SIAM Conference on Applications of Dynamical Systems

Figure courtesy J. Meiss and D. Simpson, DSWeb media gallery.

May 22 - 26, 2011
Snowbird Ski and Summer Resort
Snowbird, Utah USA

Sponsored by the SIAM Activity Group on Dynamical Systems (SIAG/DS)

The SIAM Activity Group on Dynamical Systems provides a forum for the exchange of ideas and information between mathematicians and applied scientists whose work involves dynamical systems. The goal of this group is to facilitate the development and application of new theory and methods of dynamical systems. The techniques in this area are making major contributions in many areas, including biology, nonlinear optics, fluids, chemistry, and mechanics. This activity group supports the web portal DSWeb, sponsors special sessions at SIAM meetings, organizes a biennial conference, and awards biennial prizes—the Jürgen Moser Lecture and the J. D. Crawford Prize. The activity group also sponsors the DSWeb Student Competition for tutorials on dynamical systems and its applications written by graduate and undergraduate students and recent graduates. Members of SIAG/DS receive a complimentary subscription to the all-electronic, multimedia SIAM Journal on Applied Dynamical Systems.
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University of Bath, United Kingdom
Vivien Kirk
University of Auckland, New Zealand

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SIAM Registration Desk
The SIAM registration desk is located in the Ballroom Foyer. It is open during the following times:

Saturday, May 21
4:00 PM - 8:00 PM

Sunday, May 22
7:15 AM - 5:30 PM

Monday, May 23
8:00 AM - 5:30 PM

Tuesday, May 24
8:00 AM - 5:30 PM

Wednesday, May 25
8:00 AM - 5:30 PM

Thursday, May 26
8:00 AM - 12:30 PM

Hotel Address
Snowbird Ski and Summer Resort
Snowbird, UT 84092-9000
Toll free reservations: 800-453-3000
(US and Canada)
Fax: +1-801-947-8227
Direct telephone: +1-801-742-2222
http://www.snowbird.com

Hotel Telephone Number
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Check-in time is 4:00 PM and check-out time is 11:00 AM.

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As a service to SIAM attendees, SIAM has made arrangements for in-room child care. If you have not already made reservations for child care, please contact Camp Snowbird at +1-801-933-2256 for fee information and to determine space availability.

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IBM Corporation
IDA Center for Communications Research, La Jolla
IDA Center for Communications Research, Princeton
Institute for Defense Analyses, Center for Computing Sciences
Lawrence Berkeley National Laboratory
Lockheed Martin
Funding Agency Panel
Tuesday, May 24
12:45 PM - 1:45 PM
Ballroom

Co-Chairs:
Steven Shaw
Michigan State University, USA

Hans G. Kaper
Argonne National Laboratory and
Georgetown University, USA

Panelists:
Jeff Rogers
Defense Advanced Research Projects Agency, USA

Karin Remington
National Institutes of Health, USA

Eduardo Misawa
National Science Foundation, USA

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Postal mail: Society for Industrial and Applied Mathematics, 3600 Market Street, 6th floor, Philadelphia, PA 19104-2688 USA
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The plenary session room will have two overhead projectors, two screens, and one data projector. All other breakout rooms will have one screen and one data projector.

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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.

E-mail Access

E-mail stations will be available to attendees during registration hours. The Cliff Lodge at Snowbird offers wireless Internet access to hotel guests in the lodging and public areas of the hotel at no additional charge.

Registration Fee Includes

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

Job Postings

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

Important Notice to Poster Presenters

The poster session is scheduled for Tuesday, May 24, 2011 at 8:30 PM. Presenters are requested to put up their posters between 8:00 PM and 8:30 PM on Tuesday. Poster displays must be removed at 10:30 PM, the end of the poster session. Boards and push pins will be available to presenters beginning Tuesday, May 24, at 8:00 PM. SIAM is not responsible for discarded posters.

SIAM Books and Journals

Display copies of books and complimentary copies of journals are available on site. SIAM books are available at a discounted price during the conference. If a SIAM books representative is not available, completed order forms and payment (credit cards are preferred) may be taken to the SIAM registration desk. The books table will close at 10:05 AM on Thursday, May 26.

Table Top Displays

Oxford University Press
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Springer

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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: Sven Leyffer, SIAM Vice President for Programs (vpp@siam.org)

Get-togethers

- Saturday, May 21
  Welcome Reception
  6:00 PM - 8:00 PM

- Monday, May 23
  Business Meeting
  (open to SIAG/DS Members)
  8:15 PM - 9:00 PM
  Complimentary beer and wine will be served.

- Tuesday, May 24
  Poster Session and Dessert Reception
  8:30 PM - 10:30 PM

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.

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Save the Date!

2013 SIAM Conference on Application of Dynamical Systems

May 19 – May 23, 2013
Snowbird Ski and Summer Resort
Snowbird, Utah, USA
Invited Plenary Speakers

** All Invited Plenary Presentations will take place in the Ballroom**

Sunday, May 22
11:45 AM - 12:30 PM
IP1 Will the Climate Change Mathematics?
Christopher Jones, University of North Carolina at Chapel Hill, USA & University of Warwick, United Kingdom

2:00 PM - 2:45 PM
IP2 From Newton’s Cradle to New Materials
Chiara Daraio, California Institute of Technology, USA

Monday, May 23
11:45 AM - 12:30 PM
IP3 How Can We Model the Regulation of Stress Hormones?
Stafford Lightman, University of Bristol, United Kingdom

2:00 PM - 2:45 PM
IP4 Climate Sensitivity, Feedback and Bifurcation: From Snowball Earths to the Runaway Greenhouse
Raymond T. Pierrehumbert, University of Chicago, USA

Tuesday, May 24
11:45 AM - 12:30 PM
IP5 Robust and Generic Dynamics: A Phenomenon/mechanism Correspondence
Enrique Pujals, Instituto Nacional de Matematica Pura e Aplicada, Brazil

2:00 PM - 2:45 PM
IP6 Models and Control of Collective Spatio-Temporal Phenomena in Power Grids
Michael Chertkov, Los Alamos National Laboratory, USA
**Invited Plenary Speakers**

**All Invited Plenary Presentations will take place in the Ballroom**

**Wednesday, May 25**

11:45 AM - 12:30 PM  
**IP7** Pattern Formation and Partial Differential Equations  
**Felix Otto**, *Max Planck Institute for Mathematics in the Sciences, Germany*

2:00 PM - 2:45 PM  
**IP8** Mathematical Models for Tissue Engineering Applications  
**Sarah Waters**, *University of Oxford, United Kingdom*

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**Thursday, May 26**

11:55 AM - 12:40 PM  
**IP9** Moving Pattern Formation from the Real World to the Lab, and the Reverse  
**Stephen Morris**, *University of Toronto, Canada*
Prizes and Special Lecture

The Prize Presentations and Special Lectures will take place in the Ballroom.

Sunday, May 22
Prize Presentations
8:15 PM - 8:30 PM

Jürgen Moser Lecture
8:30 PM – 9:15 PM

SIAM Activity Group on Dynamical Systems Prizes

J. D. Crawford Prize

Eric Vanden-Eijnden, Courant Institute of Mathematics Sciences, New York University, USA

Jürgen Moser Lecture: The Many Facets of Chaos

James A. Yorke, University of Maryland, College Park, USA
SIAM Activity Group on Dynamical Systems (SIAG/DS)

www.siam.org/activity/ds

A GREAT WAY TO GET INVOLVED!
Collaborate and interact with mathematicians and applied scientists whose work involves dynamical systems.

ACTIVITIES INCLUDE:
• DSWeb portal
• Special sessions at SIAM meetings
• Biennial conference
• Jürgen Moser Lecture
• J. D. Crawford Prize
• DSWeb Student Competition for tutorials

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Final Program

SIAM Conference on Applications of Dynamical Systems

Figure courtesy J. Meiss and D. Simpson, DSWeb media gallery.

May 22 - 26, 2011
Snowbird Ski and Summer Resort
Snowbird, Utah USA
Saturday, May 21

Registration
4:00 PM-8:00 PM
Room: Ballroom Foyer

Welcome Reception
6:00 PM-8:00 PM
Room: Amphitheatre Lobby Terrace

Sunday, May 22

Registration
7:15 AM-5:30 PM
Room: Ballroom Foyer

Sunday, May 22

MS1
Mixing in Geophysics and Engineering
8:20 AM-10:00 AM
Room: Ballroom 1

Mixing in fluids is a fundamental phenomenon that generates persistent interests and efforts in its scientific understanding and engineering application, especially the enhanced mixing of scalars, such as temperature, chemical concentration and etc., beyond molecular diffusion by various mechanical, geophysical or biological mechanisms. This minisymposium intends to incorporate some recent analyses, simulations and experiments to provide new insights on these common themes. In particular, topics will include flow optimization for stirring-induced mixing, biogenic mixing, wind driven circulation in the ocean surface mixed layer and underwater oil plumes.

Organizer: Zhi Lin
University of Minnesota, Twin Cities, USA

8:20-8:40 Optimal Stirring for Passive Scalar Mixing
Charles R. Doering, University of Michigan, Ann Arbor, USA; Zhi Lin, University of Minnesota, USA; Jean-Luc Thiffeault, University of Wisconsin, Madison, USA

8:45-9:05 Topological Detection of Lagrangian Coherent Structures
Jean-Luc Thiffeault, University of Wisconsin, Madison, USA; Michael Allshouse, Massachusetts Institute of Technology, USA

9:10-9:30 Langmuir Circulation, Mixing, and Instabilities in the Ocean Surface Boundary Layer
Greg Chini, University of New Hampshire, USA; Ke Li, University of Wisconsin, USA; Zhexuan Zhang and Ziemowit Malecha, University of New Hampshire, USA; Keith Julien, University of Colorado at Boulder, USA

9:35-9:55 Internal Trapping of Bodies, Plumes and Jets in a Stratified Fluid: A Theoretical and Experimental Study
Richard McLaughlin, University of North Carolina at Chapel Hill, USA
Classically chaotic behavior can lead to surprising results when transplanted to a quantum or wave-dynamical system. The phenomena often have no classical counterpart or are qualitatively different. We focus on statistical fluctuations in conductance, tunneling and many-body systems. These include graphene quantum dots with chaotic scattering dynamics found in many graphene-based devices; quantum tunneling rates which fluctuate wildly for regular systems, but vary very little in chaotic systems; and atomic Bose-Einstein Condensates with a classical phase space complexity that is encoded in the quantum statistics of the atomic population and in the fluctuations of the scattering cross section.

Organizer: Louis M. Pecora
Naval Research Laboratory, USA

Organizer: Edward Ott
University of Maryland, USA

8:20-8:40 Chaos Regularization of Quantum Tunneling Rates
Louis M. Pecora, Naval Research Laboratory, USA

8:45-9:05 Theory of Chaos Regularization of Tunneling
Edward Ott, Ming Jer Lee, and Thomas M. Antonsen, University of Maryland, USA; Louis Pecora, Dong-Ho Wu, and Hoshik Lee, U.S. Naval Research Laboratory, USA

9:10-9:30 Relativistic Quantum Chaos in Graphene Systems
Ying-Cheng Lai, Arizona State University, USA

Tsampikos Kottos, Wesleyan University, USA
Sunday, May 22

**MS5**

*Multiple Time Scale Dynamics: from Theory to Biological Applications*

8:20 AM-10:00 AM

*Room: Magpie B*

Systems with different time scales are commonplace in many scientific areas, in particular, in biological problems. The mathematical modelling of such situations involve singularly perturbed equations, e.g., (non)smooth differential equations, partial differential equations, etc … In this session, we give a panorama of recent advances in slow-fast dynamical systems and related typical phenomena such as canard solutions, mixed-mode oscillations, bursting oscillations. The aim is to span different theoretical frameworks: smooth ODEs, nonsmooth ODEs, PDEs, as well as to present recent developments in the mathematical modelling of cellular activity, in particular, in endocrine cells and neuronal bursters.

Organizer: Mathieu Desroches  
*University of Bristol, United Kingdom*

Organizer: Mike R. Jeffrey  
*University of Bristol, United Kingdom*

8:20-8:40 Mixed Mode Oscillations Underly Bursting in Pituitary Cells  
*Richard Bertram, Florida State University, USA*

8:45-9:05 Canards and Bifurcation Delays of Spatially Homogeneous and Inhomogeneous Types in Reaction-diffusion Equations  
*Tasso J. Kaper, Boston University, USA; Peter De Maesschalck, Hasselt University, Belgium; Nikola Popovic, University of Edinburgh, United Kingdom*

9:10-9:30 Exploring Torus Canards in a Simple Neuron Model  
*Mark Kramer, Boston University, USA*

*Mathieu Desroches and Mike R. Jeffrey, University of Bristol, United Kingdom*

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Sunday, May 22

**MS6**

*Infinite Dimensional Models in Mathematical Epidemiology*

8:20 AM-10:00 AM

*Room: Wasatch A*

Advanced modeling of the transmission dynamics of infectious diseases often requires the application of infinite dimensional dynamical systems, typically due to heterogeneity (when a population is structured by age, size, spatial position or any relevant characteristics). Many structured models can be formulated as delay differential equations, but time delays may arise during the modeling process as well. In either case an adequate model can be defined as a dynamical system in an appropriate function space. This session provides an overview of recent applications of infinite dimensional models to various situations in mathematical epidemiology.

Organizer: Gergely Röst  
*University of Szeged, Hungary*

Organizer: Rongsong Liu  
*University of Wyoming, USA*

8:20-8:40 Impact of Heterogeneity on the Dynamics of SEIR Epidemic Models  
*Zhisheng Shuai, University of Victoria, Canada*

8:45-9:05 Interactions Among Virulence, Coinfection and Drug Resistance in a Complex Life-cycle Parasite  
*Dashun Xu, Southern Illinois University, USA*

9:10-9:30 Spread of Avian Influenza in Networks of Wild Bird Migratory Pathways  
*Lydia Bourouiba, Massachusetts Institute of Technology, USA*

9:35-9:55 Spatiotemporal Distributions of Migratory Birds: Patchy Models with Delay  
*Rongsong Liu, University of Wyoming, USA*

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Sunday, May 22

**MS7**

*Nonlinear Waves: From Spectral Study to Nonlinear Dynamics*

8:20 AM-10:00 AM

*Room: Wasatch B*

This minisymposium will highlight recent developments regarding the spectral, linear and nonlinear stability of waves. In particular, it will bring together work on a variety of techniques, such as the Evans function and Krein signature, both of which have proven to be useful tools for determining to the location and/or number of unstable eigenvalues, and in several applications, including solitary water waves and transition fronts for Cahn-Hilliard.

Organizer: Margaret Beck  
*Boston University, USA*

Organizer: Toan Nguyen  
*Brown University, USA*

8:20-8:40 Asymptotic Linear Stability of Solitary Water Waves  
*Robert Pego, Carnegie Mellon University, USA*

8:45-9:05 Stability of Transition Front Solutions in Cahn-Hilliard Systems  
*Peter Howard, Texas A&M University, USA*

9:10-9:30 The Evans Function and the Weyl-Titchmarsh Function  
*Yuri Latushkin, University of Missouri, Columbia, USA; Alim Sukhtayev, University of Missouri, Columbia, USA*

9:35-9:55 A Signature-Detecting Evans Function: The Krein Matrix  
*Todd Kapitula, Calvin College, USA*
Noise is ubiquitous in nature and influences the behavior of many dynamical systems. Even weak noise can have a profound effect on the dynamics on a appropriate long time scale. Therefore, understanding this effect is important for analyzing and computing long time dynamics of stochastically perturbed dynamical systems. A lot of effort has been put in recent years towards the development of analytical and computational tools for the study of stochastic dynamical systems, with particular emphasis to high dimensional problems with multiple scales. The goal of this minisymposium is to bring together experts working on the analysis and development of numerical algorithms for the study of multiscale stochastic dynamical systems.

Organizer: Dirk Blömker
Universität Augsburg, Germany
Organizer: Greg Pavliotis
Imperial College London, United Kingdom

8:20-8:40 Analysis and Numerics for SPDEs with Multiple Scales
Greg Pavliotis, Imperial College London, United Kingdom
8:45-9:05 Numerical Methods for Stochastic Bio-chemical Reacting Networks with Multiple Time Scales
Liu Di, Michigan State University, USA

9:10-9:30 Stochastic Similarity Ultimately Emerges from Some Stochastic Reaction, Advection, Diffusion Equations
Anthony J. Roberts, University of Adelaide, Australia

9:35-9:55 Simplifying the Dynamical Description of Complex Stochastic Systems
Lee DeVille, University of Illinois at Urbana-Champaign, USA

8:20-8:40 Wave Dynamics in Nonlinear Disordered Media - A Coin with Many Faces
Sergej Flach, and Joshua Bodyfelt, Max Planck Institute for Physics of Complex Systems, Germany

8:45-9:05 Scaling of Energy Spreading in Strongly Nonlinear Disordered Lattices
Mario Mulansky, University of Potsdam, Germany

9:10-9:30 Emergence of Generalized Gibbs Distribution in Quantum FPU Problem
Rafael Hipolito, City University of New York, College of Staten Island, USA

9:35-9:55 Scaling Properties of Weak Chaos in Nonlinear Disordered Lattices
Arkady Pikovsky, University of Potsdam, Germany; Shmuel Fishman, Technion, Haifa, Israel

Organizer: Michael Rosenblum
Universität Potsdam, Germany
Organizer: Hiroya Nakao
Kyoto University, Japan

8:45-9:05 Collective Enhancement of Temporal Precision in Networks of Noisy Oscillators
Hiroshi Kori, Ochanomizu University, Japan; Yoji Kawamura, Japan Agency for Marine-Earth Science and Technology, Japan; Naoki Masuda, University of Tokyo, Japan

9:10-9:30 Collective Phase Response of Macroscopic Rhythms in Coupled Oscillator Ensembles
Hiroya Nakao, Kyoto University, Japan; Yoji Kawamura, Japan Agency for Marine-Earth Science and Technology, Japan

9:35-9:55 Non-universal Results in Noise-induced Common Firing in Active Rotators
Raul Toral, IFISC CISC-UIB Palma de Mallorca, Spain; Luis F. Lafuerza and Pere Colet, IFISC, CSIC-UIB, Spain
Sunday, May 22

**MS11**

**Symmetry in Variational Problems and Differential Equations**

**8:20 AM-10:00 AM**

**Room: White Pine**

A number of phenomena in mechanics, physics, and optimal control have a variational nature. This minisymposium will concentrate on the modern trends in variational techniques and their applications to dynamics, and in particular, on the use of variational methods in combination with symmetry. The talks will discuss invariant flows, Darboux integrability, symmetry reduction, and higher-order variational integrators. Applications include conservation laws, integrable systems, including integrable PDE’s, and symmetry-preserving numerical methods for controlled mechanical systems.

Organizer: Irina Kogan
*North Carolina State University, USA*

Organizer: Dmitry Zenkov
*North Carolina State University, USA*

**8:20-8:40 Darboux Integrability -- A Historical Survey**

*Ian Anderson*, Utah State University, USA

**8:45-9:05 Invariant Variational Problems and Invariant Flows**

*Peter Olver*, University of Minnesota, USA

**9:10-9:30 Higher-Order Variational Integrators Using Prolongation-Collocation**

*Melvin Leok* and Tatiana Shingel,
University of California, San Diego, USA

**9:35-9:55 Variational Calculus in Invariant Frames**

*Irina Kogan*, North Carolina State University, USA

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**CP1**

**Molecular Modelling**

**10:05 AM-11:05 AM**

**Room: Maybird**

**Chair:** Vakhtang Putkaradze, Colorado State University

**10:05-10:20 Geometric Mechanics of Molecules with Non-Local Interactions**

Vakhtang Putkaradze, Colorado State University, USA

**10:25-10:40 Internal Lever Arm Model for Myosin II**

*Andras Bibo*, Budapest University of Technology and Economics, Hungary

**10:45-11:00 Modeling DNA Overstrectching at the Basepair Level**

Attila G. Kocsis, Budapest University of Technology and Economics, Hungary; David Swigon, University of Pittsburgh, USA

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**Intermission**

**10:00 AM-10:05 AM**

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**CP2**

**Population Dynamics I**

**10:05 AM-11:05 AM**

**Room: Ballroom II**

**Chair:** Ernest Barany, New Mexico State University, USA

**10:05-10:20 Cell Population Dynamics: Bifurcation Theory Reveals Emergent Behaviour**

Petros Mina, Mario Di Bernardo, Krasimira Tsaneva-Atanasova, and Nigel Savery, University of Bristol, United Kingdom

**10:25-10:40 Bifurcations in Models of Evolution of Polymorphism**

Ernest Barany, New Mexico State University, USA

**10:45-11:00 Dynamics of Infection Spreading in Adaptive Networks with Communities**

Ilker Tunc, The College of William & Mary, USA; Leah Shaw, College of William & Mary, USA
Sunday, May 22  

**CP3**  
**Inter-Cellular Processes**  
10:05-10:25 AM  
**Room:** Ballroom III  
**Chair:** Todd Young, Ohio University, USA  

10:05-10:20 Cell Cycle  
**Synchronization vs. Clustering**  
Erik M. Boczko, Vanderbilt University, USA; Bastien Fernandez, Centre de Physique Théorique - CNRS, France; Todd Young and Richard Buckalew, Ohio University, USA  

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Sunday, May 22  

**CP4**  
**Mesoscales in Complex Networks I**  
10:05 AM-11:05 AM  
**Room:** Magpie A  
**Chair:** Ernesto Estrada, University of Strathclyde, United Kingdom  

10:05-10:20 **Communicability, Centrality and Communities in Complex Networks**  
Ernesto Estrada, University of Strathclyde, United Kingdom  

10:25-10:40 **Clustering of Networks with Mesoscaled Structure Through Multilevel Networks**  
Regino Criado, Julio Flores, Alejandro García del Amo, Jesús Gómez-Gardeñes, and Miguel Romance, Universidad Rey Juan Carlos, Spain  

10:45-11:00 **Dynamics in Modular Networks at the Mesoscale Level**  
Juan A. Almendral and Inmaculada Leyva, Universidad Rey Juan Carlos, Spain; Daqing Li, Bar-Ilan University, Israel; Irene Sendina-Nadal, Universidad Rey Juan Carlos, Spain; Javier M. Buldu, Rey Juan Carlos University, Spain; Shlomo Havlin, Bar-Ilan University, Israel; Stefano Boccaletti, CNR, Italy  

