ryota, MS11, 12:00 Mon Tong, Xin, PP1, 12:30 Wed Topaz, Chad M., MS57, 4:00 Tue Tornberg, Anna-Karin, MS58, 5:30 Tue Towers, Sherry, MS106, 5:00 Thu Trayanova, Natalia A., IP6, 11:50 Thu Treister, Eran, CP19, 9:10 Thu Tsogka, Chrysoula, MS61, 8:30 Wed Tsogka, Chrysoula, MS77, 4:00 Wed Tsogka, Chrysoula, MS77, 4:00 Wed Tsurkov, Vladimir I., PP1, 12:30 Wed Tulzer, Gerhard, CP11, 4:20 Tue Tummescheit, Hubertus, MS43, 8:30 Tue Tuncer, Necibe, MS120, 8:30 Fri Tuncer, Necibe, MS133, 4:00 Fri

Italicized names indicate session organizers.

Tuncer, Necibe, MS133, 4:00 Fri Turanova, Olga, MS54, 4:30 Tue *Turner, Peter R., MS9, 10:30 Mon Turner, Peter R., MS23, 4:00 Mon Turner, Peter R., MS37, 8:30 Tue Turner, Peter R., MS68, 8:30 Wed Turner, Peter R., MS84, 4:00 Wed Turner, Peter R., MS90, 4:00 Wed* Turner, Peter R., MS92, 9:30 Thu *Turner, Peter R., MS121, 8:30 Fri* Turner, Peter R., MS121, 8:30 Fri Turner, Peter R., MS138, 4:30 Fri Turner, Peter R., MS138, 4:30 Fri Tutberidze, Mikheil, CP29, 9:50 Fri

### U

Underhill, Patrick, MS40, 10:00 Tue Ur Rehman, Attique, CP29, 9:30 Fri

### V

Van Beeumen, Roel, MS97, 10:00 Thu Van Den Berg, Jan Bouwe, MS52, 4:30 Tue Varatharajah, Rajah P., CP10, 9:10 Tue Veerapaneni, Shravan, MS115, 5:30 Thu Venturi, Daniele, MS132, 9:00 Fri Vervliet, Nico, MS39, 8:30 Tue Vervliet, Nico, MS123, 10:00 Fri Villalobos, Cristina, MS32, 8:30 Tue Villalobos, Cristina, MS48, 4:00 Tue Villalobos, Cristina, MS79, 4:00 Wed Villalobos, Cristina, MS95, 8:30 Thu Villalobos, Cristina, MS109, 4:00 Thu Vishwanathan, S V N, MS2, 12:00 Mon Vogelsberger, Mark, MS118, 4:00 Thu Vogl, Chris, MS42, 9:00 Tue Voss, Heinrich, MS97, 9:30 Thu Voth, Eric, MS13, 12:00 Mon Voulgarakis, Nikolaos, MS82, 5:00 Wed

### W

Wakin, Michael B., MS117, 4:30 Thu Walker, Shawn W., MS55, 4:00 Tue Walker, Shawn W., MS55, 4:00 Tue Walker, Shawn W., MS70, 8:30 Wed Walker, Shawn W., MS86, 4:00 Wed Waluga, Christian, MS14, 4:00 Mon Waluga, Christian, MS28, 8:30 Tue Wang, Hong, MS80, 4:00 Wed Wang, Hong, MS80, 5:30 Wed

Wang, Hong, MS96, 8:30 Thu Wang, Jilu, CP29, 9:10 Fri Wang, Lei, MS144, 5:00 Fri Wang, Xueying, MS5, 10:30 Mon Wang, Xueying, MS19, 4:00 Mon Wang, Yingwei, CP17, 5:00 Wed Wang, Yu V., CP9, 9:30 Tue Wang, Yunjiao, MS67, 8:30 Wed Wang, Zhu, MS135, 4:30 Fri Watkins, David S., MS65, 9:00 Wed Weaver, Chelsea, CP4, 12:10 Mon Webster, Clayton G., MS29, 8:30 Tue Webster, Clayton G., MS45, 4:00 Tue Webster, Clayton G., MS139, 4:00 Fri Wendland, Holger, MS116, 4:30 Thu Westphal, Chad, CP15, 8:50 Wed Wetter, Michael, MS43, 9:30 Tue Wheeler, Mary F., MS28, 9:00 Tue White, Jacob, MS100, 9:30 Thu Wiens, Alexander J., CP21, 8:50 Thu Wild, Stefan, MS2, 10:30 Mon Wildey, Tim, MS85, 4:30 Wed Williams, J.F., MS52, 5:30 Tue Wirkus, Stephen, MS32, 8:30 Tue Wirkus, Stephen, MS48, 4:00 Tue Wirkus, Stephen, MS63, 8:30 Wed Wirkus, Stephen, MS63, 8:30 Wed Wirkus, Stephen, MS79, 4:00 Wed Wirkus, Stephen, MS95, 8:30 Thu Wirkus, Stephen, MS109, 4:00 Thu Wise, Steven M., MS86, 4:30 Wed Wise, Steven M., MS129, 9:30 Fri Wolf, Eric, CP25, 4:00 Thu Woodward, Carol S., MS91, 8:30 Thu Woodward, Carol S., MS91, 9:00 Thu Wright, Grady B., MS76, 4:00 Wed Wrobel, Jacek K., MS70, 10:00 Wed