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Sunday, May 22  

**CP5**  
**Fluids I**  
10:05 AM-11:05 AM  
**Room:** Superior B  
**Chair:** Juan M. Lopez, Arizona State University, USA  

10:05-10:20 **Vortex Sheet Model for a Turbulent Mixing Layer**  
Ujjayan Paul and Roddam Narasimha, Jawaharlal Nehru Centre for Advanced Scientific Research, India  

10:25-10:40 **Vortex Generation by An Oscillatory Magnetic Obstacle**  
Morten Brøns, Technical University of Denmark, Denmark  

10:45-11:00 **Optimal Harmonic Response in a Confined Bödewadt Boundary Layer Flow**  
Juan M. Lopez, Arizona State University, USA; Younghae Do, Kyungpook National University, Korea; Francisco Marques, Universidad Politecnica de Catalunya, Spain
Sunday, May 22

**CP6**

**Partial Differential Equations I**
10:05 AM-11:05 AM

**Room:** Wasatch B

**Chair:** Thomas Bellsky, Michigan State University, USA

10:05-10:20 Asymptotic Analysis of a Specific Type of Multi-Bump Blowup Solutions of the Ginzburg-Landau Equation

*Vivi Rottschafer*, Leiden University, Netherlands

10:25-10:40 Stability of Periodic-Wave Solutions in the Parametrically Driven Damped Nonlinear Schroedinger Equation

*Igor Barashenkov* and *Maxim Molchan*, University of Cape Town, South Africa

10:45-11:00 Nonlinear Asymptotic Stability for a Generalized Gierer-Meinhardt Model

*Thomas Bellsky*, Michigan State University, USA; *Keith Promislow*, Michigan State University, USA

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Sunday, May 22

**CP7**

**Delay Differential Equations**
10:05 AM-11:05 AM

**Room:** Superior A

**Chair:** Jan Sieber, University of Portsmouth, United Kingdom

10:05-10:20 Periodic Orbits in Differential Equations with State-Dependent Delay

*Jan Sieber*, University of Portsmouth, United Kingdom

10:25-10:40 Cavitation in Tissue under High-Intensity Focused Ultrasound

*David Sinden*, Eleanor Stride, and *Nader Saffari*, University College London, United Kingdom

10:45-11:00 Some Effects of the Gamma Distribution on the Dynamics of a Scalar Delay Differential Equation

*Israel Ncube*, Memorial University, Newfoundland, Canada; *Sue Ann Campbell*, University of Waterloo, Canada

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Sunday, May 22

**CP8**

**Numerical Methods**
10:05 AM-10:45 AM

**Room:** Wasatch A

**Chair:** Thorsten Riess, Universität Konstanz, Germany

10:05-10:20 Computing N-Heteroclinic EtoP Orbits Near Non-Reversible Homoclinic Snaking

*Thorsten Riess*, Universität Konstanz, Germany

10:25-10:40 On the Numerical Integration of One Nonlinear Parabolic Equation

*Mikheil Tutberidze*, Ilia State University, Georgia
**CP9**

**Dynamics in Social Sciences**

**10:05 AM-11:05 AM**

*Room: Ballroom I*

*Chair: Michael Busch, University of California, Santa Barbara, USA*

**10:05-10:20 Why Ignoring Your Darwinian Fitness May be Adaptive: Evolutionary Dynamics of Movement Strategies in the Presence of Realistic Constraints**

*Theodore E. Galanthay and Samuel Flaxman, University of Colorado, USA*

**10:25-10:40 Information Propagation Models and Social Networks**

*Michael Busch and Jeff Moehlis, University of California, Santa Barbara, USA*

**10:45-11:00 Modelling the Dynamics of Decision-Making on Networks**

*Nick McCullen and Mikhail Ivanchenko, University of Leeds, United Kingdom; Vladimir Shalfeev, Nizhny Novgorod State Technical University, Russia; Alastair M. Rucklidge, University of Leeds, United Kingdom; Tim Foxon and William Gale, University of Leeds, United Kingdom*

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**CP10**

**Hamiltonian and Volume Preserving Dynamics**

**10:05 AM-11:05 AM**

*Room: Magpie B*

*Chair: Levi DeVries, University of Maryland, USA*

**10:05-10:20 Existence and Stability of Symmetric Periodic Sbc Orbits in the Planar Pairwise Symmetric Four-Body Problem**

*Lennard F. Bakker and Tiancheng Ouyang, Brigham Young University, USA; Duokui Yan, Nankai University, China; Skyler Simmons, Brigham Young University, USA*

**10:25-10:40 From Systematic Search to Systematic Proof**

*Marcos Rodriguez and Roberto Barrio, University of Zaragoza, Spain*

**10:45-11:00 Improving Hurricane Forecasts Using Unmanned Aircraft: Motion Coordination in a Strong Flowfield**

*Levi DeVries and Angela Maki, University of Maryland, USA; Doug Koch and Sharan Majumdar, University of Miami, USA; Derek A. Paley, University of Maryland, USA*

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**CP11**

**CANCELLED**

**10:05 AM-11:05 AM**

*Room: Golden Cliff*

**Coffee Break**

**11:05 AM-11:35 AM**

*Room: Ballroom*

**Opening Remarks**

**11:35 AM-11:45 AM**
Sunday, May 22

**IP1**
**Will the Climate Change Mathematics?**
11:45 AM-12:30 PM
Room: Ballroom
Chair: Alan R. Champneys, University of Bristol, United Kingdom

Computational models of the Earth system lie at the heart of modern climate science. Concerns about their predictions have been illegitimately used to undercut the case that the climate is changing and this has put dynamical systems in an awkward position. It is important that we extricate ourselves from this situation as climate science, whose true objective is to build an understanding of how the climate works, badly needs our expertise. I will discuss ways that we, as a community, can contribute by highlighting some of the major outstanding questions that drive climate science, and I will outline their mathematical dimensions. I will put a particular focus on the issue of simultaneously handling the information coming from data and models. I will argue that this balancing act will impact the way in which we formulate problems in dynamical systems.

Christopher Jones
*University of North Carolina at Chapel Hill, USA & University of Warwick, United Kingdom*

**Lunch Break**
12:30 PM-2:00 PM
Attendees on their own

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Sunday, May 22

**IP2**
**From Newton’s Cradle to New Materials**
2:00 PM-2:45 PM
Room: Ballroom
Chair: Steve Shaw, Michigan State University, USA

The bouncing beads of Newton’s cradle fascinate children and executives alike, but their symmetric dance hides complex nonlinear dynamic behavior. Lift a bead on one side off a chain of a few suspended beads, let it swing back: one bead bounces off on the other side. Do the same with a long chain of beads: several beads bounce off on the other side. This represents an example of nonlinear wave dynamics, which can be exploited for a variety of engineering applications. By assembling grains in crystals or layers in composites such that they support nonlinear waves, we are developing new materials and devices with unique properties. We have constructed acoustic lenses that allow sound to travel as compact bullets that can be used in medical applications, have developed new materials for absorbing explosive blasts, and are exploring new ways to test aircraft wings and bone implants nondestructively with the help of nonlinear waves.

Chiara Daraio
*California Institute of Technology, USA*

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Sunday, May 22

**MS12**
**Theory and Computation of Lagrangian Coherent Structures - Part I of II**
3:00 PM-4:40 PM
Room: Ballroom I
For Part 2 see MS23

Lagrangian Coherent Structures (LCS) are distinguished invariant surfaces that act as cores of observable trajectory patterns in dynamical systems. As such, LCS extend the classic concept of hyperbolic invariant manifolds to finite-time experimental and numerical data sets. This two-part minisymposium brings together theoreticians and computational experts to survey the current state of the art and challenges in LCS analysis. Part I reviews various aspects of LCS theory with an emphasis on recent analytic results, while Part II focuses on progress in the numerical computation and visualization of LCS.

Organizer: Sanjeeva Balasuriya
*Connecticut College, USA*

Organizer: Xavier M. Tricoche
*Purdue University, USA*

Organizer: George Haller
*McGill University, Canada*

3:00-3:20 Lagrangian Coherent Structures: An Overview and Recent Analytic Results
George Haller, McGill University, Canada

Gary Froyland and Naratip Santitissadeekorn, University of New South Wales, Australia; Adam Monahan, University of Victoria, Canada

3:50-4:10 Coherent Structures and Transport in Transitory Systems
Brock Mosovsky and James D. Meiss, University of Colorado at Boulder, USA

4:15-4:35 Boundaries of Unsteady Lagrangian Coherent Structures
Sanjeeva Balasuriya, Connecticut College, USA

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**Intermission**
2:45 PM-3:00 PM
Over the past decade, there has been an explosion of interest focused on the study of granular chains. These media come not only in different varieties (homogeneous, heterogeneous, disordered), but can be tailored to have tunable nonlinear responses. The tunability of granular chains is valuable not only for basic studies of the underlying physics but also in potential engineering applications, including shock absorbing layers, acoustic lenses and sound scramblers. In that light, and in connection also to the plenary talk by Professor Chiara Daraio, the aim of this minisymposium is to explore the frontiers of our current understanding of such granular media.

Organizer: Georgios Theocharis
California Institute of Technology, USA
Organizer: Panayotis Kevrekidis
University of Massachusetts, Amherst, USA

3:00-3:20 Nonlinear Resonance Phenomena in Granular Dimers with no Pre-Compression
Alexander F. Vakakis, Yuli Starosvetsky, and K. R. Jayaprakash, University of Illinois at Urbana-Champaign, USA

3:25-3:45 Wave Propagation in Chains of Beads with Hertzian Contacts and the p-Schrödinger Equation
Guillaume James, Université de Grenoble and CNRS, France

3:50-4:10 Granular Chains: The Binary Collision Approximation
Katja Lindenberg and Upendra Harbola, University of California, San Diego, USA; Alexandre Rosas, Universidade Federal da Paraiba, Brazil; A. H. Romero, CINVESTAV-IPN, Queretaro, Mexico

4:15-4:35 Tailoring Stress Propagation in Granular Media: Effects of Particle and System Geometry
Duc Ngo and Chiara Daraio, California Institute of Technology, USA
Neuronal networks feature a rich variety of complex spatio-temporal phenomena. The formation of patterns of neuronal activity is shaped by the interplay of the dynamical properties of the individual neurons and the structure of connections between them. It is therefore important to study the contribution of the network topology to the dynamics. The goal of this minisymposium is to highlight the role of the ideas, language, and the methods of discrete mathematics (and, in particular, of the algebraic graph theory) in the analysis of neuronal networks.

Organizer: Georgi S. Medvedev  
Drexel University, USA

Organizer: Vladimir Itskov  
University of Nebraska, Lincoln, USA

3:00-3:20 Connectivity vs. Dynamics in a Simple Model of Neuronal Networks  
Winfried Just, Ohio University, USA;  
David H. Terman, Ohio State University, USA;  
Sungwoo Ahn, Indiana University-Purdue University Indianapolis (IUPUI), USA

3:25-3:45 Random Graphs and Sleep-wake Dynamics  
Janet Best, Deena Schmidt, and Boris Pittel, Ohio State University, USA;  
Mark Blumberg, University of Iowa, USA

3:50-4:10 Network Dynamics on Random Graphs  
Deena Schmidt, Janet Best, and Boris Pittel, Ohio State University, USA;  
Mark Blumberg, University of Iowa, USA

4:15-4:35 Neural Networks Computing Relaxations of Hard Combinatorial Problems  
Christopher Hillar, Mathematical Sciences Research Institute, USA
Sunday, May 22

**MS18**

**Epidemiology, Population Dynamics and Networks I**

3:00 PM-4:15 PM

Room: Wasatch B

This minisymposium is about mathematical models for the spread of infectious diseases. The talks concern effects of variabilities of abiotic determinants: spatial heterogeneities or seasonal variations. Particular emphasis is give on how the network structure and the multi-scale dynamics have an effect on the epidemic spreading. Methods of controlling and reducing the epidemic impact, such as vaccination and genetic methods, will also be discussed. Actual applications will be considered.

Organizer: Stefanelia Boatto
Universidade Federal do Rio De Janeiro, Brazil

3:00-3:20 Genetic Control of Vector-borne Diseases: Artificial Selection and Heterogeneity of the Immune Response in Mosquitoes
Claudio Struchiner, Oswaldo Cruz Foundation, Brazil

3:25-3:45 Stochastic Effects in Infection Dynamics: Simulations and Analytical Models
Ganna Rozhnova, University of Lisbon, Portugal and University of Manchester, United Kingdom; Ana Nunes, University of Lisbon, Portugal

3:50-4:10 Pandemic Influenza Vaccination Timing in a Population Dynamical Model
Jessica M. Conway, University of British Columbia, Canada; Ashleigh Tuite, University of Toronto, Canada; Rafael Meza and Babak Pourbohloul, University of British Columbia, Canada

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Sunday, May 22

**MS19**

**Evolving Dynamical Networks - Part I of II**

3:00 PM-4:40 PM

Room: Maybird

For Part 2 see MS30

In many biological, ecological and engineering networks the coupling strength and the network topology can vary in time. In addition, the networks can adapt their structure in response to node dynamics. This minisymposium focuses on the mathematical analysis and various applications of dynamical networks whose coupling structure evolves over time, on a time scale that ranges from fast to slow.

Organizer: Igor Belykh
Georgia State University, USA

Organizer: Mario Di Bernardo
University of Bristol, United Kingdom

Organizer: Juergen Kurths
Potsdam Institute for Climate Impact Research and Humboldt University Berlin, Germany

Organizer: Maurizio Porfiri
Polytechnic Institute of New York University, USA

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Sunday, May 22

**MS20**

**Rheology and Fluctuations of Sheared Soft Sphere Models near Jamming**

3:00 PM-4:40 PM

Room: Superior A

Many complex fluids exhibit nontrivial rheology: their flow is not described by the Navier-Stokes equation. Complex fluids often also exhibit instabilities and nonlinear behavior not found for regular fluids, but analysis is often based on ad-hoc phenomenological models. This symposium reviews the recent advances for systems of soft spheres (soft colloids, wet foams), for which close to the jamming point ideas developed for static packings can be extended to derive the scaling exponents and rheology under shear. Experiments on soft colloids confirm many of these features; velocity correlations and avalanches in such models are also nontrivial.

Organizer: Wim van Saarloos
Leiden University, Netherlands

3:00-3:20 Non-Newtonian Rheology of Sheared Soft Sphere Systems near the Jamming Point: An Introduction
Wim van Saarloos, Leiden University, Netherlands

3:25-3:45 Microfluidic Rheology and Dynamical Heterogeneity of Soft Colloids above and below Jamming
Douglas Durian, Kerstin Nordstrom, and Emilie Verneuil, University of Pennsylvania, USA; Jerry P. Gollub, Haverford College, USA

3:50-4:10 Asymmetries and Velocity Correlations in Shearing Media
Peter Olsson, Umeå University, Sweden

4:15-4:35 Avalanches and Diffusion in Model Bubble Rafts Near Jamming
Craig Maloney, Carnegie Mellon University, USA
Sunday, May 22

MS21
Modeling and Analysis of Oceanic Phytoplankton Growth
3:00 PM-4:40 PM
Room: Superior B
Phytoplankton forms the basis of the aquatic food chain. The dynamical behavior of phytoplankton blooms is affected by environmental conditions and, conversely, affects the environment. Most prominently, plankton blooms act as large-scale carbon pumps, removing tens of gigatons of carbon dioxide from the atmosphere per year through photosynthesis. Recent results suggest that these blooms can exhibit much more complex (possibly chaotic) dynamics than previously thought, especially when their growth is co-limited by both light and nutrients. This minisymposium presents recent research carried out in that direction.

Organizer: Antonios Zagaris
University of Twente, Netherlands
Organizer: Arjen Doelman
Leiden University, Netherlands
3:00-3:20 Emergence and Annihilation of Localized Structures in a Phytoplankton-nutrient System
Antonios Zagaris, University of Twente, Netherlands
3:25-3:45 A Weakly Nonlinear Model for Phytoplankton Pattern Formation in Estuaries
Huib de Swart, Utrecht University, The Netherlands
3:50-4:10 Bistability in Vertical Distributions of Phytoplankton in a Stratified Water Column
Kohei Toshiyama, University of Tokyo, Japan
4:15-4:35 A Game-theoretic Approach to the Vertical Distribution of Phytoplankton
Jarad Mellard, University of Kansas, USA

Coffee Break
4:40 PM-5:10 PM
Room: Golden Cliff

Sunday, May 22

MS22
Geometric Mechanics
3:00 PM-4:40 PM
Room: White Pine
This minisymposium will focus on the application of geometric methods to dynamical systems with a mechanical origin. The geometric viewpoint provides a unified framework to address a broad range of issues, such as numerical integration and qualitative dynamics. In particular, topics represented include nonholonomic mechanics, discrete dynamics, and recent progress in the three body problem. This provides a unique opportunity for mathematicians, applied mathematicians, and engineers to come together and explore their common interest in the geometric approach to mechanics.

Organizer: Jared M. Maruskin
San Jose State University, USA
3:00-3:20 Automatically Generated Variational Integrators
George Patrick, University of Saskatchewan, Canada
3:25-3:45 From Brakes-to-Syzygy in the Three-Body Problem
Richard Montgomery, University of California, Santa Cruz, USA
3:50-4:10 Frame Selection in Nonholonomic Mechanics
Jared M. Maruskin, San Jose State University, USA
4:15-4:35 Structure-Preserving Integrators for Chaplygin Systems
Dmitry Zenkov and Cameron Lynch, North Carolina State University, USA

Sunday, May 22

MS23
Theory and Computation of Lagrangian Coherent Structures - Part II of II
5:10 PM-6:50 PM
Room: Ballroom I
For Part I see MS12
Lagrangian Coherent Structures (LCS) are distinguished invariant surfaces that act as cores of observable trajectory patterns in dynamical systems. As such, LCS extend the classic concept of hyperbolic invariant manifolds to finite-time experimental and numerical data sets. This two-part minisymposium brings together theoreticians and computational experts to survey the current state of the art and challenges in LCS analysis. Part I reviews various aspects of LCS theory with an emphasis on recent analytic results, while Part II focuses on progress in the numerical computation and visualization of LCS.

Organizer: Sanjeeva Balasuriya
Connecticut College, USA
Organizer: Xavier M. Tricoche
Purdue University, USA
Organizer: George Haller
McGill University, Canada
5:10-5:30 Efficient Computation of Lagrangian Coherent Structures for Interactive Visual Analysis in Computational Fluid Dynamics
Xavier M. Tricoche, Purdue University, USA
5:35-5:55 An Eulerian Approach for Computing the Finite Time Lyapunov Exponent
Shingyu Leung, Hong Kong University of Science and Technology, Hong Kong
6:00-6:20 Ridge Surface Methods for the Visualization of LCS
Ronald Peikert, ETH Zürich, Switzerland
6:25-6:45 Fast Computation of Time-Varying Finite Time Lyapunov Exponents
Steven L. Brunton and Clarence Rowley, Princeton University, USA
Sunday, May 22

MS24

Data Assimilation in Weather, Climate, and Biomathematics - Part II of II

5:10 PM-6:50 PM

Room: Ballroom II

For Part 1 see MS13

‘Data assimilation’ refers to a class of algorithms by which initial conditions for a complex spatiotemporal model are estimated from empirical measurements and model forecasts. DA is an essential part of numerical weather prediction, but applications to climate modeling and biomathematics are becoming important. Whereas modern observing networks provide meteorologists with a nearly continuous data stream, many climate, ocean, and biological models must contend with sparse measurements that are spatially and temporally averaged over uncertain scales. This minisymposium will address some mathematical issues associated with applications of data assimilation in a general context (Part I) and in the context of modeling Earth’s atmosphere (Part II).

Organizer: Chris Danforth
University of Vermont, USA

Organizer: Christopher Jones
University of North Carolina at Chapel Hill, USA & University of Warwick, United Kingdom

Organizer: Eric J. Kostelich
Arizona State University, USA

5:10-5:30 Variance Limiting Kalman Filtering: Controlling Covariance Overestimation and Model Error

Lewis Mitchell and Georg Gottwald, University of Sydney, Australia; Sebastian Reich, Universität Potsdam, Germany

continued in next column

5:35-5:55 Lagrangian Data Assimilation for Nonlinear Ocean Process Models

Elaine Spiller, Marquette University, USA

6:00-6:20 Forecasting Regime Changes in a Chaotic Toy Climate

Kameron D. Harris and Chris Danforth, University of Vermont, USA

6:25-6:45 Effects of Nonlinear Saddles and Centers on Data Assimilation

Amit Apte, TIFR Centre, Bangalore, India; Christopher Jones, University of North Carolina at Chapel Hill, USA & University of Warwick, United Kingdom

Sunday, May 22

MS25

Different Faces of Mixing

5:10 PM-6:50 PM

Room: Ballroom III

In the current minisymposium we address theoretical, numerical, and experimental aspects of mixing from micro- to industrial-size scale in both fluid and granular flow. Two speakers will discuss mixing in tilted tanks, which will illustrate the common and distinct features of mixing in granular (Ivan Christov) vs. fluid (Thomas Ward) systems. The evolution of adiabatic 2-D structures will be discussed in both settings and it will be further theoretically investigated (Dmitri Vainchtein). Special attention will be paid to the survival of coherent structures in the presence of inertia (Herman Clercx and Thomas Ward) and appearance of specifically 3-D features.

Organizer: Dmitri Vainchtein
Temple University, USA

5:10-5:30 Formation of Coherent Structures by Fluid Inertia in 3D Laminar Flows

Herman Clercx and Michel Speetjens, Eindhoven University of Technology, Netherlands

5:35-5:55 Mixing in a Tilted Rotating Tank

Thomas Ward, North Carolina State University, USA

6:00-6:20 3D Aspects of Mixing and Transport in Tumbled Granular Flow

Ivan C. Christov, Richard M Lueptow, and Julio M Ottino, Northwestern University, USA; Rob Sturman, University of Leeds, United Kingdom; Stephen Wiggins, University of Bristol, United Kingdom

6:25-6:45 Adiabatic Mixing: Improved Invariants and Refined Boundaries

Dmitri Vainchtein and Alimu Abudu, Temple University, USA
Sunday, May 22

**MS26**

Combinatorial Neurodynamics - Part III of III

5:10 PM-6:50 PM

Room: Magpie A

For Part 2 see MS15

Neuronal networks feature a rich variety of complex spatio-temporal phenomena. The formation of patterns of neuronal activity is shaped by the interplay of the dynamical properties of the individual neurons and the structure of connections between them. It is therefore important to study the contribution of the network topology to the dynamics. The goal of this minisymposium is to highlight the role of the ideas, language, and the methods of discrete mathematics (and, in particular, of the algebraic graph theory) in the analysis of neuronal networks.

Organizer: Georgi S. Medvedev
Drexel University, USA

Organizer: Vladimir Itskov
University of Nebraska, Lincoln, USA

5:10-5:30 Using Feed-forward Maps to Explore the Role of Synaptic Dynamics in a Reciprocally Inhibitory Network

Farzan Nadim and Myongkeun Oh, New Jersey Institute of Technology, USA

5:35-5:55 Dynamical Moment Neuronal Network: Model and Approach

Wenlian Lu, Fudan University, China; Jianfeng Feng, Warwick University, United Kingdom

6:00-6:20 Networks of Phase-amplitude Neural Oscillators

Kyle C. Wedgwood and Stephen Coombes, University of Nottingham, United Kingdom

6:25-6:45 Combinatorics of Stable Sets and Learning in Recurrent Networks

Vladimir Itskov, University of Nebraska, Lincoln, USA

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Sunday, May 22

**MS27**

Nonlinear Stability of Localized Structures

5:10 PM-6:50 PM

Room: Magpie B

Localized structures are ubiquitous in nature, occurring in a multitude of systems in chemistry, physics and biology. The stability properties of these structures describe their persistence in the presence of perturbations. Nonlinear stability is particularly challenging involving a methodological extension of linear stability analysis. This minisymposium features a collection of talks by four leading researchers in this field, each having a different approach to the problem. Hence, we expect both an interesting exposition of the state-of-the-art and a platform for communication among experts.

Organizer: Martina Chirilus-Bruckner
Boston University, USA

Organizer: Peter van Heijster
Brown University, USA

5:10-5:30 Nonlinear Stability for a Model of a Source-type Defect

Margaret Beck, Boston University, USA; Toan Nguyen and Bjorn Sandstede, Brown University, USA; Kevin Zumbrun, Indiana University, USA

5:35-5:55 Stability of the Line Soliton of the KP-II Equation in $L^2(R^2 x T)$

Tetsu Mizumachi, Kyushu University, Japan; Nikolay Tzvetkov, Universite de Cergy-Pontoise, France

6:00-6:20 Nonlinear Stability of Fronts and Pulses for a Class of Reaction-diffusion Systems that Arise in Chemical Reaction Models

Anna Ghazaryan, Miami University and University of Kansas, USA; Yuri Latushkin, University of Missouri, Columbia, USA; Stephen Schecter, North Carolina State University, USA

6:25-6:45 Geometric Evolution of Structured Interfaces

Keith Promislow, Michigan State University, USA

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Sunday, May 22

**MS28**

Controlling Neurons

5:10 PM-6:50 PM

Room: Wasatch A

There is by now a long, fruitful history of using dynamical systems techniques to understand the dynamics of individual neurons and neural populations. More recently, there has been growing interest in the control of neural populations, as motivated by applications such as deep brain stimulation treatment for Parkinson’s disease, in which current is injected into the appropriate brain region to try to modify the behavior of a neural population in order to relieve the tremors associated with this disease. Talks in this session will address different approaches for controlling neurons.

Organizer: Jeff Moehlis
University of California, Santa Barbara, USA

Organizer: Ali Nabi
University of California, Santa Barbara, USA

5:10-5:30 Model Based Control of Seizures and Parkinson’s Disease

Steven J. Schiff, Pennsylvania State University, USA

5:35-5:55 Stimulation and Information in the Peripheral Nervous System

Eric Shea-Brown, University of Washington, USA

6:00-6:20 Synchronization Control of Interacting Oscillatory Ensembles by Mixed Nonlinear Delayed Feedback

Oleksandr Popovych and Peter A. Tass, Research Centre Juelich, Germany

6:25-6:45 Optimal Control for Globally Coupled Neural Networks

Ali Nabi and Jeff Moehlis, University of California, Santa Barbara, USA
Sunday, May 22

**MS29**

Epidemiology, Population Dynamics and Networks II
5:10 PM-6:50 PM

*Room:Wasatch B*

This minisymposium is about mathematical models for the spread of infectious diseases in large communities and/or over different countries. The talks concern effects of variabilities of abiotic determinants: spatial heterogeneities or seasonal variations. Particular emphasis is given on how the network and the multiscale dynamics have an effect on the epidemic spreading. General models will also be discussed and actual applications will be considered.

Organizer: Roberto A. Kraenkel  
*Instituto de Física Teórica, Brazil*

Organizer: Claudio Struchiner  
*Oswaldo Cruz Foundation, Brazil*

5:10-5:30 Investigating the Spatiotemporal Dynamics of Pandemic Influenza in Europe

*Marco Ajelli* and *Stefano Merler*, Bruno Kessler Foundation, Italy

5:35-5:55 The Role of Immunity and Seasonality in Cholera Epidemics

*Roberto A. Kraenkel*, Instituto de Física Teórica, Brazil; *Rosangela Sanchez* and *Claudia Pio Ferreira*, Universidade Estadual Paulista, Brazil

6:00-6:20 A Toy Model for Epidemics in Rio de Janeiro: The Importance of the Network Structure

*Stefanella Boatto*, Universidade Federal do Rio de Janeiro, Brazil; *Francisco C. Santos*, New University of Lisbon, Portugal; *Lucas Stolerman*, Federal University of Rio de Janerio, Brazil; *Claudia Codec* and *Fundação Oswaldo Cruz*, Brazil; *Renata Stella Khouri*, Federal University of Rio de Janeiro, Brazil

6:25-6:45 Multiscale Networks and the Spatial Spread of Infectious Diseases

*Vittoria Colizza*, INSERM, Paris, France and ISI Foundation, Torino, Italy

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Sunday, May 22

**MS30**

Evolving Dynamical Networks - Part II of II
5:10 PM-6:50 PM

*Room:Maybird*

For Part 1 see MS19

In many biological and engineering networks the coupling strength and the network topology can vary in time. In addition, the networks can adapt their structure in response to node dynamics. This minisymposium focuses on the mathematical analysis and various applications of dynamical networks whose coupling structure evolves over time, on a time scale that ranges from fast to slow.

Organizer: Igor Belykh  
*Georgia State University, USA*

Organizer: Mario Di Bernardo  
*University of Bristol, United Kingdom*

Organizer: Juergen Kurths  
*Potsdam Institute for Climate Impact Research and Humboldt University Berlin, Germany*

Organizer: Maurizio Porfiri  
*Polytechnic Institute of New York University, USA*

5:10-5:30 Evolving Dynamical Networks for Synchronization: Analysis and Emergent Properties

*Mario Di Bernardo* and *Thomas Gorochowski*, University of Bristol, United Kingdom

5:35-5:55 Adaptive Networks and the Spontaneous Emergence of Modularity and Heterogeneity

*Stefano Boccaletti*, CNR, Italy

6:00-6:20 Period Doubling and Macroscopic Chaos in a Time-varying Network of Globally Coupled Phase Oscillators

*Paul So*, George Mason University, USA

6:25-6:45 Creating Delay-tolerant Networked Dynamical Systems via Designing the Network Graphs

*Rifat Sipahi* and *Wei Qiao*, Northeastern University, USA

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Sunday, May 22

**MS31**

Nontwist Hamiltonian Systems: Theory and Applications
5:10 PM-6:50 PM

*Room:Superior A*

This minisymposium brings together researchers from several different countries to present the latest developments in the subject of nontwist Hamiltonian systems with an emphasis on the study of transition to chaos and global transport in these systems. In recent years, more and more physical systems have been found that locally violate a non-degeneracy condition, e.g., reversed magnetic shear configurations in test fusion reactors. In addition to the mathematical challenges resulting from the absence of the twist condition, these systems display a wealth of new phenomena whose mathematical origins and impact on physical models are being investigated.

Organizer: Alexander Wurm  
*Western New England College, USA*

Organizer: P.J. Morrison  
*University of Texas at Austin, USA*

5:10-5:30 Transition to Global Transport in Nontwist Area-preserving Maps: Recent Results

*Alexander Wurm*, Western New England College, USA

5:35-5:55 Adaptive Networks and the Spontaneous Emergence of Modularity and Heterogeneity

*Stefano Boccaletti*, CNR, Italy

6:00-6:20 Period Doubling and Macroscopic Chaos in a Time-varying Network of Globally Coupled Phase Oscillators

*Paul So*, George Mason University, USA

6:25-6:45 Creating Delay-tolerant Networked Dynamical Systems via Designing the Network Graphs

*Rifat Sipahi* and *Wei Qiao*, Northeastern University, USA

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*continued on next page*
Sunday, May 22

**MS31**
Nontwist Hamiltonian Systems: Theory and Applications
5:10 PM-6:50 PM

6:00-6:20 Interplay of Magnetic Shear and Resonances in Magnetic Fusion Devices
Marie-Christine Firpo, Ecole Polytechnique, Palaiseau, France; Dana Constantinescu, University of Craiova, Romania

6:25-6:45 Gyroaverage Effects on Separatrix Reconnection and Destruction of Shearless Kam Barriers in Non-Twist Systems
Diego Del-Castillo-Negrete, Oak Ridge National Laboratory, USA; Julio J. Martinell, National Autonomous University of Mexico, Mexico

Sunday, May 22

**MS32**
Biomimetic Robotics
5:10 PM-6:50 PM

Room: Superior B

A recent trend in the analysis of animal behavior has involved the construction of biomimetic robots that include animal-like sensors, actuators and neural circuit controllers and analysis of their dynamics during interaction with the environment. Development of such robots allows the investigator to instantiate hypotheses and to test their operation in a vehicle. The minisymposium focuses on the problems of nonlinear control with synthetic neurobiological networks, its modulation with sensory inputs and physical implementation of biomimetic robot.

Organizer: Joseph Ayers
Northeastern University, USA

Organizer: Nikolai Rulkov
University of California, San Diego, USA

5:10-5:30 Controlling the Zoo: A Conservative Control Model for Biomimetic Robots
Joseph Ayers, Northeastern University, USA

5:35-5:55 Using Robotic Models to Test Animal Networks and Hypothesized Connections
Roger Quinn, Case Western Reserve University, USA

6:00-6:20 Synthetic CPG Controller for Real-time Implementation of Locomotion Activity and Control System in Swimming Lamprey-base Robot
Nikolai Rulkov, University of California, San Diego, USA

6:25-6:45 Implementation of Neuronal Networks for Reactive Autonomy
Anthony Westphal, Northeastern University, USA

Sunday, May 22

**MS33**
Dynamics of Scroll Waves
5:10 PM-6:50 PM

Room: White Pine

Scroll waves are nonlinear dissipative patterns, three-dimensional extensions of spiral waves, and are observed in a variety of active media including heart muscle where they correspond to dangerous arrhythmias. Study of their dynamics by experimental, numerical and analytical approaches goes back nearly forty years. Recent advances in all three directions have revealed new aspects that may change the established concepts of filament tension and interaction of filaments with each other, with medium inhomogeneities and with external factors. The minisymposium gives a small sampling of the current state of the problem and brings together experimentalists and theoreticians working on scroll waves.

Organizer: Vadim N. Biktashev
University of Liverpool, United Kingdom

5:10-5:30 Applications of Asymptotic Theory to Scroll Wave Dynamics
Vadim N. Biktashev, Irina Biktasheva, and Stuart W. Morgan, University of Liverpool, United Kingdom; Narine Sarvazyan, George Washington University, USA

5:35-5:55 Pinning of Scroll Waves in Excitable Systems
Oliver Steinbock, Florida State University, USA

6:00-6:20 Interaction of Scroll Waves in the Presence and Absence of External Gradients
Marcus Hauser, Otto-von-Guericke University, Magdenburg, Germany

6:25-6:45 Scroll Wave Break-up and Filament Turbulence
Jörn Davidsen, University of Calgary, Canada

Dinner Break
6:50 PM-8:15 PM

Attendees on their own
Monday, May 23

MS35
Reconstruction and Analysis of Individual Dynamics in Bio-groups
8:30 AM-10:10 AM
Room: Ballroom II

The problem area is the application of mathematics and dynamical systems to (1) quantitatively reconstruct the motion of individuals in complex bio-groups and (2) invert these data to identify and validate predictive models of collective motion. This research has significant applications ranging from improved understanding of complexity in natural systems to the design of multi-agent robotic systems. Current directions of research include the use of computer vision and estimation theory to identify and track individuals in dynamic, dense groups; and the use of detection theory and statistical physics to analyze trajectories. The scope will range from fish schools to mosquito swarms.

Organizer: Derek A. Paley
University of Maryland, USA

8:30-8:50 Reconstruction and Analysis of Individual Dynamics in Fish Schools and Mosquito Swarms
Derek A. Paley and Sachit Butail, University of Maryland, USA

8:55-9:15 Tracking Fish Schools in 2D with Real-time Applications
Daniel T. Swain, Naomi E. Leonard, and Iain Couzin, Princeton University, USA

9:20-9:40 Deconfliction in Biological and Bio-inspired Coordinated Control
Kristi Morgan, University of Washington, USA

9:45-10:05 Learning Hybrid Controllers from Animal Tracking
Tucker Balch, Georgia Institute of Technology, USA

Juergen Moser
Lecture: The Many Facets of Chaos
8:30 PM-9:15 PM
Room: Ballroom

Chair: Alan R. Champneys, University of Bristol, United Kingdom

Chaos reveals itself differently in different situations. Understanding its many aspects or facets will help in creating innovative models. My talk will illustrate how different facets of chaos lead us in different directions in my recent works on:
- HIV population dynamics;
- determining the current state of the atmosphere (for weather prediction);
- genome assembly (determining the sequence of ACGT’s for a species);
- partial control of chaos.

James A. Yorke
University of Maryland, USA

Monday, May 22

Prize Presentations
Juergen Moser and J. D. Crawford
8:30 PM-9:15 PM
Room: Ballroom

Juergen Moser Lecture:
The Many Facets of Chaos
8:30 PM-9:15 PM
Room: Ballroom

Chair: Alan R. Champneys, University of Bristol, United Kingdom

Chaos reveals itself differently in different situations. Understanding its many aspects or facets will help in creating innovative models. My talk will illustrate how different facets of chaos lead us in different directions in my recent works on:
- HIV population dynamics;
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- partial control of chaos.

James A. Yorke
University of Maryland, USA
Monday, May 23

**MS36**

**Traveling Waves in Partially Parabolic Systems**

8:30 AM-10:10 AM

Room: Ballroom III

“Partially parabolic systems” have diffusion in some equations and no diffusion in others. Examples include nerve impulse equations, chemical reaction or combustion equations in which some reactants are solids, and population-interaction equations in which some populations cannot diffuse. Traveling fronts or pulses are often important solutions of such equations. Issues include proving stability when linearized operators are not sectorial; whether traveling waves and their stability properties persist when small diffusion is added; and when it is safe to ignore small diffusion terms. Speakers include researchers who have focused on some of these issues and others whose work touches on them.

Organizer: Stephen Schecter
North Carolina State University, USA

8:30-8:50 Stability of Traveling Waves for Parabolic and Partially Parabolic Combustion Problems
Anna Ghazaryan, Miami University and University of Kansas, USA; Yuri Latushkin, University of Missouri, Columbia, USA; Stephen Schecter, North Carolina State University, USA

8:55-9:15 Traveling Waves in the Buffered FHN System
Je-Chiang Tsai, National Chung Cheng University, Taiwan

9:20-9:40 Traveling Waves for Reaction-convection-diffusion Systems
Dan Marchesin, Instituto Nacional de Matematica Pura e Aplicada, Brazil; Alexei A. Mailybaev, Moscow State University, Russia; Julio D. Machado Silva, Instituto Nacional de Matematica Pura e Aplicada, Brazil

9:45-10:05 Long-time Behavior and Approximation of Nonlinear Waves
Jens Rottmann-Matthes, Bielefeld University, Germany

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Monday, May 23

**MS37**

**Dynamics of Heteroclinic Cycles and Networks**

8:30 AM-10:10 AM

Room: Magpie A

Heteroclinic cycles can occur robustly in systems with symmetries or other constraints. Heteroclinic networks are the union of several heteroclinic cycles, and dynamics near heteroclinic networks can be very complicated. As well as introducing the research area, this minisymposium will address the stability of heteroclinic networks, the nature of their basins of attraction, what might occur when the heteroclinic network loses stability, how trajectories switch between visiting different parts of the network, and how the itinerary of a trajectory passing close to the network might reliably encode ‘memory items’ in neuronal networks.

Organizer: Claire M. Postlethwaite
University of Auckland, New Zealand

Organizer: Alastair M. Rucklidge
University of Leeds, United Kingdom

8:30-8:50 Switching on a Heteroclinic Network
Claire M. Postlethwaite, University of Auckland, New Zealand; Alastair M. Rucklidge, University of Leeds, United Kingdom; Vivien Kirk, University of Auckland, New Zealand; Mary Silber, Northwestern University, USA; Emily Lane, National Institute of Water and Atmospheric Research, New Zealand

8:55-9:15 Homoclinic Cycles: Dynamics and Bifurcations
Ale Jan Homburg, University of Amsterdam, The Netherlands

9:20-9:40 Universal Computation by Switching in Neural Networks
Fabio Schittler Neves, Max Planck Institute for Dynamics and Self-Organization, Germany; Marc Timme, Max-Planck Institut fuer Stroemungsforschung, Germany

9:45-10:05 Stability Indices for Heteroclinic Networks
Peter Ashwin, University of Exeter, United Kingdom; Olga Podvigina, Institute of Earthquake Prediction Theory & Math Geophysics, Russia

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Monday, May 23

**MS38**

**Stochastic Dynamics in Biological Systems at Different Scales**

8:30 AM-10:10 AM

Room: Magpie B

Randomness plays an important role in determining the behavior of biological systems. Not only can noise change the qualitative behavior of complex biological systems but often can play an important role in driving the dynamics. Tools ranging from ordinary differential equations, stochastic differential equations and Markov models are employed to study the role of stochasticity. Each speaker will present research on the role of randomness at a different scale: we look at molecular motors within a cell, migration of individual cells and collective dynamics of a group of cells in a network.

Organizer: Badal Joshi
Duke University, USA

8:30-8:50 Collective Dynamics of Processive Molecular Motors
Avanti Athreya, Duke University, USA; John Fricks, Pennsylvania State University, USA; Pete Kramer, Rensselaer Polytechnic Institute, USA; Scott McKinley, University of Florida, USA

8:55-9:15 Stochastic Inference of Cell Migration Phenotypes
Richard Allen, University of North Carolina, Chapel Hill, USA; Christopher Welch, University of North Carolina, USA; Klaus Hahn and Tim Elston, University of North Carolina at Chapel Hill, USA

9:20-9:40 A General Markov Model for Pole Formation
Badal Joshi, Duke University, USA; Scott McKinley, University of Florida, USA; Michael C. Reed, Duke University, USA

9:45-10:05 Analytical Theory for Cascade Formation in Clustered Scale-Free Neuronal Network Model
Katherine Newhall, Peter R. Kramer, and Gregor Kovacic, Rensselaer Polytechnic Institute, USA; Max Shkarayev, College of William & Mary, USA; David Cai, Shanghai Jiao Tong University, China and Courant Institute of Mathematical Sciences, New York University, USA
Monday, May 23

**MS39**

Applications of Differential Equations and Dynamical Systems in Immunology and Medicine - Part I of III

8:30 AM-9:45 AM

Room: Wasatch A

For Part 2 see MS50

Many biomedical processes including tumor growth, cardio-vascular disease, infection, and healing are mediated by immunologic mechanisms. The study of nonlinear differential equations arises in the endeavor to characterize many complex processes observed in immunology and medical applications. This mini-symposium is dedicated to research and analysis of mathematical models of such phenomena. It is believed that the features of solutions such as instabilities, bifurcations, symmetries, and blow-up can provide insight into the nature of the underlying bio-physical mechanisms. Such insight will contribute to the understanding and treatment of disease and its spread.

Organizer: Laura Ritter

*Southern Polytechnic State University, USA*

Organizer: Akif Ibragimov

*Texas Tech University, USA*

Organizer: Jay R. Walton

*Texas A&M University, USA*

8:30-8:50 Ensemble Modeling of Human Immune Response to IAV Infection

Baris Hancioglu, Virginia Polytechnic Institute & State University, USA; Gilles Clermont and David Swigon, University of Pittsburgh, USA

8:55-9:15 The Dynamics of Foreign Body Reaction Models in 2-dimensions

Jianzhong Su, University of Texas at Arlington, USA

9:20-9:40 A Mathematical Model of Ischemic Wound Healing

Chuan Xue and Avner Friedman, Ohio State University, USA; Chandan Sen, The Ohio State University Medical Center, USA

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Monday, May 23

**MS40**

Dynamical System Methods for Design and Operation of Sustainable Buildings - Part I of II

8:30 AM-10:10 AM

Room: Wasatch B

For Part 2 see MS51

Energy consumption is a global concern for scientists and engineers as building operation accounts for approximately 40% of this consumption in developed economies. Efficient design and operation is essential to reduce this consumption. This two-part minisymposium will investigate the dynamics of high performance buildings and how current design and analysis tools are being used to make buildings more efficient. We report on efforts to quantify how uncertainty or component failures propagate through whole-building models, zoning concerns when defining models, model reduction for capturing relevant dynamics, Lagrangian coherent structures and multiple steady state analysis of airflows, and some of the current challenges to future design tools.