Xia, Jianlin, MS87, 4:30 Wed Xia, Jianlin, MS142, 5:00 Fri Xiang, Yang, MS129, 9:00 Fri Xin, Zixing, MS89, 5:00 Wed Xu, Feifei, PP1, 12:30 Wed Xu, Feifei, PP1, 12:30 Wed Xu, Shujing, PP1, 12:30 Wed Xue, Fei, MS111, 5:00 Thu

# Y

Yan, Hong, MS94, 10:00 Thu Yang, Boyi, CP15, 9:50 Wed Yang, Chao, MS97, 8:30 Thu Yang, Chao, MS111, 4:00 Thu Yang, Chao, MS126, 8:30 Fri Yang, Chao, MS126, 10:00 Fri Yang, Fan, CP6, 5:40 Mon Yang, Haizhao, CP4, 10:50 Mon Yang, Xiu, MS20, 5:30 Mon Yarman, Evren, CP26, 8:30 Fri Ye, Qiang, MS65, 10:00 Wed Yeh, Li-Ming, CP31, 4:40 Fri Yeh, Peter, PP1, 12:30 Wed Yilmaz, Ozgur, MS145, 5:30 Fri Ying, Wenjun, MS101, 9:30 Thu Yoon, Hongkyu, PP1, 12:30 Wed Young, Yuan-Nan, MS58, 4:00 Tue Young, Yuan-Nan, MS58, 5:00 Tue Young, Yuan-Nan, MS112, 4:00 Thu Young, Yuan-Nan, MS127, 8:30 Fri Young, Yuan-Nan, MS140, 4:00 Fri Yu, Gexin, MS74, 9:00 Wed Yue, Xingye, CP5, 5:20 Mon

# Z

Zahr, Matthew J., CP1, 11:50 Mon Zannon, Mohammad, CP2, 11:50 Mon Zavala, Victor, MS44, 4:00 Tue Zavala, Victor, MS59, 8:30 Wed Zavala, Victor, MS75, 4:00 Wed Zavala, Victor, MS75, 4:00 Wed Zayernouri, Mohsen, MS80, 4:00 Wed Zavernouri, Mohsen, MS96, 8:30 Thu Zayernouri, Mohsen, MS96, 10:00 Thu Zeng, Xianyi, CP17, 4:00 Wed Zhang, Guannan, MS29, 8:30 Tue Zhang, Guannan, MS29, 9:00 Tue Zhang, Guannan, MS45, 4:00 Tue Zhang, Hao, MS119, 5:30 Thu Zhang, Haopeng, CP19, 8:50 Thu Zhang, Hong, MS81, 4:30 Wed Zhang, Hongxuan, CP23, 5:40 Thu Zhang, Pingwen, IC6, 11:00 Wed Zhang, Tingnan, MS8, 12:00 Mon

Zhang, Weijian, MS23, 4:30 Mon Zhang, Wujun, CP15, 8:30 Wed Zhang, Xu, CP22, 9:50 Thu Zhang, Yizhi, MS104, 9:30 Thu Zhang, Yu, CP30, 5:20 Fri Zhao, Hongkai, MS115, 4:00 Thu Zhao, Xuanhe, MS110, 5:30 Thu Zhong, Xinghui, MS33, 10:00 Tue Zhou, Xianghong J., CP14, 9:50 Wed Zhou, Xianghong J., MS108, 5:30 Thu Zhou, Xuan, CP28, 8:30 Fri Zhou, Yang, MS68, 9:30 Wed Zhou, Zhengyi, PP1, 12:30 Wed Zhu, Luoding, MS102, 9:30 Thu Zhukova, Aleksandra A., CP5, 5:00 Mon zu Castell, Wolfgang, MS130, 8:30 Fri Zwicknagl, Barbara, MS130, 9:30 Fri

Italicized names indicate session organizers.



The collection, *Featured Lectures from our Archives*, includes audio and slides from twenty conferences since 2008, including talks by invited and prize speakers, select minisymposia, and minitutorials from the 2013 Annual Meeting and six 2013 SIAG meetings.

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# Conference Budget SIAM Annual Meeting July 7-11, 2014 Chicago, IL

# **Expected Paid Attendance: 900**

Revenue		
Registration Income	_	\$257,625.00
Tota	al	\$257,625.00
_		
Expenses		
Printing		\$7,600.00
Organizing Committee		\$5,200.00
Invited Speakers		\$36,000.00
Food and Beverage		\$87,200.00
AV Equipment and Telecommunicatio	n	\$55,400.00
Advertising		\$34,500.00
Professional Services		\$20,750.00
Conference Labor (including benefits)		\$117,361.00
Other (supplies, staff travel, freight, misc.)		\$35,600.00
Administrative		\$42,717.00
Accounting/Distribution & Shipping		\$20,973.00
Information Systems		\$37,506.00
Customer Service		\$13,891.00
Marketing		\$21,571.00
Office Space (Building)		\$11,778.00
Other SIAM Services		\$13,352.00
	Total:	\$561,399.00
Net Conference Expense		(\$303,774.00)
Support Provided by SIAM	-	\$303,774.00
		\$0.00

# Estimated Support for Travel Awards not included above:

50	\$32,500.00
	50

Budget