Organizer: Bryan Eisenhower

*University of California, Santa Barbara, USA*

Organizer: Amit Surana

*United Technologies Research Center, USA*

8:30-8:50 Challenges and Numerical Consideration in Building Energy Modeling

Michael Wetter and Wangda Zuo, Lawrence Berkeley National Laboratory, USA

8:55-9:15 Uncertainty and Sensitivity Analysis in Building Models

Bryan Eisenhower, University of California, Santa Barbara, USA

continued in next column
Monday, May 23

**MS41**

**Dynamics in Systems Biology - Part I of II**

8:30 AM-10:10 AM

Room: Maybird

*For Part 2 see MS52*

Dynamical system theory has proven to be a fundamental tool to describe fundamental processes in cell biology. In this minisymposium, we address how the theories of dynamical systems and stochastic processes provide key insight into two questions of utmost biological importance, robustness and coordination. In Part I, we will discuss how dynamics can ensure robustness to fluctuations and how to characterize robustness of a biological model to parameter changes. In Part II, we will consider how spatial coordination can be achieved in intra-cell and cell-to-cell communication, and development. Special emphasis will be put on integrating theoretical predictions with experimental results.

Organizer: Marc Lefranc
*Université de Lille 1, France*

Organizer: Marco Thiel
*University of Aberdeen, United Kingdom*

8:30-8:50 **Robustness of Circadian Clocks to Daylight Fluctuations: Hints from Picoeukaryote Ostreococcus Tauri**

Quentin Thommen, Benjamin Pfeuty, and Pierre-Emmanuel Morant, Université de Lille 1, France; Florence Corellou, Observatoire Océanologique de Banyuls, France; François-Yves Bouget, CNRS, France; *Marc Lefranc*, Université de Lille 1, France

8:55-9:15 **Translational Regulation of Gene Expression**

*M. Carmen Romano*, Luca Ciandrini, and Ian Stansfield, University of Aberdeen, United Kingdom

continued in next column

9:20-9:40 **Ribosome Traffic During Protein Synthesis**

*David Broomhead*, University of Manchester, United Kingdom

9:45-10:05 **Identifiability and Observability Analysis for Experimental Design in Nonlinear Dynamical Models in Systems Biology**

*Andreas Raue* and *Clemens Kreutz*, University of Freiburg, Germany; *Ursula Klingmueller*, German Cancer Research Center, Germany; *Jens Timmer*, University of Freiburg, Germany

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Monday, May 23

**MS42**

**Exploring High-dimensional Chaos with Characteristic Lyapunov Vectors**

8:30 AM-10:10 AM

Room: Superior A

Characteristic Lyapunov vectors (CLVs) carry the dynamical information of the system: they are intrinsic, independent of the scalar product, and invariant under time reversal. However, until recently, it was not known how to compute CLVs efficiently in large systems. Over the last 50 years, these computational difficulties have made researchers to replace genuine CLVs by other, less useful and incomplete quantifiers, easier to compute but with doubtful meaning. Very novel computational algorithms have recently allowed to compute truly covariant CLVs in complex high-dimensional systems. The session will cover applications of CLV including correlations of CLVs, hydrodynamic modes, and hyperbolicity of extended dynamical systems, among others.

Organizer: Juan M. Lopez
*Instituto de Física de Cantabria (IFCA), Spain*

Organizer: Antonio Politi
*CNR, Italy*

8:30-8:50 **Characteristic Lyapunov Vectors: Critical Overview and State of the Art**

*Diego Pazó*, Instituto de Física de Cantabria (IFCA), Spain

8:55-9:15 **Efficient Computation of Characteristic Lyapunov Vectors in Spatially Extended Systems**

*Christopher L. Wolfe*, Scripps Institution of Oceanography, USA; *Roger Samelson*, Oregon State University, USA

9:20-9:40 **Lyapunov Analysis and Hyperbolicity of Extended Dynamical Systems**

*Hong-Liu Yang* and *Gunter Radons*, Chemnitz University of Technology, Germany

9:45-10:05 **Structure and Dynamic Localization of Characteristic Lyapunov Vectors in Anharmonic Hamiltonian Lattices**

*Mauricio Romero-Bastida*, Instituto Politécnico Nacional, Mexico
Monday, May 23

**MS43**

**Criticality and Dynamic Range in Neuronal Networks**

*8:30 AM-10:10 AM*

*Room: Superior B*

Recent experiments and several models suggest that neuronal networks may operate in a critical regime, balanced at the boundary between ordered and disordered dynamics. This minisymposium will provide an overview of current research on the origin and implications of criticality for information processing. Topics will include experimental studies connecting criticality with optimized dynamic range and neural synchrony, as well as theoretical studies of the effect of network topology on the dynamic range of neuronal networks, and how criticality can emerge in a biologically realistic neural model.

Organizer: Juan G. Restrepo
*Rochester Institute of Technology, USA*

Organizer: Woodrow L. Shew
*National Institutes of Health, USA*

8:30-8:50 *Neuronal Avalanches and Optimized Information Processing in Cortical Neural Networks*

*Woodrow L. Shew, National Institutes of Health, USA*

8:55-9:15 *Predicting Criticality and Dynamic Range in Complex Networks: Effects of Topology*

*Daniel Larremore, University of Colorado at Boulder, USA*

9:20-9:40 *Criticality and Dynamic Network Reconfiguration in Human Brain fMRI and MEG Recordings*

*Manfred G. Kitzbichler, University of Cambridge, United Kingdom*

9:45-10:05 *Self-organized Criticality in Adaptive Neural Networks*

*Thilo Gross, Max Planck Institute for Physics of Complex Systems, Germany*

Monday, May 23

**MS44**

**Nonlinear Dynamics of Cardiac Electrophysiology**

*8:30 AM-10:10 AM*

*Room: White Pine*

The heart is an excitable system, with a wave of electrical activity triggering a calcium-mediated contraction process. The electrical waves arise from local reactions within the cell and across the cell membrane that produce propagating action potentials. Cardiac tissue can support a rich variety of dynamics, including bifurcations and spiral waves. This minisymposium will present some of the latest discoveries of complex behavior in cardiac tissue using results obtained from numerical integration of mathematical models as well as experimental data.

Organizer: Elizabeth M. Cherry
*Rochester Institute of Technology, USA*

8:30-8:50 *Alternans and Nonlinear Dynamics in Cardiac Tissue*

*Elizabeth M. Cherry, Rochester Institute of Technology, USA; Flavio H. Fenton, Cornell University, USA*

8:55-9:15 *Temperature Effects on Spatial Patterns of Cardiac Alternans*

*Alessio Gizzi, University Campus Bio-Medico of Rome, Italy; Elizabeth M. Cherry, Rochester Institute of Technology, USA; Stefan Luther, Max-Planck-Institute for Dynamics and Self-Organization, Germany; Simonetta Filippi, University of Rome La Sapienza, Italy; Flavio Fenton, Cornell University, USA*

9:20-9:40 *Spatio-Temporal Dynamics of Alternans in the Heart*

*Alena Talkachova, University of Minnesota, USA*

9:45-10:05 *Spiking and Bursting in an Autonomous Model of Mouse Ventricular Myocytes*

*Vladimir E. Bondarenko and Andrey Shilnikov, Georgia State University, USA*

Monday, May 23

**Intermission**

*10:10 AM-10:15 AM*

**CP12**

**Bifurcation Theory**

*10:15 AM-11:15 AM*

*Room: Wasatch B*

Chair: Hartmut Erzgraber, University of Exeter, United Kingdom

10:15-10:30 *Analyzing the Bifurcations of Ergodic Tori Using a Second Poincaré Section*

*Soumitro Banerjee, Indian Institute of Science Education and Research, India; Damian Giaouris, Newcastle University, United Kingdom*

10:35-10:50 *Modelling and Dynamics of Lasers Coupled by a Passive Resonator*

*Hartmut Erzgraber and Sebastian M. Wieczorek, University of Exeter, United Kingdom*

10:55-11:10 *Multiple Time Scale Dynamics in the Gyorgyi and Field Models of the Belousov-Zhabotinsky Reaction*

*Christopher J. Scheper and John Guckenheimer, Cornell University, USA*
Monday, May 23

CP13
Data Assimilation
10:15 AM-11:15 AM
Room: Ballroom I
Chair: Andrew M. Fraser, Los Alamos National Laboratory, USA

10:15-10:30 Dynamics of the Data Assimilation Linked Ecosystem Carbon Model (dalec)
Anna M. Chuter, University of Surrey, United Kingdom

10:35-10:50 Optimal Phase Response Curve for Synchronization of Limit-Cycle Oscillators.
Shigefumi Hata and Hiroya Nakao, Kyoto University, Japan

10:55-11:10 The Dynamic Radiation Environment Assimilation Model Project (dream)
Humberto C. Godinez and Andrew M. Fraser, Los Alamos National Laboratory, USA

Monday, May 23

CP14
Stochastics I
10:15 AM-11:15 AM
Room: Superior A
Chair: Xiaowen Li, Beijing Normal University, China and University of Maryland, USA

10:15-10:30 Scalable Parallel Physical Random Number Generator Based on a Superluminescent LED
Xiaowen Li, Beijing Normal University, China and University of Maryland, USA; Adam B. Cohen, University of Maryland, USA; Thomas E. Murphy, University of Maryland, College Park, USA; Rajarshi Roy, University of Maryland, USA

10:35-10:50 Dynamics and Bifurcations of Stochastic Mean-Field Equations
Jonathan D. Touboul, INRIA, France

10:55-11:10 The Dynamic Radiation Environment Assimilation Model Project (dream)
Humberto C. Godinez and Andrew M. Fraser, Los Alamos National Laboratory, USA

Monday, May 23

CP15
Partial Differential Equations II
10:15 AM-11:15 AM
Room: Superior B
Chair: Rouslan Krechetnikov, University of California, Santa Barbara, USA

10:15-10:30 On the Origin and Nature of Finite-Amplitude Instabilities in Physical Systems
Rouslan Krechetnikov, University of California, Santa Barbara, USA

10:35-10:50 Analytical Time and Frequency Cause-and-Effect Analyses Using Volterra Series
Ashraf Omran and Brett Newman, Old Dominion University, USA

10:55-11:10 Low-Dimensional Models and Anomaly Detection for TCP-like Networks Using the Koopman Operator
Ryan Mohr and Igor Mezic, University of California, Santa Barbara, USA
Monday, May 23

**CP16**

**CANCELLED**

10:15 AM-11:15 AM

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**CP17**

**Fluids II**

10:15 AM-11:15 AM

*Room: Maybird*

*Chair: Mohsen Gheisarieha, Virginia Polytechnic Institute & State University, USA*

10:15-10:30 An Arbitrary Stokes Flow in and Around a Liquid Sphere

*Sripadmavati Bhavaraju, University of Hyderabad, India*

10:35-10:50 Low Dimensional Models for Optimal Streaks in the Blasius Boundary Layer

*Maria Higuera, Universidad Politécnica de Madrid, Spain; Jose Vega, Universidad Politécnica de Madrid, Spain*

10:55-11:10 Stirring and Mixing in a Stokes’ Flow: Topological Chaos, Almost Invariant Sets, and Lobe Dynamics

*Mohsen Gheisarieha and Mark Stremler, Virginia Polytechnic Institute & State University, USA*

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**CP18**

**Population Dynamics II**

10:15 AM-10:55 AM

*Room: Magpie A*

*Chair: Anuraj Singh, Indian Institute of Technology, Roorkee, India*

10:15-10:30 Effect of Delay in a Lotka-Volterra Type Predator-Prey Model with a Transmissible Disease in the Predator Species

*Sabiar Rahaman, Social Science and Humanities Society, India; Sabuddin Sarwardi, Aliah University, India; Mainul Haque, University of Nottingham, United Kingdom*

10:35-10:50 Complexity in a Prey-Predator Delayed Model with Modified Leslie-Gower and Holling-Type II Schemes

*Anuraj Singh and Sunita Gakkhar, Indian Institute of Technology Roorkee, India*
Monday, May 23

CP19
Neuroscience I
10:15 AM-11:15 AM
Room: Ballroom II
Chair: Jian-Young Wu, Georgetown University, USA

10:15-10:30 Illusory Persistent States in a Model of Visual Motion Perception
James Rankin, Olivier Faugeras, Émilien Tlapale, Romain Veltz, and Pierre Kornprobst, INRIA Sophia Antipolis, France

10:35-10:50 Patterns of Excitation Waves in Cerebral Cortex
Jian-Young Wu, Georgetown University, USA

10:55-11:10 Hebbian Learning in Hopfield Networks Leads to Reaction-Diffusion Equations on Geometrical Shapes.
Mathieu N. Galtier and Olivier Faugeras, INRIA Sophia Antipolis, France; Paul C. Bressloff, University of Utah, USA and University of Oxford, United Kingdom

Monday, May 23

CP20
Oscillators I
10:15 AM-11:15 AM
Room: Ballroom III
Chair: Alexey Kuznetsov, Indiana University - Purdue University Indianapolis, USA

10:15-10:30 Phase Oscillator Networks with Star-Like Coupling: Bifurcation Analysis
Oleksandr Burylko, Ukraine National Academy of Sciences, Ukraine; Yakov Kazanovich, Russian Academy of Sciences, Russia; Roman M. Borisyuk, University of Plymouth, United Kingdom

10:35-10:50 Sensitivity Analysis of Phase Response Curves
Pierre Sacré and Rodolphe Sepulchre, Université de Liège, Belgium

10:55-11:10 Dynamical Properties of the Repressilator Model
Alexey Kuznetsov, Indiana University - Purdue University Indianapolis, USA

Monday, May 23

CP21
Mesoscales in Complex Networks II
10:15 AM-11:15 AM
Room: Magpie B
Chair: Irene Sendina-Nadal, Universidad Rey Juan Carlos, Spain

10:15-10:30 Structural Properties and Models for Multilevel Networks
Miguel Romance, Regino Criado, Julio Flores, and Alejandro Garcia del Amo, Universidad Rey Juan Carlos, Spain; Jesus Gomez-Gardenes, Universidad de Zaragoza, Spain

10:35-10:50 Complex Networks Mesoscopically Characterized by IPO: Courtship Grammar Beyond Chance
Ruedi Stoop, Institute of Neuroinformatics ETHZ/UNIZH, Switzerland

10:55-11:10 Unveiling Multi-functional Proteins by Means of the Synchronization Properties of the PPI Network
Irene Sendina-Nadal, Universidad Rey Juan Carlos, Spain; Yanay Ofran, Bar-Ilan University, Israel; Juan A. Almendral, Javier Buldu, and Inmaculada Leyva, Universidad Rey Juan Carlos, Spain; Daqing Li and Shlomo Havlin, Bar-Ilan University, Israel; Stefano Boccaletti, CNR, Italy
Monday, May 23

**CP22**

**Dynamical Systems I**

**10:15 AM-11:15 AM**

**Room:** Wasatch A

**Chair:** Joshua Garland, University of Colorado at Boulder, USA

**10:15-10:30 Prediction of Computer Dynamics**

Joshua T. Garland and Elizabeth Bradley, University of Colorado at Boulder, USA

**10:35-10:50 The Iterated Traveler's Dilemma: Seeking Stability in An Unstable Action Space**

Philip Dasler and Predrag Tosic, University of Houston, USA

**10:55-11:10 Statistics of Branched Flow Structure in Optical Media**

Xuan Ni, Wenxu Wang, and Ying-Cheng Lai, Arizona State University, USA

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**Coffee Break**

**11:15 AM-11:45 AM**

**Room:** Golden Cliff

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**12:30 PM-2:00 PM**

**Attendees on their own**

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**Lunch Break**

**12:30 PM-2:00 PM**

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**Intermission**

**2:45 PM-3:00 PM**

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**Monday, May 23**

**IP3**

**How Can We Model the Regulation of Stress Hormones?**

**11:45 AM-12:30 PM**

**Room:** Ballroom

**Chair:** Carson C. Chow, National Institutes of Health and University of Pittsburgh, USA

Daily and monthly rhythms of hormones are well recognised. Less well known are the more rapid ultradian changes which are a characteristic of most biologically active hormone systems. We have looked at the regulation of the stress hormones – glucocorticoids – secreted by the adrenal glands. It has always been assumed that the episodic release of these hormones was a result of some form of pulse generator in the brain. A dispassionate look at this system however, revealed that there was a feedforward: feedback relationship between the pituitary gland and the adrenal gland providing scope for a peripheral oscillating hormonal system. The background to this system and the biological testing of our mathematical predictions will be described.

**Stafford Lightman**

*University of Bristol, United Kingdom*

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**IP4**

**Climate Sensitivity, Feedback and Bifurcation: From Snowball Earths to the Runaway Greenhouse**

**2:00 PM-2:45 PM**

**Room:** Ballroom

**Chair:** Mary Lou Zeeman, Bowdoin College and Cornell University, USA

The concept of climate sensitivity lays at the heart of assessment of the magnitude of the imprint of human activities on the Earth’s climate. Most commonly, the “climate” is represented by a simple projection such as a global mean temperature, and we wish to know how this changes in response to changes in a single control parameter -- usually atmospheric CO2 concentration. This problem is an instance of a broad class of related problems in parameter dependence of dynamical systems. I will discuss the shortcomings of the traditional linear approach to this problem, particularly in light of the spurious “runaway” states produced when feedback becomes large. The extension to include nonlinear effects relates in a straightforward way to bifurcation theory. I will discuss explicit examples arising from ice-albedo, water vapor, and cloud feedbacks. Finally, drawing on the logistic map as an example, I will discuss the problem of defining climate sensitivity for problems exhibiting structural instability.

**Raymond T. Pierrehumbert**

*University of Chicago, USA*
Monday, May 23

**MS45**

**Arctic Sea Ice and Climate Change: Bifurcations in Mathematical and Computational Models**

3:00 PM-4:40 PM

*Room: Ballroom I*

This minisymposium focuses on investigations of Arctic sea ice loss, with increases in greenhouse gases, within models that range in complexity from low order dynamical systems to state-of-the-art global climate models. Questions concerning evidence for multistability, bifurcations, and threshold behavior associated with seasonally varying Arctic sea ice will be addressed. In the case of low-order models these questions can be tackled analytically using tools of dynamical systems. However, there are enormous challenges in using these results to determine whether comparable bifurcations or tipping points occur in large scale global climate model simulations. These challenges will be highlighted.

Organizer: Dorian S. Abbot  
*University of Chicago, USA*

Organizer: Mary C. Silber  
*Northwestern University, USA*

3:00-3:20 Rapid Sea Ice Loss in Climate Model Simulations of a Changing Arctic  
*Marika Holland, National Center for Atmospheric Research, USA*

3:25-3:45 Factors Controlling the Stability of the Sea Ice Cover  
*Ian Eisenman, California Institute of Technology, USA*

3:50-4:10 Bifurcation Analysis of a Low-Order Model of Arctic Sea Ice  
*Mary C. Silber, Northwestern University, USA; Dorian S. Abbot and Raymond T. Pierrehumbert, University of Chicago, USA*

4:15-4:35 Sea Ice as a Discrete Map  
*Kay Huebner, Max Planck Institute for Meteorology, Hamburg, Germany*

Monday, May 23

**MS46**

**Dynamics of Spatially Extended Structures in Higher Order Systems - Part I of II**

3:00 PM-4:40 PM

*Room: Ballroom II*

For Part 2 see MS57

Many physical applications including reaction-diffusion systems, phase separation in charged polymer-solvent interactions, and ion channels are modeled by higher order systems of equations which display a range of dynamics beyond that of lower order counterparts. In higher space dimension the interaction of spots, curvature driven evolution of bi-layers and pore-like solutions leads to complex bifurcations and challenging stability problems. This minisymposium will present latest developments in this emerging field.

Organizer: Keith Promislow  
*Michigan State University, USA*

Organizer: Gurgen Hayrapetyan  
*Michigan State University, USA*

3:00-3:20 The Dynamics and Stability of Localized Spot Patterns for the Gray-Scott model in Two Dimensions  
*Michael Ward, University of British Columbia, Canada; Wan Chen, Oxford University, United Kingdom*

3:25-3:45 Geometric Evolution of bi-layers in the Functionalyzed Cahn-Hilliard Equation  
*Gurgen Hayrapetyan, Michigan State University, USA*

3:50-4:10 The Pearlring Instability in Polymer Electrolyte Solutions  
*Arjen Doelman, Leiden University, Netherlands; Greg Hayrapetyan, Michigan State University, USA; Keith Promislow, Michigan State University, USA*

4:15-4:35 Energetic Variational Approaches in Ionic Fluids and Ion Channels  
*Chun Liu, Pennsylvania State University, USA*

Monday, May 23

**MS47**

**Piecewise Isometries: Applications and Theory**

3:00 PM-4:40 PM

*Room: Ballroom III*

Recently, piecewise isometries (PWIs) have emerged as a branch of dynamical systems. They exhibit complex and intricate dynamics, despite a lack of hyperbolicity, and having zero Lyapunov exponents and zero topological entropy. In applications, PWIs have been found to play a role in areas as diverse as digital filter design and the mixing of granular matter. Discontinuities play a significant role in the dynamics of PWIs, their growth, classification and characterization reveal both understanding and open problems. The speakers of this minisymposium will address the application of PWIs in engineering and science and the role of discontinuities.

Organizer: Rob Sturman  
*University of Leeds, United Kingdom*

Organizer: Ivan C. Christov  
*Northwestern University, USA*

3:00-3:20 Dynamics and Applications of Piecewise Isometries  
*Rob Sturman, University of Leeds, United Kingdom*

3:25-3:45 Singularities of Invertible Planar Piecewise Rotations  
*Byungik Kahng, University of North Texas, USA*

3:50-4:10 Interval Exchange Discontinuity Growth and Group Actions  
*Chris Novak, University of Michigan, Dearborn, USA*

4:15-4:35 Applications of Piecewise Isometries in Electronic Engineering  
*Jonathan Deane, University of Surrey, United Kingdom*
Monday, May 23

**MS48**

**A Glimpse of Stochastic Dynamics - Part I of II**

3:00 PM-4:40 PM

Room: Magpie A

For Part 2 see MS59

Nonlinear systems are often under random influences. The uncertainties may be due to external fluctuations or unresolved scales. These random influences may affect system evolution at various spatial and temporal scales, subtly or profoundly. Taking uncertainty into account is essential in modeling various complex phenomena in biological, physical and chemical systems. The objective of this minisymposium is to bring together experts from multiple disciplines with complementary views and approaches to stochastic dynamics in the context of applications.

Organizer: Jinqiao Duan
Illinois Institute of Technology, USA

3:00-3:20 An Overview of Stochastic Dynamics
Manfred Denker, Pennsylvania State University, USA

3:25-3:45 Connection Between Discrete Stochastic Cell-based Models and Nonlinear Diffusion Equations
Mark Alber, University of Notre Dame, USA

3:50-4:10 Derivation of SPDEs for Correlated Random Walks and SDEs for Sunspot Activity
Edward J. Allen, Ummugul Bulut, Elife Dogan, and Chisum Huff, Texas Tech University, USA

4:15-4:35 Impact of Noise on Invariant Manifolds
Jinqiao Duan, Illinois Institute of Technology, USA

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**MS49**

**Time Averages of Observables: Theory, Numerics, and Applications - Part I of II**

3:00 PM-4:40 PM

Room: Magpie B

For Part 2 see MS60

Recently, averaging-based methods for analyzing dynamical systems have been gaining attention as indicated in the plenary talks of Igor Mezic (DS09) and Christopher Jones (DS11). In this minisymposium, we connect to these plenaries and explore diverse and novel methods for obtaining a range of beneficial information that one can extract from averaging purposefully chosen observables. Specifically, we will (1) discuss the theory behind several time-averaging methods for identifying coherent structures and building models, (2) consider numerical analysis issues that arise with these methods, and (3) present applications of the methods in the analysis of systems such as ocean flows and power systems.

Organizer: Marko Budisic
University of California, Santa Barbara, USA

3:00-3:20 Time Averaged Observables in Dynamical System Analysis: An Overview
Marko Budisic, University of California, Santa Barbara, USA

Sherry Scott, Marquette University, USA

3:50-4:10 Shadowing the Trajectories of Molecular Dynamics
Paul Tupper, Simon Fraser University, Canada

4:15-4:35 Convergence of Long Time Numerical Averages of SDEs
Jonathan C. Mattingly, Duke University, USA

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**MS50**

**Applications of Differential Equations and Dynamical Systems in Immunology and Medicine - Part II of III**

3:00 PM-4:40 PM

Room: Wasatch A

For Part 1 see MS39
For Part 3 see MS61

Many biomedical processes including tumor growth, cardio-vascular disease, infection, and healing are mediated by immunologic mechanisms. The study of nonlinear differential equations arises in the endeavor to characterize many complex processes observed in immunology and medical applications. This minisymposium is dedicated to research and analysis of mathematical models of such phenomena. It is believed that the features of solutions such as instabilities, bifurcations, symmetries, and blow-up can provide insight into the nature of the underlying bio-physical mechanisms. Such insight will contribute to the understanding and treatment of disease and its spread.

Organizer: Laura Ritter
Southern Polytechnic State University, USA

Organizer: Akif Ibragimov
Texas Tech University, USA

Organizer: Jay R. Walton
Texas A&M University, USA

3:00-3:20 Using a Mathematical Model to Analyze the Treatment of a Wound Infection with Oxygen Therapy
Richard Schugart, Western Kentucky University, USA

3:25-3:45 Modeling the Effects of Systemic Cortisol on the Wound Healing Process
Angela M. Reynolds, Virginia Commonwealth University, USA

continued on next page
Monday, May 23
MS50
Applications of Differential Equations and Dynamical Systems in Immunology and Medicine - Part II of III
3:00 PM-4:40 PM
continued

3:50-4:10 Dynamics of Hepatitis B Virus Infection: What Causes Viral Clearance?
Anne Catlla, Wofford College, USA; Stanca Ciupe, University of Louisiana, USA; Jonathan Forde, Hobart and William Smith Colleges, USA; David G. Schaeffer, Duke University, USA

4:15-4:35 Moving the Head: The Donderian Way
Bijoy K. Ghosh, Texas Tech University, USA

Monday, May 23
MS51
Dynamical System Methods for Design and Operation of Sustainable Buildings - Part II of II
3:00 PM-4:40 PM
Room: Wasatch B
For Part I see MS40
Energy consumption is a global concern for scientists and engineers as building operation accounts for approximately 40% of this consumption in developed economies. Efficient design and operation is essential to reduce this consumption. This two-part minisymposium will investigate the dynamics of high performance buildings and how current design and analysis tools are being used to make buildings more efficient. We report on efforts to quantify how uncertainty or component failures propagate through whole-building models, zoning concerns when defining models, model reduction for capturing relevant dynamics, Lagrangian coherent structures and multiple steady state analysis of airflows, and some of the current challenges to future design tools.

Organizer: Bryan Eisenhower
University of California, Santa Barbara, USA

Organizer: Amit Surana
United Technologies Research Center, USA

3:00-3:20 Reduced-order Models for Control of Building Indoor Environment
Sunil Ahuja and Amit Surana, United Technologies Research Center, USA; Eugene Cliff, Virginia Polytechnic Institute & State University, USA

John A. Burns, Eugene Cliff, and Lizette Zietsman, Virginia Polytechnic Institute & State University, USA

3:50-4:10 Optimal Zoning in Building Energy Models
Michael Georgescu, University of California, Santa Barbara, USA

4:15-4:35 Nonlinear Behaviors in Building Ventilation Systems
Jinchao Yuan and Leon Glicksman, Massachusetts Institute of Technology, USA

continued in next column
Monday, May 23

**MS52**

**Dynamics in Systems Biology - Part II of II**

3:00 PM-4:40 PM

Room: Maybird

For Part I see MS41

Dynamical system theory has proven to be a fundamental tool to describe fundamental processes in cell biology. In this minisymposium, we address how the theories of dynamical systems and stochastic processes provide key insight into two questions of utmost biological importance, robustness and coordination. In Part I, we will discuss how dynamics can ensure robustness to fluctuations and how to characterize robustness of a biological model to parameter changes. In Part II, we will consider how spatial coordination can be achieved in intra-cell and cell-to-cell communication, and development. Special emphasis will be put on integrating theoretical predictions with experimental results.

Organizer: Marc Lefranc

Universite de Lille 1, France

Organizer: Marco Thiel

University of Aberdeen, United Kingdom

3:00-3:20 Genetic Oscillations: From Time to Space

Mogens Jensen, Sandeep Krishna, and Simone Pigolotti, Niels Bohr Institute, Denmark

3:25-3:45 Synchronized Genetic Clocks in E. Coli

Tal Danino, Octavio Mondragon-Palomino, Lev S. Tsimring, and Jeff Hasty, University of California, San Diego, USA

3:50-4:10 How Do Cells Behave as a Collective During Embryogenesis? The Role of Cell-cell Interaction

Yasushi Saka, University of Aberdeen, United Kingdom; Cedric Lhoussaine and Celine Kuttler, Universite de Lille 1, France; Ekkehard Ullner and Marco Thiel, University of Aberdeen, United Kingdom

4:15-4:35 Bifurcation Theory for Evo-devo

Paul François, McGill University, Canada

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Monday, May 23

**MS53**

**Discrete and Continuous Waves - Part I of II**

3:00 PM-4:40 PM

Room: Superior A

For Part 2 see MS64

Nonlinear waves are a fundamental mechanism by which energy or activity can be transported from one spatial region to another in a spatially extended systems. This mini-symposium highlights recent work on the existence, stability, and interaction properties of waves for both partial differential equations and lattice differential equations. Of particular interest are differences in the dynamics between continuous and discrete systems and between one and higher space dimension.

Organizer: Aaron Hoffman

Franklin W. Olin College of Engineering, USA

Organizer: Erik Van Vleck

University of Kansas, USA

Organizer: Atanas Stefanov

University of Kansas, USA

3:00-3:20 Nonlinear Stability of Semidiscrete Shocks

Björn Sandstede, Brown University, USA

3:25-3:45 Fast and Slow Pulses for the Discrete FitzHugh-Nagumo Equation

Hermen Jan Hupkes, Brown University, USA

3:50-4:10 Propagation Failure in the Discrete Nagumo Equation

Dmitry Pelinovsky, McMaster University, Canada

4:15-4:35 Neutral Mixed Type Functional Differential Equations

Charles Lamb, University of Kansas, USA

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Monday, May 23

**MS54**

**Dynamical implications of network structures**

3:00 PM-4:40 PM

Room: Superior B

The study of complex networks of dynamical systems has become an area of wide interest, following an explosion of our knowledge of the detailed structure of connectivity in many real networks. Given this ever-expanding body of knowledge, a natural and fundamental problem for the dynamical systems community is to study how the time evolution of the node dynamics is influenced by the properties of the network structure. The speakers of this minisymposium will address various aspects of this problem using synchronization, as well as other dynamical processes taking place on the network.

Organizer: Takashi Nishikawa

Clarkson University, USA

3:00-3:20 Synchronization and Network Directionality

Takashi Nishikawa, Clarkson University, USA

3:25-3:45 Synchronization in Networks with Disconnected Components

Igor Belykh, Georgia State University, USA

3:50-4:10 Controlling Nonlinear Dynamics in Complex Networks

Adilson E. Motter, Northwestern University, USA

4:15-4:35 Building a Cancer-type Specific Metabolic Network Model

Joo Sang Lee, John Marko, and Adilson E. Motter, Northwestern University, USA
Monday, May 23

**MS55**

**Neuronal and Network Dynamics in Basal Ganglia**

3:00 PM-4:40 PM

*Room: White Pine*

Abnormalities in oscillatory activity and synchronization in the basal ganglia (BG) neurons and networks are believed to contribute to many BG–associated disorders, including Parkinson’s disease (PD). Recent experimental studies of PD and BG physiology opened a way for application of dynamical systems to a variety of important phenomena, from the oscillations in the dopaminergic cells to the beta-band synchronization in PD. We will discuss dynamical systems applications to the neurons and networks in BG to get insights into their role in the mechanisms of Parkinson’s disease and other BG disorders as well as in healthy brain function.

**Organizer:** Choongseok Park  
*Indiana University - Purdue University Indianapolis, USA*

**Organizer:** Leonid Rubchinsky  
*Indiana University-Purdue University Indianapolis (IUPUI), USA*

**3:00-3:20 Intermittent Synchronization of Basal Ganglia Activity**

Leonid Rubchinsky, and Choongseok Park, Indiana University - Purdue University Indianapolis, USA; Robert Worth, Indiana University School of Medicine, USA

**3:25-3:45 A Novel Phase Model of Subthalamic Neurons Capturing the Interaction Between Synaptic Excitation and Spike Threshold**

Michael Farries and Charles Wilson, University of Texas, San Antonio, USA

continued in next column

**3:50-4:10 Firing Pattern of Mid-brain Dopaminergic Neurons**

Joon Ha, National Institutes of Health, USA; Alexey Kuznetsov, Indiana University - Purdue University Indianapolis, USA

**4:15-4:35 Entrainment of a Thalamocortical Neuron to Periodic Sensorimotor Signals**

Dennis Guang Yang and Yixin Guo, Drexel University, USA

### Coffee Break

4:40 PM-5:10 PM

*Room: Golden Cliff*

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Monday, May 23

**MS56**

**Mathematical Neuroendocrinology - Part I of II**

5:10 PM-6:50 PM

*Room: Ballroom I*

**For Part 2 see MS67**

The regulation of hormone release from glands in the body is crucial to good health. Much of this regulation is through hormone-secreting cells in the pituitary gland. Secretion from these cells is in turn controlled largely by a region of the brain called the hypothalamus. Neuroendocrinology refers to the study of interactions between the pituitary and the hypothalamus. In this minisymposium, speakers describe mathematical models for these interactions. In addition, some of the cellular behavior is quite complex, often involving bursting electrical oscillations. This complex, multiscale behavior is also a focus area of the minisymposium.

**Organizer:** Richard Bertram  
*Florida State University, USA*

**Organizer:** Krasimira Tsaneva-Atanasova  
*University of Bristol, United Kingdom*

**Organizer:** Joel Tabak  
*Florida State University, USA*

**5:10-5:30 Mathematical Modeling of P2X7 Receptor/channel Gating**

Anmar Khadra, Arthur Sherman, Yan Zonghe, and Stanko Stojilkovic, National Institutes of Health, USA

**5:35-5:55 Model Calibration and Testing on the Same Cell**

Maurizio Tomaiuolo, Richard Bertram, Arturo Gonzalez-Iglesias, and Joel Tabak, Florida State University, USA

**6:00-6:20 Mathematical Modelling of Adult GnRH Neurons in the Mouse Brain**

Wen Duan, University of Auckland, New Zealand; Kiho Lee and Allan Herbison, University of Otago, New Zealand; James Sneyd, University of Auckland, New Zealand

**6:25-6:45 Searching for the Glucocorticoid Pulse Generator**

Jamie Walker, University of Bristol, United Kingdom
Monday, May 23

MS57
Dynamics of Spatially Extended Structures in Higher Order Systems - Part II of II
5:10 PM-6:50 PM
Room: Ballroom II
For Part 1 see MS46

Many physical applications including reaction-diffusion systems, phase separation in charged polymer-solvent interactions, and ion channels are modeled by higher order systems of equations which display a range of dynamics beyond that of lower order counterparts. In higher space dimension the interaction of spots, curvature driven evolution of bilayers and pore-like solutions leads to complex bifurcations and challenging stability problems. This minisymposium will present that latest developments in this emerging field.

Organizer: Keith Promislow
Michigan State University, USA
Organizer: Gurgen Hayrapetyan
Michigan State University, USA

5:10-5:30 Pattern Selection Through Invasion in Cahn-Hilliard and Phase-Field Models
Arnd Scheel, University of Minnesota, Minneapolis, USA

5:35-5:55 Existence of Homoclinic Solutions of the Functionalized Cahn-Hilliard Equation
Li Yang, Michigan State University, USA; Keith Promislow, Michigan State University, USA

6:00-6:20 Accelerating and Oscillating Fronts in a Three-component System
Martina Chirilus-Bruckner, Boston University, USA; Jens Rademacher, CWI, Amsterdam, Netherlands; Arjen Doelman, Leiden University, Netherlands

6:25-6:45 Towards Traveling Spots in a Three-component FitzHugh-Nagumo System
Peter van Heijster and Bjorn Sandstede, Brown University, USA

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Monday, May 23

MS58
Piecewise Affine Maps: Theory
5:10 PM-6:50 PM
Room: Ballroom III

Piecewise affine (linear plus constant) maps arise in models of hybrid systems and mechanics. They are also interesting in their own right. A theory is emerging for the general case, addressing invariant measures, topological entropy and periodic orbits. At the same time special cases continue to fascinate: piecewise isometries have structures reminiscent of Hamiltonian dynamics, and there has been a resurgence of work on the continuous case (boundary-collisions, Lozi maps) showing resonant tongues (see the conference logo!) and proofs of the existence of simple geometric attractors. We will address recent developments and look at how the different cases interact.

Organizer: Paul Glendinning
University of Manchester, United Kingdom

5:10-5:30 Piecewise Isometries
Arek Goetz, San Francisco State University, USA

5:35-5:55 Entropy of the Lozi Maps
Yutaka Ishii, Kyushu University, Japan

6:00-6:20 Resonance in Piecewise-smooth Continuous Maps
David J. Simpson, University of British Columbia, Canada

6:25-6:45 Two-dimensional Attractors of the Border Collision Normal Form
Paul Glendinning, University of Manchester, United Kingdom

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Monday, May 23

MS59
A Glimpse of Stochastic Dynamics - Part II of II
5:10 PM-6:50 PM
Room: Magpie A
For Part 1 see MS48

Nonlinear systems are often under random influences. The uncertainties may be due to external fluctuations or unresolved scales. These random influences may affect system evolution at various spatial and temporal scales, subtly or profoundly. Taking uncertainty into account is essential in modeling various complex phenomena in biological, physical and chemical systems. The objective of this minisymposium is to bring together experts from multiple disciplines with complementary views and approaches to stochastic dynamics in the context of applications.

Organizer: Jingqiao Duan
Illinois Institute of Technology, USA

5:10-5:30 Molecular Motors and Pattern Formation with Microtubules
Peter Bates, Michigan State University, USA

5:35-5:55 Dynamical Systems Driven by Levy Motions
Zhihui Yang, University of Phoenix, USA; Jingqiao Duan, Illinois Institute of Technology, USA; Peter Imkeller, Humboldt University at Berlin, Germany; Ilya Pavlyukevich, Friedrich Schiller Universität Jena, Germany

6:00-6:20 A Backward-forward Method for Simulating Stochastic Inertial Manifolds
Xingye Kan and Jingqiao Duan, Illinois Institute of Technology, USA; Yannis Kevrekidis, Princeton University, USA; Anthony J. Roberts, University of Adelaide, Australia

6:25-6:45 Multiscale Modeling for Stochastic Forest Dynamics
Maud Comboul, University of Southern California, USA; Roger Ghanem, University of Southern California, USA
Monday, May 23

MS60
Time Averages of Observables: Theory, Numerics, and Applications - Part II of II
5:10 PM-6:50 PM
Room: Magpie B
For Part 1 see MS49
Recently, averaging-based methods for analyzing dynamical systems have been gaining attention as indicated in the plenary talks of Igor Mezic (DS09) and Christopher Jones (DS11). In this minisymposium, we connect to these plenaries and explore diverse and novel methods for obtaining a range of beneficial information that one can extract from averaging purposefully chosen observables. Specifically, we will (1) discuss the theory behind several time-averaging methods for identifying coherent structures and building models, (2) consider numerical analysis issues that arise with these methods, and (3) present applications of the methods in the analysis of systems such as ocean flows and power systems.
Organizer: Marko Budisic
University of California, Santa Barbara, USA
5:10-5:30 Koopman Operator, Time Averages and the Big Oil Spill
Igor Mezic, University of California, Santa Barbara, USA
5:35-5:55 A Theory of Ergodic Partition in Continuous-time Dynamical Systems with Applications to Power System Analysis
Yoshihiko Susuki, Kyoto University, Japan
6:00-6:20 Understanding the Interplay Between Lagrangian Coherent Structures, Trajectory Complexities, and Transport in the Ocean
Irina Rypina, Woods Hole Oceanographic Institute, USA; Sherry Scott, Marquette University, USA; Lawrence Pratt, Woods Hole Oceanographic Institute, USA
6:25-6:45 Probabilistic Averages of Jacobi Operators
Helge Krueger, California Institute of Technology, USA

Monday, May 23

MS61
Applications of Differential Equations and Dynamical Systems in Immunology and Medicine - Part III of III
5:10 PM-6:50 PM
Room: Wasatch A
For Part 2 see MS50
Many biomedical processes including tumor growth, cardio-vascular disease, infection, and healing are mediated by immunologic mechanisms. The study of nonlinear differential equations arises in the endeavor to characterize many complex processes observed in immunology and medical applications. This minisymposium is dedicated to research and analysis of mathematical models of such phenomena. It is believed that the features of solutions such as instabilities, bifurcations, symmetries, and blow-up can provide insight into the nature of the underlying bio-physical mechanisms. Such insight will contribute to the understanding and treatment of disease and its spread.
Organizer: Laura Ritter
Southern Polytechnic State University, USA
5:10-5:30 Stability Analysis of a Reaction-Diffusion System Modeling Atherogenesis
Laura Ritter, Southern Polytechnic State University, USA; Jay R. Walton, Texas A&M University, USA; Akif Ibragimov, Texas Tech University, USA; Catherine McNeal, Scott & White Hospital, USA
6:00-6:20 Traveling Waves of Bacterial Population Chemotaxis
Zhi-An Wang, Hong Kong Polytechnic University, China
6:25-6:45 Spatial Dynamics in a Dengue Epidemic Model
Andrew Nevai, University of Central Florida, USA; Edy Soewono, Institut Teknologi Bandung, Indonesia

5:35-5:55 Bone Remodeling Dynamics in Myeloma Bone Disease
Bruce P. Ayati, University of Iowa, USA; Claire Edwards, Vanderbilt University Medical Center, USA; Glenn F. Webb and John P. Wikswo, Vanderbilt University, USA

continued in next column
Monday, May 23

**MS62**

**Traffic Dynamics**
5:10 PM-6:50 PM

*Room: Wasatch B*

The introduction of the assembly line in the automotive industry about a century ago allowed the mass production of automobiles. This revolutionized land transportation but also generated a problem that has not yet been resolved: traffic congestion. This session will represent how state-of-the-art dynamical systems theory can be used to analyze the complex dynamics of vehicular traffic on highways as well as on urban networks. Linear and nonlinear flow stability and the effects of bottlenecks and reaction-time delays will be addressed. Understanding such dynamical phenomena is crucial for the development of future traffic control systems.

*Organizer: Gabor Orosz*

*University of Michigan, Ann Arbor, USA*

5:10-5:30 **Traffic Jams: Dynamics and Control**

*Gabor Orosz, University of Michigan, Ann Arbor, USA*

5:35-5:55 **Absolute and Convective Instability in Traffic Flow Models**

*Jonathan A. Ward, University of Limerick, Ireland; R. Eddie Wilson, University of Southampton, United Kingdom*

6:00-6:20 **Dynamics Induced by Bottlenecks**

*Ingenuin Gasser and Bodo Werner, University of Hamburg, Germany*

5:10-6:50 **Macroscopic Relations of Urban Traffic Variables: Instability, Bilurecations, and Hysteresis**

*Vikash Gayah and Carlos Daganzo, University of California, Berkeley, USA*

Monday, May 23

**MS63**

**Adaptive Network Dynamics**
5:10 PM-6:50 PM

*Room: Maybird*

The field of complex networks has recently seen the emergence of a new type of model, adaptive networks. Adaptive networks incorporate a feedback loop between dynamics of the network and dynamics on the network. The network structure changes adaptively in response to the state of the nodes, and the nodes’ subsequent dynamics is affected by the network structure. Many physical systems are thought to be adaptive, including neural networks, social networks, and certain man-made communications networks. This session brings together researchers in adaptive network dynamics from a variety of fields and applications.

*Organizer: Leah Shaw*

*College of William & Mary, USA*

5:10-5:30 **Self-organized Criticality on Adaptive Networks**

*Stefan Bornholdt, University of Bremen, Germany*

5:35-5:55 **Computational Approaches to Adaptive Network Modeling**

*Hiroti Sayama, Binghamton University, USA*

6:00-6:20 **Adaptive-network Models for Collective Motion**

*Cristian Huepe, USA; Gerd Zschaler, Max Planck Institute for Physics of Complex Systems, Germany; Anne-Ly Do, Max Planck Institute for Complex Systems, Germany; Thilo Gross, Max Planck Institute for Physics of Complex Systems, Germany*

6:25-6:45 **Dynamics of Epidemic Extinction in Adaptive Social Networks**

*Leah Shaw, College of William & Mary, USA; Ira Schwartz, Naval Research Laboratory, USA*

Monday, May 23

**MS64**

**Discrete and Continuous Waves - Part II of II**
5:10 PM-6:50 PM

*Room: Superior A*

For Part 1 see MS53

Nonlinear waves are a fundamental mechanism by which energy or activity can be transported from one spatial region to another in a spatially extended systems. This minisymposium highlights recent work on the existence, stability, and interaction properties of waves for both partial differential equations and lattice differential equations. Of particular interest are differences in the dynamics between continuous and discrete systems and between one and higher space dimension.

*Organizer: Aaron Hoffman*

*Franklin W. Olin College of Engineering, USA*

5:10-5:30 **Phase Transition Waves in a Diatomic Chain**

*Anna Vainchtein, University of Pittsburgh, USA; Panayotis Kevrekidis, University of Massachusetts, Amherst, USA*

5:35-5:55 **Multidimensional Stability of Planar Fronts in the Discrete Allen-Cahn Equation**

*Aaron Hoffman, Franklin W. Olin College of Engineering, USA; Erik Van Vleck, University of Kansas, USA*

6:00-6:20 **The Transverse Instability of Periodic Traveling Waves in the Generalized Kadomtsev-Petviashvili (KP) Equation**

*Mat Johnson, Indiana University, USA*

6:25-6:45 **Asymptotic Stability of Small Gap Solitons in the Nonlinear Dirac Equations**

*Atanas Stefanov, University of Kansas, USA*
Monday, May 23

**MS65**

**Linking Neuronal Network Architecture and Collective Dynamics - Part I of II**

5:10 PM-6:50 PM

*Room: Superior B*

**For Part 2 see MS76**

Networks of neurons in the brain can exhibit complex connectivity structure that is not captured by simplified or homogeneous models. Such structure may arise, for example, from spatial dependencies in connection probabilities, clustering, or non-trivial distributions of divergent and convergent connections. This added structure can yield collective dynamics that are not exhibited by simpler network models. This symposium will feature studies that relate the structure of connectivity in neuronal networks to collective dynamics such as synchrony, oscillations, or persistent activity.

Organizer: Robert Rosenbaum  
*University of Houston, USA*

Organizer: Ashok L. Kumar  
*Carnegie Mellon University, USA*

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5:10-5:30 **Non-synchronous Behavior of Oscillators on Graphs**

Bard Ermentrout, University of Pittsburgh, USA

5:35-5:55 **Collective Phase Diffusion in Networks of Noisy Oscillators**

Naoki Masuda, University of Tokyo, Japan; Yoji Kawamura, Japan  
Agency for Marine-Earth Science and Technology, Japan; Hiroshi Kori, Ochanomizu University, Japan

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6:00-6:20 **The Interaction of Intrinsic Dynamics and Network Topology in Determining Network Burst Synchrony**

Jonathan E. Rubin, University of Pittsburgh, USA

6:25-6:45 **The Impact of Cellular Dynamics, Synaptic Noise, and Synaptic Convergence on Correlations and Synchrony**

Robert Rosenbaum, University of Houston, USA

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Monday, May 23

**MS66**

**Hydrodynamics of Filaments and Particles**

5:10 PM-6:50 PM

*Room: White Pine*

Nonlinear systems comprising hydrodynamically coupled filaments and particles arise in both natural and engineered settings, particularly on small physical scales. Microorganisms employ oscillating cilia to capture food particles suspended in their surroundings, for instance, while analogous manmade actuators promise novel applications ranging from the contact-free manipulation of delicate living cells for medical research to the precision polishing of brittle surfaces. This minisymposium convenes scholars engaged in complementary theoretical, computational, and experimental research into the modeling, design, and control of such systems.

Organizer: Scott D. Kelly  
*University of North Carolina, Charlotte, USA*

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5:10-5:30 **Manipulation of Suspended Micro-Particles via Localized Fluid Boundary Dynamics**

Scott D. Kelly, University of North Carolina, Charlotte, USA

5:35-5:55 **Inertial Focusing, Ordering, and Separation of Particles in Confined Flows**

Dino Di Carlo, University of California, Los Angeles, USA

6:00-6:20 **Modeling Particle Suspensions Near Ciliated Surfaces**

Alexander Alexeev, Georgia Institute of Technology, USA

6:25-6:45 **Interaction Between an Elastic Filament and the Vesicle Membrane**

Yuan-Nan Young, New Jersey Institute of Technology, USA
Tuesday, May 24

Registration
8:00 AM-5:30 PM
Room: Ballroom Foyer

MS68
Stochastic Transitions and Bifurcation Analysis
8:30 AM-9:45 AM
Room: Ballroom II

This minisymposium aims at presenting recent advances on numerical techniques for stochastic systems, with a special focus on numerical continuation and stability computations. Numerical methods for the bifurcation analysis of multiscale complex stochastic systems have recently been proposed (equation-free methods); practical implementations are inherently problem specific, and there are still open questions concerning how to identify systematically adequate macroscopic variables, and how to choose appropriate moment maps in order to select initial data. The talks will present applications related to fluid dynamics (Samaey, Barkley) and biology (Hoyle, Laing). Samaey’s talk will also serve as a brief introduction to equation-free methods.

Organizer: Daniele Avitabile
University of Surrey, United Kingdom

8:30-8:50 Model-based Study of the Back-and-forth Transitions Between the Pulsatile and Surge Phase in GnRH Secretion
Alexandre Vidal, University of Evry-Val-d’Essonne, France; Martin Krupa, INRIA Paris-Rocquencourt Research Centre, France; Frédérique Clément, INRIA Rocquencourt, France; Mathieu Desroches, University of Bristol, United Kingdom

8:55-9:15 From Plateau to Pseudo-Plateau Bursting: Making the Transition
Wondimu W. Teka, Florida State University, USA; Krasimira Tsaneva-Atanasova, University of Bristol, United Kingdom; Richard Bertram and Joel Tabak, Florida State University, USA

9:20-9:40 Decoding Pulsatile GnRH Signals
Krasimira Tsaneva-Atanasova and Craig McArdle, University of Bristol, United Kingdom

9:45-10:05 Dynamics of Plateau Bursting in Dependence on the Location of its Equilibrium
Hinke M. Osinga and Krasimira Tsaneva-Atanasova, University of

continued in next column
Global bifurcations of maps and vector fields are characterized by the re-arrangement of stable and unstable manifolds of invariant objects under parameter variation. This may result in drastic changes of the dynamics, including transitions to chaotic dynamics. The key question is how higher-dimensional manifolds change in global bifurcations to reorganize the phase space, transforming or creating basins of attractions and chaotic sets. The objective of this minisymposium is to discuss how the study of global invariant manifolds by analytical and computational methods allows one to obtain deeper insight into the nature of global bifurcations.

Organizer: Stefanie Hittmeyer
University of Bristol, United Kingdom
Organizer: Pablo Aguirre
University of Bristol, United Kingdom

8:30-8:50 Global Invariant Manifolds Organizing Shilnikov Chaos
Pablo Aguirre, Bernd Krauskopf, and Hinke M. Osinga, University of Bristol, United Kingdom

8:55-9:15 A Lin’s Method Approach to Finding and Continuing Heteroclinic Connections Between Periodic Orbits of Saddle Type
Wenjun Zhang, University of Auckland, New Zealand; Bernd Krauskopf, University of Bristol, United Kingdom; Vivien Kirk, University of Auckland, New Zealand

continued in next column
Tuesday, May 24

**MS71**

**Pattern Formation in Biological Systems**

*8:30 AM-10:10 AM*

*Room: Magpie B*

Spatial pattern formation is an important phenomenon in many biological domains, ranging from ecology to neuroscience to developmental biology, and the application of dynamical systems methods to study biological pattern formation dates back at least to Turing’s seminal work in the mid-twentieth century. This minisymposium focuses on the formulation and analysis of PDE models of growth, development, and pattern formation in multicellular systems, viz. microbial communities and embryonic development. The models presented address two areas of current biological interest, namely the spatial patterning of gene expression in development and the growth of antibiotic tolerant bacteria, and largely consider reaction-diffusion patterns.

**Organizer:** John Burke

*Boston University, USA*

*8:30-8:50 Spatial Modeling of Bacterial Antibiotic Tolerance*

*John Burke*, Boston University, USA

*8:55-9:15 Dynamics of Persister Formation: Dosing and Fluid Interactions*

*Nick Cogan*, Florida State University, USA

*9:20-9:40 Pattern Formation in Reaction-diffusion Systems with an External Morphogen Gradient*

*Tilmann Glimm*, Western Washington University, USA

*9:45-10:05 Dorsal-ventral Patterning in Sea Urchin and Drosophila Embryos*

*Heather D. Hardway*, Boston University, USA

*9:20-9:40 Transient Vector Field Effects on Oscillations in a Neuromechanical Model of Limbed Locomotion*

*Lucy Spardy*, University of Pittsburgh, USA; *Sergey Markin* and *Natalia Shevtsova*, Drexel University College of Medicine, USA; *Boris Prilutsky*, Georgia Institute of Technology, USA; *Ilya A. Rybak*, Drexel University, USA; *Jonathan Rubin*, University of Pittsburgh, USA

*9:45-10:05 Phase Resetting in Phaseless Systems*

*Peter J. Thomas* and *Kendrick Shaw*, Case Western Reserve University, USA; *Klaus Stiefel*, Okinawa Institute of Science and Technology, Japan; *Hillel Chiel*, Case Western Reserve University, USA

continued in next column
Tuesday, May 24

**MS73**
Collective Behavior - Part I of II
8:30 AM-10:10 AM
Room: Wasatch B

For Part 2 see MS84

Collective behavior is a wide-ranging notion in that encompasses coupled oscillators, clustering in networks, herding and flocking in animals, and more. Oscillators can synchronize by phase-locking or other means; groups of nodes in a network can belong to the same or related communities; in the context of cattle, a herd might try to eat or lie down at the same time. In this minisymposium, several speakers will provide a survey of numerous aspects of collective behavior. This set of talks also serves a second purpose, as many of the speakers are young scientists who are making important contributions to these areas.

Organizer: Mason A. Porter
University of Oxford, United Kingdom

Organizer: Erik Bollt
Clarkson University, USA

8:30-8:50 Collective Chaotic Incoherence Stabilizes
Synchronization Chimera
Erik Bollt, Clarkson University, USA; Sun Jie, Northwestern University, USA; Takashi Nishikawa, Clarkson University, USA

8:55-9:15 Social Influence and the Spread of Facebook Applications
Jukka-Pekka Onnela, Harvard University, USA

9:20-9:40 Gang Dynamics in Los Angeles
Alethea Barbaro, University of California, Los Angeles, USA

9:45-10:05 Robustness of Overlapping Modular Networks
James Bagrow and Yong-Yeol Ahn, Northeastern University, USA; Sune Lehmann, Technical University of Denmark, Denmark

Tuesday, May 24

**MS74**
Modelling the Dynamics of the Atomic Force Microscope
8:30 AM-10:10 AM
Room: Maybird

The atomic force microscope celebrates its 25th birthday in 2011. Its use stretches over many disciplines from DNA analysis to microchip manufacturing. In this minisymposium we will show, using contributions by experimentalists and theoreticians, how a greater understanding of the dynamics between the microscope and the sample surface is leading to a wealth of new quantitative measuring techniques. Analysis of the highly nonlinear system is shining light on the origin of artefacts and noise in the images produced, while mathematical modelling of the interactions between the microscope, sample and surface fluid is helping to explain newly discovered operating regimes.

Organizer: Oliver D. Payton
University of Bristol, United Kingdom

8:30-8:50 High Speed Atomic Force Microscopy
Oliver D. Payton, University of Bristol, United Kingdom

8:55-9:15 Good Vibrations: Bimodal Atomic Force Microscopy
Ricardo Garcia, Instituto de Microelectronica de Madrid, Spain

9:20-9:40 The Dynamics of Tapping Mode Atomic Force Microscopy
Arvind Raman, Purdue University, USA

9:45-10:05 Hysteretic Capillary Interactions in Models of Atomic-Force Microscopy: a Bifurcation Paradigm for Nonsmooth Systems
Harry Dankowicz and Michael Katzenbach, University of Illinois at Urbana-Champaign, USA

Tuesday, May 24

**MS75**
Low-dimensional Reduction Methods and Their Applications - Part I of II
8:30 AM-10:10 AM
Room: Superior A

For Part 2 see MS86

Dimensionality reduction techniques are of growing importance due to their ability to render highly complex systems to a more manageable and insightful system of equations. In this minisymposium, a wide range of applications will be considered, from neuroscience to laser physics to turbulence control, where dimensionality reduction techniques such as those arising from principle component analysis, orthogonal decompositions or structural construction of the set of equations play a critical role in understanding the governing dynamical system of interest.

Organizer: J. Nathan Kutz
University of Washington, USA

8:30-8:50 Parabolic Resonance Instability in Near-integrable PDEs
Eli Shlizerman, University of Washington, Seattle, USA; Vered Rom-Kedar, Weizmann Institute of Science, Israel

8:55-9:15 Variational Approximations in Discrete Nonlinear Schrödinger Equations
Christopher Chong, University of Stuttgart, Germany

9:20-9:40 Dynamics and Pattern Formation in Large Systems of Spatially-Coupled Oscillators with Finite Response Times
Wai S. Lee, University of Maryland, USA; Juan G. Restrepo, University of Colorado at Boulder, USA; Edward Ott and Thomas Antonsen, University of Maryland, USA

9:45-10:05 Principal Component Analysis of the Ginzburg-Landau Equation
Edwin Ding, University of Washington, USA; Eli Shlizerman, University of Washington, Seattle, USA; J. Nathan Kutz, University of Washington, USA
Tuesday, May 24

MS76
Linking Neuronal Network Architecture and Collective Dynamics - Part II of II
8:30 AM-10:10 AM
Room: Superior B
For Part 1 see MS65
Networks of neurons in the brain can exhibit complex connectivity structure that is not captured by simplified or homogeneous models. Such structure may arise, for example, from spatial dependencies in connection probabilities, clustering, or non-trivial distributions of divergent and convergent connections. This added structure can yield collective dynamics that are not exhibited by simpler network models. This symposium will feature studies that relate the structure of connectivity in neuronal networks to collective dynamics such as synchrony, oscillations, or persistent activity.
Organizer: Ashok L. Kumar
Carnegie Mellon University, USA
Organizer: Robert Rosenbaum
University of Houston, USA
8:30-8:50 The Case Against Common Input: Why Convergence and Chains are Network Structures that Influence Synchrony in Recurrent Neuronal Networks
Duane Nykamp, University of Minnesota, USA
8:55-9:15 Slow Dynamics in Balanced Networks with Distance-dependent Connections
Ashok L. Kumar, Carnegie Mellon University, USA; Brent Doiron, University of Pittsburgh, USA
9:20-9:40 Effective Langevin Equations for Heterogeneous Coupled Neural Networks
Michael Buice, National Institutes of Health, USA; Carson C. Chow, National Institutes of Health and University of Pittsburgh, USA

Tuesday, May 24

MS77
Interface Motion in a Hele-Shaw Cell
8:30 AM-10:10 AM
Room: White Pine
Interface dynamics in a Hele-Shaw cell as well as many other physical processes are governed by the Laplacian growth model. Despite significant efforts, the model still lacks a complete mathematical description. The minisymposium addresses both theoretical understanding and applications. The problem of the avoidance of singularity formation in Hele-Shaw problem, achievable by a proper way of suction or through a physically motivated regularization of the model, is tackled. The talks present also an exponential transform appropriate for the description of planar shapes, and the modification of the Hele-Shaw model in the problem of a thin film evaporation.
Organizer: Alexander Nepomnyashchy
Technion Israel Institute of Technology, Israel
Organizer: Tatiana Savin
Ohio University, USA
8:30-8:50 The Case Against Common Input: Why Convergence and Chains are Network Structures that Influence Synchrony in Recurrent Neuronal Networks
Duane Nykamp, University of Minnesota, USA
8:55-9:15 Slow Dynamics in Balanced Networks with Distance-dependent Connections
Ashok L. Kumar, Carnegie Mellon University, USA; Brent Doiron, University of Pittsburgh, USA
9:20-9:40 Effective Langevin Equations for Heterogeneous Coupled Neural Networks
Michael Buice, National Institutes of Health, USA; Carson C. Chow, National Institutes of Health and University of Pittsburgh, USA

Tuesday, May 24

CP23
Biological Applications I
10:15 AM-11:15 AM
Room: Ballroom I
Chair: Richard Buckalew, Ohio University, USA
10:15-10:30 A Dynamical Model of the Innate Immune Response in the Lungs
Richard Buckalew and Todd Young, Ohio University, USA; Erik M. Boczko, Vanderbilt University, USA
10:35-10:50 Gradient Flow Model for Osmotic Cell Swelling
Martijn Zaal, Vrije Universiteit Amsterdam, The Netherlands
10:55-11:10 Development of a Model of Human Cardiovascular System and Heart Rate Variability
Vladimir Fonoberov, AIMdyn, Inc., USA; Igor Mezic, University of California, Santa Barbara, USA; Marsha Bates, Rutgers University, USA

Intermission
10:10 AM-10:15 AM
Tuesday, May 24

**CP24**
CANCELLED
10:15 AM-11:15 AM

**Tuesday, May 24**

**CP25**
Networks and Transport
10:15 AM-11:15 AM
Room: Wasatch A
Chair: Rosa M. Benito, Universidad Politécnica de Madrid, Spain
10:15-10:30 Mesoscale Analysis of Porous Soil Networks
Rosa M. Benito, Universidad Politécnica de Madrid, Spain; Juan Pablo Cardenas, Antonio Santiago, Ana Tarquis, and Juan Carlos Losada, Universidad Politécnica de Madrid, Spain; Florentino Borondo, Universidad Autonoma de Madrid, Spain
10:35-10:50 A Neutral Theory of Speciation Matching Empirical Diversity
Marcus A. Aguiar, Universidade Estadual de Campinas, Brazil; Yaneer Bar-Yam, New England Complex Systems Institute, USA; Michel Baranger, Massachusetts Institute of Technology, USA; Les Kaufman, Boston University, USA; Elizabeth Baptestini, UNICAMP, Brazil; Ayana Martins, Universidade de Sao Paulo, Brazil
10:55-11:10 Analysis of the Pattern Formation in Various Models of Hormone Transport
Delphine Draelants, Universiteit Antwerpen, Belgium

**Tuesday, May 24**

**CP26**
Stochastics II
10:15 AM-11:15 AM
Room: Maybird
Chair: Robert Bryce, Defence R&D Canada, Canada
10:15-10:30 Nonlinearities in Stocks As a Consequence of Socio-Political Events: Classification of Events Triggering Nonlinearity in Stock Exchange
Syed Nasir Danial and Rosheena Siddiqi, Bahria University, Pakistan
10:35-10:50 Chaotic Fluctuations in Stocks in a Market: Approximating with the Duffing-Oscillator Model
Varsha S. Kulkarni, Indiana University, USA; Raghav Gaiha, University of Delhi, India
10:55-11:10 Fluctuation Analysis Via Synthetic Diffusion
Robert Bryce, Defence R&D Canada, Canada
Tuesday, May 24

CP27
Partial Differential
Equations III
10:15 AM-11:15 AM
Room: Magpie B
Chair: Kazuyuki Yagasaki, Niigata University, Japan
10:15-10:30 Bifurcation and Stability Properties for Asymptotically Asymmetric Slowly Non-Dissipative Equations
Nitsan Ben-Gal, Weizmann Institute of Science, Israel; Kristen Moore, University of Michigan, USA; Juliette Hell, Freie Universitat Berlin, Germany
10:35-10:50 Some Applications of Differential Galois Theory in Dynamical Systems
Kazuyuki Yagasaki, Niigata University, Japan
10:55-11:10 Existence and Regularity Result for Functional Integrodifferential Equations with Finite Delay Via Fractional Operators: An Application to Bacterial Growth and Multication
Hechmi Hattab, ENIT-LAMSIN, Tunisia

Tuesday, May 24

CP28
Fluids III
10:15 AM-11:15 AM
Room: Ballroom III
Chair: John R. Mahoney, University of California, Merced, USA
10:15-10:30 Lagrangian Coherent Structures in Aerobiological Transport
Amir E. Bozorgmagham, Shane D. Ross, and David Schmale, Virginia Polytechnic Institute & State University, USA; Phanindra Tallapragada, University of North Carolina, USA
10:35-10:50 Fast Computations of Lagrangian Coherent Structures in 2 and 3 Dimensions
Douglas M. Lipinski, University of Colorado at Boulder, USA; Kamran Mohseni, University of Florida, Gainesville, USA
10:55-11:10 Invariant Manifolds in Chaotic Advection-Reaction-Diffusion Systems
John R. Mahoney and Kevin A. Mitchell, University of California, Merced, USA; Tom Solomon, Bucknell University, USA

Tuesday, May 24

CP29
Non-smooth Dynamical Systems I
10:15 AM-11:15 AM
Room: Superior B
Chair: Mario Di Bernardo, University of Bristol, United Kingdom
10:15-10:30 Multistability Analysis Via a Lyapunov-Based Approach
Qing Hui, Texas Tech University, USA
10:35-10:50 Discontinuity Geometry - An Alternative Way to Analyse Impacting Systems
Neil Humphries and Petri Piiroinen, National University of Ireland, Galway, Ireland
10:55-11:10 Non-Smooth Bifurcations in a Sustainable Development Model
Gerard Olivar, Jorge Amador, David Angulo, and Hector Granada, Universidad Nacional de Colombia, Colombia
Tuesday, May 24

**CP30**
**Systems Biology**
10:15 AM-11:15 AM
Room: Ballroom II

*Chair: John Hogan, Bristol Centre for Applied Nonlinear Mathematics and University of Bristol, United Kingdom*

10:15-10:30 The Nonlinear Dynamics of Transcription Regulation in Mammalian Timekeeping
*Richard Yamada, University of Michigan, USA*

*Mainul Haque, John King, and David dePomarai, University of Nottingham, United Kingdom*

10:55-11:10 Analysis and Design of a Versatile Synthetic Network for Inducible Gene Expression in Mammalian Systems
*John Hogan, Bristol Centre for Applied Nonlinear Mathematics and University of Bristol, United Kingdom*

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**CP31**
**CANCELLED**

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**CP32**
**Network Dynamics I**
10:15 AM-11:15 AM
Room: Magpie A

*Chair: Dane Taylor, University of Colorado at Boulder, USA*

10:15-10:30 A General Theory of Percolation Thresholds for Networks
*Dane Taylor and Juan G. Restrepo, University of Colorado at Boulder, USA*

10:35-10:50 Noise Bridges Dynamical Correlation and Topology in Coupled Oscillator Networks
*Wenxu Wang and Ying-Cheng Lai, Arizona State University, USA; Jie Ren and Baowen Li, National University of Singapore, Singapore*

*John L. Aven, National Institutes of Health, USA; Arnold Mandell, Cielo Institute, USA; Tom Holroyd and Richard Coppola, National Institutes of Health, USA*
Tuesday, May 24

CP33
Dynamical Systems II
10:15 AM-11:15 AM
Room: Wasatch B
Chair: Bruce B. Peckham, University of Minnesota, Duluth, USA

10:15-10:30 New Computational Methods for Open Dynamics
Rua Murray, University of Canterbury, New Zealand; Christopher Bose, University of Victoria, Canada

10:35-10:50 Recent Advances in Mostly Conjugacy
Rana D. Parshad, Erik Bollt, Joe Skufca, and Jiongxuan Zheng, Clarkson University, USA

10:55-11:10 A Conjecture of Lorenz: Transitive Plus Noninvertible Implies Sensitive
Bruce B. Peckham, University of Minnesota, Duluth, USA; Garrett Taft, Indiana University - Purdue University Indianapolis, USA

Coffee Break
11:15 AM-11:45 AM
Room: Golden Cliff

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

Tuesday, May 24

IP5
Robust and Generic Dynamics: A Phenomenon/mechanism Correspondence
11:45 AM-12:30 PM
Room: Ballroom
Chair: Tim Sauer, George Mason University, USA

If we consider that the mathematical formulation of natural phenomena always involves simplifications of the physical laws, real significance of a model may be accorded only to those properties that are robust under perturbations. In loose terms, robustness means that some main features of a dynamical system are shared by all nearby systems. In the talk, we will explain the structures related to the presence of robust phenomena and the universal mechanisms that lead to lack of robustness. Providing a conceptual framework, the goal is also to show how to provide a generic correspondence phenomenon/mechanism for all dynamical systems.

Enrique Pujals
Instituto Nacional de Matematica Pura e Aplicada, Brazil

Tuesday, May 24

PD1
Funding Agency Panel
12:45 PM-1:45 PM
Room: Ballroom
Co-Chair: Steven Shaw, Michigan State University, USA

Co-Chair: Hans G. Kaper, Argonne National Laboratory, USA

The purpose of this session is to allow Program Managers from various funding agencies to present brief overviews of their programs and be available for questions and discussions. There will be short presentations from three speakers.

Jeff Rogers is the Program Manager in the Microsystems Technology Office within the US Defense Advanced Research Projects Agency (DARPA).

Karin Remington is the Director of the Center for Bioinformatics and Computational Biology, part of the National Institute of General Medical Sciences which is one of the US National Institutes of Health.

Eduardo Misawa is the Program Director for the Dynamical Systems Program in the Division of Civil, Mechanical, and Manufacturing Innovation in the Directorate of Engineering at the US National Science Foundation (NSF). He is also Co-Chair of the Cyber-enabled Discovery and Innovation Initiative which is an NSF-wide activity, and Chair of the Complex Systems Working Group.

Jeff Rogers
Defense Advanced Research Projects Agency, USA

Karin Remington
National Institutes of Health, USA

Eduardo Misawa
National Science Foundation, USA
Tuesday, May 24

**IP6**

**Models and Control of Collective Spatio-Temporal Phenomena in Power Grids**

2:00 PM-2:45 PM

*Room:* Ballroom

*Chair:* Vivien Kirk, University of Auckland, New Zealand

We are asking modern power grids to serve under conditions it was not originally designed for. We also expect the grids to be smart, in how they function, how they withstand contingencies, respond to fluctuations in generation and load, and how the grids are controlled. To meet these ever increasing expectations requires extending power grid models beyond the scope of traditional power engineering. In this talk aimed at applied mathematicians and physicists I first review basics of power flows, and then outline a number of new problems in modeling, optimization and control theory for smart grids. In particular, I describe new approaches to control of voltage and reactive flow in distribution networks, algorithms to study distance to failure, and statistical analysis of cascading blackouts in transmission networks.

Michael Chertkov

*Los Alamos National Laboratory, USA*

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**Intermission**

2:45 PM-3:00 PM

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Tuesday, May 24

**MS78**

**Dynamical Systems Approaches in Smart (Power) Grids - Part I of II**

3:00 PM-4:40 PM

*Room:* Ballroom I

*For Part 2 see MS79*

This minisymposium will bring together power engineers, control theorists, applied mathematicians and statisticians to discuss dynamical systems approaches and techniques used (or to be used in the future) to study new challenging problems related to design, optimization, control and stability of power grids of the future.

Organizer: Konstantin Turitsyn

*Massachusetts Institute of Technology, USA*

Organizer: Michael Chertkov

*Los Alamos National Laboratory, USA*

3:00-3:20 Critical Slowing Down As An Indicator of Dynamic Instability in Power Systems

Paul Hines and Eduardo Cotilla-Sanchez, University of Vermont, USA

3:25-3:45 Inverse Problems in Power System Dynamics

Ian Hiskens, University of Michigan, USA

3:50-4:10 Cascading Dynamics of Power Grid Networks

Konstantin Turitsyn, Massachusetts Institute of Technology, USA

4:15-4:35 Algebraic Methods for Robust Power Grid Analysis and Design

Marian Anghel, Los Alamos National Laboratory, USA

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Tuesday, May 24

**MS79**

**Modeling Dynamics of Sleep-Wake Regulation - Part I of II**

3:00 PM-4:40 PM

*Room:* Ballroom II

*For Part 2 see MS90*

Sleep and wake states are regulated by the interactions among brainstem and hypothalamic neuronal populations and the expression of their neurotransmitters. This sleep-wake regulatory network receives inputs from the circadian pacemaker and from cortical regions that modulate sleep-wake dynamics. Significant advances have been made in translating the physiological understanding of these interactions into dynamical mathematical models. In this mini-symposium, we present different models of the sleep-wake regulatory network, its interaction with the circadian pacemaker, and the integration of models with experimental data.

Organizer: Bruce J. Gluckman

*Pennsylvania State University, USA*

Organizer: Victoria Booth

*University of Michigan, USA*

Organizer: Cecilia Diniz Behn

*University of Michigan, USA*

Organizer: Amritaba Bose

*New Jersey Institute of Technology, USA*

3:00-3:20 Overview of Sleep-Wake Regulation and Dynamics

Victoria Booth, University of Michigan, USA

3:25-3:45 Ultradian Dynamics in a Potential Formulation of Human Sleep

Andrew Phillips, Brigham and Women’s Hospital and Harvard Medical School, USA; Peter Robinson, University of Sydney, Australia; Elizabeth Klerman, Brigham and Women’s Hospital and Massachusetts General Hospital, USA

3:50-4:10 Mechanisms for Controlling REM Sleep Patterns

Amritaba Bose, New Jersey Institute of Technology, USA

4:15-4:35 Modeling the Human Sleep-Wake Cycle

Michael Rempe, Whitworth University, USA; Janet Best and David H. Terman, Ohio State University, USA
Tuesday, May 24

**MS80**

**Recent Applications of Dynamical Systems in Ecology - Part II of III**

3:00 PM-4:40 PM

*Room: Ballroom III*

For Part 1 see MS69
For Part 3 see MS91

Difference and differential equations are mathematical modeling tools which contribute to improved understanding of complex ecological and epidemiological systems. In this mini-symposium, we bring together distinguished researchers with expertise in applying these models to study problems arising from life sciences. Three sessions will focus on spatio-temporal trends, models of mutualism, and control and optimization.

Organizer: Andrea Bruder
Colorado College, USA

Organizer: Yun Kang
Arizona State University, USA

Organizer: Rachael Miller Neilan
Louisiana State University, USA

3:00-3:20 Competitive Outcomes Changed by Evolution
Jim M. Cushing, University of Arizona, USA; Rosalyn Rael, and Thomas Vincent, University of Arizona, USA

3:25-3:45 Measuring the Response of Species Interactions to Climate Change: The Use of Models and Experiments to Study Seed Dispersal by Ants
Judith Canner, California State University, Monterey Bay, USA

4:15-4:35 Management and Dynamics in a Predator-Prey Metapopulation
Kehinde Salau, Arizona State University, USA

**Tuesday, May 24**

**MS81**

**The Role of Invariant Manifolds in Global Bifurcations - Part II of II**

3:00 PM-4:40 PM

*Room: Magpie A*

For Part 1 see MS70

Global bifurcations of maps and vector fields are characterized by the re-arrangement of stable and unstable manifolds of invariant objects under parameter variation. This may result in drastic changes of the dynamics, including transitions to chaotic dynamics. The key question is how higher-dimensional manifolds change in global bifurcations to reorganize the phase space, transforming or creating basins of attractions and chaotic sets. The objective of this mini-symposium is to discuss how the study of global invariant manifolds by analytical and computational methods allows one to obtain deeper insight into the nature of global bifurcations.

Organizer: Stefanie Hittmeyer
University of Bristol, United Kingdom

Organizer: Pablo Aguirre
University of Bristol, United Kingdom

3:00-3:20 Interacting Global Manifolds in a Planar Map Model of Wild Chaos
Stefanie Hittmeyer, Bernd Krauskopf, and Hinke M. Osinga, University of Bristol, United Kingdom

3:25-3:45 Contact Bifurcations of Invariant Absorbing Sets and Basins in Noninvertible Maps
Gian Italo Bischi and Laura Gardini, University of Urbino, Italy

4:15-4:35 Global Dynamics Using Parameter-sweeping Techniques
Sergio Serrano, Roberto Barrio, and Fernando Blesa, University of Zaragoza, Spain

**Tuesday, May 24**

**MS82**

**New Directions in One-dimensional Localized Structures**

3:00 PM-4:40 PM

*Room: Magpie B*

Recent years have seen a lot of work on localized structures in continuous systems in one spatial dimension and as a result, the basic theory for their emergence in a bifurcation scenario known as homoclinic snaking is now well understood. This minisymposium will provide an overview of current research on extensions and generalizations of the basic scenario, as well as discussions of novel applications. Addressed topics include the interaction of snaking curves with local bifurcations, the behaviour of multi-pulses and finite domain effects.

Organizer: Thomas Wagenknecht
University of Leeds, United Kingdom

Organizer: Steve Houghton
University of Leeds, United Kingdom

3:00-3:20 Homoclinic Snaking: Overview, Recent Progress and Open Questions
Alan R. Champneys, University of Bristol, United Kingdom

3:25-3:45 Defect-mediated Snaking: Spatial and Temporal Dynamics
Yiping Ma and Edgar Knobloch, University of California, Berkeley, USA

3:50-4:10 1D Localized Structures in Bounded Domains in the Lugiato-Lefever Model
Lendert Gelens, Vrije Universiteit Brussels, Belgium; Gregory Kozyreff, Université Libre de Bruxelles, Belgium

4:15-4:35 Multi-pulse Solutions in the Swift-Hohenberg Equation
Steve Houghton and Thomas Wagenknecht, University of Leeds, United Kingdom
Tuesday, May 24

**MS83**

**Dynamics of Microswimmers - Part I of II**

3:00 PM-4:40 PM

Room: Wasatch A

For Part 2 see MS94

Recent experiments have been achieving increasingly accurate measurements for how the swimming motions of microorganisms such as bacteria affect the dynamics of the surrounding fluid as well as of nearby microorganisms. This has stimulated the development of hydrodynamic and statistical theories to explain the complex flow structure and enhanced mixing induced by the swimming dynamics as well as the collective behavior of a suspension of swimming microorganisms. Of particular interest is determining to what extent the physical aspects of the swimming motion facilitate biologically beneficial coordination and transport. Speakers in this minisymposium will address recent mathematical, computational, and experimental developments.

Organizer: Peter R. Kramer
Rensselaer Polytechnic Institute, USA

3:00-3:20 An Overview of the Simulation-based Dynamics of Microswimmer Suspensions
Patrick Underhill, Rensselaer Polytechnic Institute, USA

3:25-3:45 Simulations Versus Experiments on the Rheology of Active Suspensions
Philippe Peyla, Levan Jibuti, and Salima Rafai, Universite Joseph Fourier, France

continued in next column

3:50-4:10 Alignment Dynamics and Its Effects on Effective Viscosity of Bacterial Suspensions
Dmitry Karpeev, Argonne National Laboratory, USA; Leonid Berlyand, Pennsylvania State University, USA; Igor Aronson, Argonne National Laboratory, USA; Brian Haines, Pennsylvania State University, USA; Shawn Ryan, Pennsylvania State University, USA

4:15-4:35 Oxygen Transport and Mixing Dynamics in Thin Films of Oxytactic Microorganisms
David Saintillan, Amir Alizadeh Pahlavan, and Barath Ezhilan, University of Illinois at Urbana-Champaign, USA

**MS84**

**Collective Behavior - Part II of II**

3:00 PM-4:40 PM

Room: Wasatch B

For Part 1 see MS73

Collective behavior is a wide-ranging notion in that encompasses coupled oscillators, clustering in networks, herding and flocking in animals, and more. Oscillators can synchronize by phase-locking or other means; groups of nodes in a network can belong to the same or related communities; in the context of cattle, a herd might try to eat or lie down at the same time. In this minisymposium, several speakers will provide a survey of numerous aspect of collective behavior.

Organizer: Mason A. Porter
University of Oxford, United Kingdom

Organizer: Erik Bollt
Clarkson University, USA

3:00-3:20 Synchronization of Cows
Mason A. Porter, University of Oxford, United Kingdom

3:25-3:45 Compensatory Perturbations for Network Dynamics
Jie Sun, Sagar Sahasrabudhe, and Adilson E. Motter, Northwestern University, USA

3:50-4:10 A Dynamical Systems Analysis of Territorial Behavior
Jeff Moehlis, University of California, Santa Barbara, USA; Ronald Votol, Stanford University, USA; David A. Barton, University of Bristol, United Kingdom; Takahide Gotou, Takeshi Hatanaka, and Masayuki Fujita, Tokyo Institute of Technology, Japan

4:15-4:35 Role of the Interaction Graph Topology in the Evolution of Collective Migration
Darren Pais and Naomi E. Leonard, Princeton University, USA
Tuesday, May 24

**MS85**

**Computation and Topology in Dynamics**

3:00 PM-4:40 PM

*Room: Maybird*

The modern approach to dynamical systems is based on combining local and global information. The local-global dichotomy is reflected by Conley’s decomposition theorem: “local” recurrent dynamics and “global” connecting orbits. Topological approaches are robust and global, but lack quantitative information. On the other hand, simulations and computational methods give quantitative data, but this is local in nature (both in phase- and parameter space) and sensitive to the details of the system. The theme of this minisymposium is the major challenge to get the best of both worlds: to blend topology and computation to investigate and prove properties of dynamical systems.

**Organizer:** Jan Bouwe Van Den Berg  
VU University, Amsterdam, Netherlands

**Organizer:** Robert Vandervorst  
VU University, Amsterdam, Netherlands

3:00-3:20 **Dynamics at Infinity**  
Juliette Hell, Freie Universitat Berlin, Germany

3:25-3:45 **Flow Categories**  
Thomas Rot, VU University, Amsterdam, Netherlands

3:50-4:10 **Rigorous Numerics for Connecting Orbits for Flows**  
Jason Mireles James, Rutgers University, USA

3:15-4:35 **The Euler-Floer Characteristic and Forcing of Periodic Points in Two-dimensional Diffeomorphisms**  
Simone Munao, Vrije Universiteit Amsterdam, The Netherlands

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Tuesday, May 24

**MS86**

**Low-dimensional Reduction Methods and Their Applications - Part II of II**

3:00 PM-4:40 PM

*Room: Superior A*

**For Part 1 see MS75**

Dimensionality reduction techniques are of growing importance due to their ability to render highly complex systems to a more manageable and insightful system of equations. In this minisymposium, a wide range of applications will be considered, from neuroscience to laser physics to turbulence control, where dimensionality reduction techniques such as those arising from principle component analysis, orthogonal decompositions or structural construction of the set of equations play a critical role in understanding the governing dynamical system of interest.

**Organizer:** J. Nathan Kutz  
University of Washington, USA

3:00-3:20 **Principal Component Analysis of the Water Wave Problem**  
J. Nathan Kutz, University of Washington, USA

3:25-3:45 **Discovery of Cellular Mechanisms and Prognosis of Cancers from Mathematical Modeling of DNA Microarray Data**  
Orly Alter, University of Utah, USA

3:50-4:10 **Master Stability Function Approach for Designing Synchronous Networks**  
Adam B. Cohen and Bhargava Ravoori, University of Maryland, College Park, USA; Francesco Sorrentino, Universita degli Studi di Napoli Parthenope, Italy; Thomas E. Murphy, University of Maryland, College Park, USA; Edward Ott and Rajarshi Roy, University of Maryland, USA

4:15-4:35 **Proper Orthogonal Modes for the Multi-Pulsing Instability in a Mode-Locked Laser Cavity**  
Matthew O. Williams, Eli Shlizerman, and J. Nathan Kutz, University of Washington, USA

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Tuesday, May 24

**MS87**

**Dynamics and Statistics of Neural Networks and Fields - Part I of II**

3:00 PM-4:40 PM

*Room: Superior B*

**For Part 2 see MS98**

In the nervous system, thousands or millions of neurons interact to produce even simple functionality. A variety of methods for deriving and analyzing the properties of neural networks will be presented. The approaches include mean-field and evolution models of spiking behavior and activity measures such as correlation functions, touching on a wide variety of mathematical techniques from renormalization to graph theory. These models give insight to the impact of individual neural dynamics and connectivity statistics on global behavior. Unifying these studies is the recognition that nontrivial, surprising global behavior can arise from the interactions of individual units.

**Organizer:** Eli Shlizerman  
University of Washington, Seattle, USA

**Organizer:** Andrea K. Barreiro  
University of Washington, USA

3:00-3:20 **Piecewise-smooth Neural Fields with Nonlinear Adaptation**  
Paul C. Bressloff, University of Utah, USA and University of Oxford, United Kingdom; Zachary Kilpatrick, University of Pittsburgh, USA

3:25-3:45 **Neural Activity Measures and Their Dynamics**  
Eli Shlizerman and Konrad Schroder, University of Washington, Seattle, USA; J. Nathan Kutz, University of Washington, USA

3:50-4:10 **A Network of Sparsely Active Interneurons Initiates Retinal Waves**  
Kevin Ford and Marla Feller, University of California, Berkeley, USA

4:15-4:35 **Finite Size Effects in Spiking Neural Networks**  
Carson C. Chow, National Institutes of Health and University of Pittsburgh, USA; Michael Buice, National Institutes of Health, USA
Tuesday, May 24

**MS88**  
Fluctuation and Noise in Living Organisms - Part I of II  
3:00 PM-4:40 PM  
Room: White Pine

For Part 2 see MS99

Recently, nonlinear dynamical systems with presence of noise appear to be important in the various fields in biological sciences, neurosciences and computer sciences. Recent developments have indicated that subtle and interesting noise-induced phenomena including synchronous and chaotic transition occur. These are observed even in systems that are rather simple nonlinear dynamical systems such as one-dimensional maps, oscillators, and gradient dynamics and spatially extended systems of them. In this minisymposium, we will outline recent results for each of these, address possible theoretical framework, and relate the dynamical behaviour to implications for real-world phenomena.

Organizer: Yuzuru Sato  
Hokkaido University, Japan

Organizer: Keiichi Kitajo  
RIKEN Brain Science Institute, Japan

Organizer: Jun-nosuke Teramae  
RIKEN Brain Science Institute, Japan

**3:00-3:20 Noise-induced Phenomena in One-dimensional Maps**  
Yuzuru Sato, Hokkaido University, Japan

**3:25-3:45 Amoeba-based Neurocomputing and Resource-Competing Oscillator Networks**  
Masashi Aono, RIKEN Institute of Physical and Chemical Research, Japan

**3:50-4:10 EHR Dynamics: An Introduction**  
George Hripcsak, Columbia University, USA

**4:15-4:35 Macroscopic Physiology**  
David Albers, Columbia University, USA

**Coffee Break**  
4:40 PM-5:10 PM  
Room: Golden Cliff

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**Tuesday, May 24**

**MS89**  
Dynamical Systems Approaches in Smart (Power) Grids - Part II of II  
5:10 PM-6:50 PM  
Room: Ballroom I

For Part 1 see MS78

This minisymposium will bring together power engineers, control theorists, applied mathematicians and statisticians to discuss dynamical systems approaches and techniques used (or to be used in the future) to study new challenging problems related to design, optimization, control and stability of power grids of the future.

Organizer: Konstantin Turitsyn  
Massachusetts Institute of Technology, USA

Organizer: Michael Chertkov  
Los Alamos National Laboratory, USA

**5:10-5:30 Modeling and Control of Aggregated Heterogeneous Thermostatically Controlled Loads for Ancillary Services**  
Duncan Callaway, University of California, Berkeley, USA; Stephan Koch, ETH Zürich, Switzerland; Johanna Mathieu, University of California, Berkeley, USA

**5:35-5:55 Modeling and Simulation of a Renewable and Resilient Electric Power Grid**  
Thomas Overbye, University of Illinois at Urbana-Champaign, USA

**6:00-6:20 Rules Versus Optimization for Enabling Adaptive Network Topologies**  
Seth Blumsack, and Clayton Barrows, Pennsylvania State University, USA

**6:25-6:45 Demand Response to Uncertainty in Renewable Energy**  
Steven Low and Libin Jiang, California Institute of Technology, USA

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**5:10 PM-6:25 PM**

Room: Ballroom II

**MS90**  
Modeling Dynamics of Sleep-Wake Regulation - Part II of II  
5:10 PM-6:25 PM  
Room: Ballroom II

For Part 1 see MS79

Sleep and wake states are regulated by the interactions among brainstem and hypothalamic neuronal populations and the expression of their neurotransmitters. This sleep-wake regulatory network receives inputs from the circadian pacemaker and from cortical regions that modulate sleep-wake dynamics. Significant advances have been made in translating the physiological understanding of these interactions into dynamical mathematical models. In this minisymposium, we present different models of the sleep-wake regulatory network, its interaction with the circadian pacemaker, and the integration of models with experimental data.

Organizer: Bruce J. Gluckman  
Pennsylvania State University, USA

Organizer: Victoria Booth  
University of Michigan, USA

Organizer: Cecilia Diniz Behn  
University of Michigan, USA

Organizer: Amitaba Bose  
New Jersey Institute of Technology, USA

**5:10-5:30 Modeling Circadian Modulation of Sleep-wake Regulatory Dynamics**  
Cecilia Diniz Behn, Michelle Fleshner, Daniel Forger, and Victoria Booth, University of Michigan, USA

**5:35-5:55 High-resolution Sleep Scoring Through the Mapping of EEG Onto a Cortical State Model**  
Beth A. Lopour, University of California, Los Angeles, USA; Savas Tasoglu, University of California, Berkeley, USA; Heidi E. Kirsch, University of California, San Francisco, USA; James W. Sleigh, University of Auckland, New Zealand; Andrew J. Szeri, University of California, Berkeley, USA

continued in next column
5:35-5:55 A Model for the Spread of Animal Diseases with Mitigation Strategies and a Case Study on Rinderpest

Carrie A. Manore, Oregon State University, USA; Benjamin McMahon and Jeanne Fair, Los Alamos National Laboratory, USA; James Hyman, Tulane University, USA; Mac Brown, Los Alamos National Laboratory, USA; Montiago LaBute, Lawrence Livermore National Laboratory, USA

6:00-6:20 Analyzing Endogenous Thresholds in Coupled Socioeconomic-ecological Systems

Rick Horan, Michigan State University, USA; Eli Fenichel, Arizona State University, USA; Kevin Drury, Bethel College, USA; David Lodge, Notre Dame University, USA

continued in next column
Tuesday, May 24

**MS92**

Weakly and Strongly Nonlinear Dynamics in Lattice Differential Equations
5:10 PM-6:25 PM

*Room: Magpie A*

Nonlinear lattice differential equations are used to model a wide variety of physical phenomena with examples ranging from light propagation in waveguide arrays (weakly nonlinear) to earthquake response (highly nonlinear). The analysis and properties of the structures that these equations emit, such as a solitary waves, can differ greatly depending on the nonlinearity strength. It is the goal of this minisymposium to bring together young and senior researchers who work on the analysis, computation, and experimental study of such problems in order to explore the most recent advances and to underline differences and commonality between these two types of models.

Organizer: Christopher Chong  
*University of Stuttgart, Germany*

5:10-5:30 Intrinsic Energy Localization Through Discrete Breathers in One-dimensional Diatomic Granular Crystals  
*Georgios Theocharis, California Institute of Technology, USA*

5:35-5:55 Breathers and Kinks in FPU Lattices  
*Jonathan Wattis, University of Nottingham, United Kingdom; Andrew Pickering and Pilar R. Gordoa, Universidad Rey Juan Carlos, Spain*

6:00-6:20 Internal Modes and Instabilities of Solitons in the Discrete NLS Equation  
*Anton Sakovich and Dmitry Pelinovsky, McMaster University, Canada*

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Tuesday, May 24

**MS93**

Multi-dimensional Localized Patterns
5:10 PM-6:50 PM

*Room: Magpie B*

Localized structures in greater than one dimension are seen in diverse settings ranging from oscillons in vertically vibrated media to vegetation rings in the Negev desert. Most analytical progress has been made in one dimension. In this minisymposium, we will explore the experimental, computational, and analytic methods used to understand the existence and dynamics of these patterns in higher dimensions.

Organizer: Scott McCalla  
*Brown University, USA*

5:10-5:30 Localized Patterns in the Swift-Hohenberg Equation  
*Scott McCalla, Brown University, USA*

5:35-5:55 Continuation of Oscillons in an Autonomous System of Reaction-Diffusion Equations  
*Daniele Avitabile, University of Surrey, United Kingdom*

6:00-6:20 Localised Patterns in a Crime Hotspot Model  
*David Lloyd, University of Surrey, United Kingdom*

6:25-6:45 Stability of Planar Layers in Reaction Diffusion Equations Coupled with a Conservation Law  
*Alin Pogan, University of Minnesota, USA*

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Tuesday, May 24

**MS94**

Dynamics of Microswimmers - Part II of II
5:10 PM-6:50 PM

*Room: Wasatch A*

For Part 1 see MS83

Recent experiments have been achieving increasingly accurate measurements for how the swimming motions of microorganisms such as bacteria affect the dynamics of the surrounding fluid as well as of nearby microorganisms. This has stimulated the development of hydrodynamic and statistical theories to explain the complex flow structure and enhanced mixing induced by the swimming dynamics as well as the collective behavior of a suspension of swimming microorganisms. Of particular interest is determining to what extent the physical aspects of the swimming motion facilitate biologically beneficial coordination and transport. Speakers in this minisymposium will address recent mathematical, computational, and experimental developments.

Organizer: Peter R. Kramer  
*Rensselaer Polytechnic Institute, USA*

5:10-5:30 Boundary Effects on Continuum Models for Active Suspensions  
*Christel Hohenegger, University of Utah, USA; Michael J. Shelley, Courant Institute of Mathematical Sciences, New York University, USA*

5:35-5:55 Collective Dynamics of Flagella and Multiflagellar Organisms  
*Michael D. Graham and Pieter Janssen, University of Wisconsin, Madison, USA*

6:00-6:20 Random Flow in Suspensions of Swimming Algae  
*Vasily Kantsler, Cambridge University, United Kingdom*

6:25-6:45 Constructive and Destructive Correlation Dynamics in Simple Stochastic Swimmer Models  
*Kajetan Sikorski, Peter R. Kramer, and Patrick Underhill, Rensselaer Polytechnic Institute, USA*
Tuesday, May 24

**MS95**

**Network Analysis Based on Data**

*5:10 PM-6:50 PM*

**Room:** Wasatch B

In this minisymposium we present different but complementary ways of how to infer and analyse networks based on measured data. Two possible scenarios will be discussed: (i) multivariate data are given and the topology of the network has to be inferred, and (ii) a model for a network is given, and it has to be validated based on its predictions and further comparison to experimental data. The talks presented in this minisymposium will show how these two approaches can be combined in a single iterative scheme. Examples of application will cover neuroscience, electrochemical oscillators and cell biology.

**Organizer:** Celso Grebogi  
King’s College, University of Aberdeen, United Kingdom

**Organizer:** Jens Timmer  
University of Freiburg, Germany

**5:10-5:30 Inferring Properties of Networks from Spike Trains**

**Tim Sauer,** George Mason University, USA

**5:35-5:55 Frequency Domain Based Estimations of Interactions Between Nonlinear Oscillators**

**Björn Schelter,** University of Freiburg, Germany; Marco Thiel and M. Carmen Romano, University of Aberdeen, United Kingdom; Linda Sommerlade and Jens Timmer, University of Freiburg, Germany

**6:00-6:20 Synchronization of Small Networks of Electrochemical Oscillators**

**Istvan Kiss** and Mahesh Wickramasinghe, Saint Louis University, USA

**6:25-6:45 Reactions of the Cell Cycle Network to Multiple Stresses**

**Elahe Radmaneshfar,** University of Aberdeen, United Kingdom; Celso Grebogi, King’s College, University of Aberdeen, United Kingdom; M. Carmen Romano and Marco Thiel, University of Aberdeen, United Kingdom

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**Tuesday, May 24**

**MS96**

**Jumps, Switches, Impacts, and Breaks: Discontinuities in Dynamical Systems**

*5:10 PM-6:50 PM*

**Room:** Maybird

The study of nonsmooth dynamical systems continues to challenge the way that we study and interpret discontinuities in modern modeling applications. This session will give a broad view of recent advances, covering problems from the general way that we describe switching and impact in terms of maps, flows and bifurcations, to some novel consequences such as non-determinism, forward-time ambiguities, and robust chaos. We present work that provides both a deeper theoretical understanding of discontinuities in dynamics, and new techniques to study systems wherever they suffer jumps, switches, impacts, and breaks.

**Organizer:** Stewart D. Johnson  
Williams College, USA

**Organizer:** Alan R. Champneys  
University of Bristol, United Kingdom

**5:10-5:30 Discontinuous Maps and Their Applications**

**Chris Budd** and **Karim Mora,** University of Bath, United Kingdom

**5:35-5:55 Piecewise Smooth Systems, Set Valued Fields, and Nondeterministic Chaos**

**Alessandro Colombo,** Massachusetts Institute of Technology, USA

**6:00-6:20 Stasis Sets and Approximating Cycles**

**Stewart D. Johnson,** Williams College, USA

**6:25-6:45 Title Not Available at Time to Publication**

**Arne Nordmark,** Royal Institute of Technology, Sweden

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**Tuesday, May 24**

**MS97**

**Numerical Approximations of Invariant Objects Including Lagrangian Systems**

*5:10 PM-6:25 PM*

**Room:** Superior A

This minisymposium considers two recent trends for efficient computation of dynamically invariant objects: a) methods based on the parameterization of stable and unstable manifolds and b) numerical approximation of invariant objects for Lagrangian systems which do not admit a dynamical systems interpretation. Techniques to be explored include local approximation of multidimensional manifolds and their intersections by power series and their globalization using splines. Lagrangian systems studied include implicitly defined systems such as billiards, and spatially extended systems such as long-range, Frenkel-Kontorova models and Heisenberg spin chains. The presentations will discuss the implementation and limitations of these methods.

**Organizer:** Hector E. Lomeli  
Instituto Tecnológico Autónomo de México, Mexico

**5:10-5:30 Parameterization of Invariant Manifolds for Lagrangian Systems with Long-range Interactions**

**Hector E. Lomeli,** Instituto Tecnológico Autónomo de México, Mexico; Rafael de La Llave, University of Texas, USA

**5:35-5:55 On the Lengths of Periodic Billiard Trajectories Inside Axisymmetric Analytic Convex Tables**

**Rafael Ramirez-Ros,** Universitat Politecnica de Catalunya, Spain

**6:00-6:20 Higher-order Adaptive Methods For Computing Invariant Manifolds of Maps**

**Jacek K. Wrobel** and **Roy Goodman,** New Jersey Institute of Technology, USA
Tuesday, May 24

**MS98**

**Dynamics and Statistics of Neural Networks and Fields - Part II of II**

5:10 PM-6:50 PM

Room: Superior B

For Part 1 see MS87

In the nervous system, thousands or millions of neurons interact to produce even simple functionality. A variety of methods for deriving and analyzing the properties of neural networks will be presented. The approaches include mean-field and evolution models of spiking behavior and activity measures such as correlation functions, touching on a wide variety of mathematical techniques from renormalization to graph theory. These models give insight to the impact of individual neural dynamics and connectivity statistics on global behavior. Unifying these studies is the recognition that nontrivial, surprising global behavior can arise from the interactions of individual units.

Organizer: Eli Shlizerman

_University of Washington, Seattle, USA_

Organizer: Andrea K. Barreiro

_University of Washington, USA_

5:10-5:30 Dynamical regimes of integrate-and-fire neuronal network models

_Katherine Newhall, Rensselaer Polytechnic Institute, USA_

5:35-5:55 A Kinetic Theory Model of Second Order Feedforward Neuronal Networks

_Chin-Yueh Liu, National University of Kaohsiung, Taiwan; Duane Nykamp, University of Minnesota, USA_

6:00-6:20 When are Pairwise continued in next column

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**MS99**

**Fluctuation and Noise in Living Organisms - Part II of II**

5:10 PM-6:50 PM

Room: White Pine

For Part 1 see MS88

Recently, nonlinear dynamical systems with presence of noise appear to be important in the various fields in biological sciences, neurosciences and computer sciences. Recent developments have indicated that subtle and interesting noise-induced phenomena including synchronous and chaotic transition occur. These are observed even in systems that are rather simple nonlinear dynamical systems such as one-dimensional maps, oscillators, and gradient dynamics and spatially extended systems of them. In this minisymposium, we will outline recent results for each of these, address possible theoretical framework, and relate the dynamical behaviour to implications for real-world phenomena.

Organizer: Yuzuru Sato

_Hokkaido University, Japan_

Organizer: Keiichi Kitajo

_RIKEN Brain Science Institute, Japan_

Organizer: Jun-nosuke Teramae

_RIKEN Brain Science Institute, Japan_

5:10-5:30 Stochastic Resonance and Noise-enhanced Phenomena in the Human Brain

_Keiichi Kitajo, RIKEN Brain Science Institute, Japan_

5:35-5:55 Fluctuation of Brain Dynamics Related to Perception

_Masanori Shimono, Indiana University, USA_

6:00-6:20 Encoding of Slow Signals in High-pass Phasic Neurons with Background Fluctuations

_Cheng Ly, University of Pittsburgh, USA_

6:25-6:45 Long-tailed EPSP Distribution Reveals Origin and Computational Role of Cortical Noisy Activity

_Jun-nosuke Teramae, RIKEN Brain Science Institute, Japan_
Tuesday, May 24

Dinner Break
6:50 PM-8:30 PM
Attendees on their own

Poster Session and Dessert Reception
8:30 PM-10:30 PM
Room: Ballroom

Desynchronization Bifurcation of Coupled Nonlinear Dynamical Systems
Suman Acharyya and R. E. Amritkar, Physical Research Laboratory, India

Learning from the Past: Empirical Correction of Models of Natural Chaotic Phenomena
Nicholas A. Allgaier, Kameron D. Harris, and Chris Danforth, University of Vermont, USA

Streamline Topology of Helical Fluid Flow
Morten Andersen, Technical University of Denmark, Denmark

Study of the Connectome of a Simple Spinal Cord Locomotor Network
Abul K. Azad and Roman Borisuyk, University of Plymouth, United Kingdom

Mixed Mode Oscillations in a GnRH Neuron Model
Sayanti Banerjee and Janet Best, Ohio State University, USA; Kelly Suter, University of Texas, San Antonio, USA

Mixed-Pattern Solutions of An Eighth Order Swift-Hohenberg Equation
David Bentley, University of Leeds, United Kingdom; Alastair M. Rucklidge, University of Leeds, United Kingdom; Thomas Wagenknecht and Rainer Hollerbach, University of Leeds, United Kingdom

Migration Effects on Disease Outbreaks
Jackson Burton and Lora Billings, Montclair State University, USA; Ira B. Schwartz, Naval Research Laboratory, USA; Derek Cummings, Johns Hopkins Bloomberg School of Public Health, USA

Effects of Variability and Noise on Synchrony Between Reciprocally Pulse Coupled Oscillators with Delays
Lakshmi Chandrasekaran and Shuoguo Wang, Louisiana State University Health Sciences Center, USA; Fernando Fernandez and John White, University of Utah, USA; Carmen Canavier, Louisiana State University, USA

Exploring the Dynamics of CRISPR Length: How Much Can a Bacterium Remember About Viruses That Infected It?
Lauren M. Childs, Cornell University, USA; Joshua Weitz, Georgia Institute of Technology, USA

Dynamic Switch in a Model of Unfolded Protein Response To Endoplasmic Reticulum Stress
Danilo Diedrichs, University of Iowa, USA; Rodica Curtu, University of Iowa, USA

Correction of Periodic Orbits in High Precision
Angeles Dena, Alberto Abad, and Roberto Barrio, University of Zaragoza, Spain

Existence and Stability of Traveling Wave Solutions in a Simplified Model of Cardiac Tissue
Lisa D. Driskell, Mesa State College, USA; Gregory Buzzard, Purdue University, USA

Dimension Reduction of Mechanical Systems
Michael Elmegaard, Jens Starke, Frank Schilder, and Jon J. Thomesen, Technical University of Denmark, Denmark

Frequency Response of Gonadotropin-Releasing Hormone (GnRH) Induced Gonadotropin Subunit Transcription in Pituitary Gonadotrophs
Patrick A. Fletcher, Florida State University, USA

Decay and Destruction of Invariant Tori in Volume Preserving Maps
Adam M. Fox and James Meiss, University of Colorado, Boulder, USA

Stochastic Network Models of Disease Outbreaks
Jonathan Hayes and Lora Billings, Montclair State University, USA

Comparison of Different Mean-Field Equations: Finite-Size Effects and Synchronization
Geoffroy Hermann, Jonathan D. Touboul, and Olivier Faugeras, INRIA, France

Analyzing Point Process Data by Distances and Recurrence Plots
Yoshito Hirata, University of Tokyo, Japan; Satoshi Suzuki, University of California, Berkeley, USA; Kazuyuki Aihara, JST/University of Tokyo, Japan

An Agent-Based Framework for Designing Water Efficient Residential Landscapes
Rhonda Hoenigman, University of Colorado, Boulder, USA; Elizabeth Bradley, University of Colorado at Boulder, USA; Nichole Barger, University of Colorado, Boulder, USA

Analysis of the Shimmie Phenomenon in Aircraft Main Landing Gears
Chris Howcroft, University of Bristol, United Kingdom

Adaptive Mathematical Model of Heat and Mass Transfer for Automatic Control of Solidification in Continuous Casting
Ganna Ivanova, National Academy of Science, Ukraine

Fronts and Pulses Locked to Stimuli in Continuum Neuronal Networks
Joszi Z. Jalics, Youngstown State University, USA; Bard Ermentrout and Jonathan E. Rubin, University of Pittsburgh, USA

Delay Coupled Limit Cycle Oscillators with Non-Linear Frequency Shift Effects
George L. Johnston, EduTron Corp., USA; Abhay Ram, Massachusetts Institute of Technology, USA; Abhijit Sen, Institute for Plasma Research, India

Linear Conjugacy of Chemical Reaction Networks
Matthew D. Johnston and David Siegel, University of Waterloo, Canada
Linearization of Hyperbolic Finite-Time Processes
Daniel Karrasch, TU Dresden, Germany

Transferring Time Series Analysis Methods to Point Processes
Malenka Killmann, Linda Sommerlade, Wolfgang Mader, Jens Timmer, and Björn Schelter, University of Freiburg, Germany

Clustering Generates Gamma Rhythms in a Recurrent Neuronal Network with Spike Frequency Adaptation
Zachary Kilpatrick and Bard Ermentrout, University of Pittsburgh, USA

Mixed Mode Oscillations and Graded Persistent Activity Contribute to Memory Formation
Jung Eun Kim and Janet Best, Ohio State University, USA

Intrinsic Localized Modes in Mechanically Coupled Cantilever Array with Tunable On-Site Potential
Masayuki Kimura, University of Shiga Prefecture, Japan; Takashi Hikihara, Kyoto University, Japan

Linear Response Prediction for Fluctuation-Dissipation With Adaptive Time Stepping
Marc Kjerland, University of Illinois at Chicago, USA; Rafail Abramov, University of Illinois, Chicago, USA

Amplitude Equations for SPDEs with Cubic Nonlinearities on Unbounded Domains
Konrad Klepel, Universitaet Augsburg, Germany

Numerical Continuation Applied to Landing Gear Mechanism Analysis
James Knowles, University of Bristol, United Kingdom; Bernd Krauskopf and Mark Lowenberg, University of Bristol, United Kingdom

Spatiotemporal Ecology by Remote Sensing from Satellite Imagery
Sean Kramer, Ranil Basnayake, Erik Bolt, and Aaron B. Luttman, Clarkson University, USA

Sliding Mode Control Applied to Suppress Grazing-Induced Chaos in An Impact Oscillator
Soumya Kundu, University of Michigan, Ann Arbor, USA

Stochastic Synchronization of Neuronal Populations with Intrinsic and Extrinsic Noise
Yi Ming Lai, University of Oxford, United Kingdom; Paul C. Bressloff, University of Utah, USA and University of Oxford, United Kingdom

Mathematical Modeling of Hydrodynamic Contributions to Amoeboid Cell Motility
Owen Lewis and Robert D. Guy, University of California, Davis, USA

From Synchronous Oscillations to Oscillation-arrested for Segmentation Clock Gene of Zebrafish
Kang-Ling Liao and Chih-Wen Shih, National Chiao Tung University, Taiwan

Interaction of Epidemic and Information Spreading in Adaptive Networks
Yunhan Long, College of William & Mary, USA; Thilo Gross, Max Planck Institute for Physics of Complex Systems, Germany; Leah Shaw, College of William & Mary, USA

From Bivariate Analysis to the Small World Property
Wolfgang Mader, Malenka Killmann, Linda Sommerlade, Jens Timmer, and Björn Schelter, University of Freiburg, Germany

Reducing the Dimension of Mathematical Models of Physiological Systems
Pingyu Nan, University of Auckland, New Zealand

Hybrid Deterministic/stochastic Processes and Optimal Search Strategies
Jay M. Newby, Oxford University, United Kingdom; Paul C. Bressloff, University of Utah, USA and University of Oxford, United Kingdom

Discovering Novel Treatment Strategies for Type 1 Diabetes Through Mathematical Modeling
Kenneth Haged M. Nielsen and Johnny T. Ottesen, Roskilde University, Denmark

Reconstructing Neuronal Inputs from Voltage Recordings
Stephen E. Odom and Alla Borisyuk, University of Utah, USA

Phase Reduction for Analyzing Collective Rhythms of Delay-Induced Oscillations
Yutaro Ogawa and Ikuihiro Yamaguchi, University of Tokyo, Japan; Hiroya Nakao, Kyoto University, Japan; Yashuhiko Jimbo and Kiyoshi Kotani, University of Tokyo, Japan

One Possible Mechanism Underlying Intermittently Synchronous Activity Patterns.
Choongseok Park, Indiana University - Purdue University Indianapolis, USA; Leonid Rubchinsky, Indiana University-Purdue University Indianapolis (IUPUI), USA

Symmetry Breaking Bifurcations in a $D_4$ Symmetric Hamiltonian System
Slawomir Piasecki, Roberto Barrio, and Fernando Blesa, University of Zaragoza, Spain

Optimal Trajectories, Front Tracking, and Lagrangian Structures in Coastal Ocean Flows
Blane Rhoads and Igor Mezic, University of California, Santa Barbara, USA; Andrew Poje, City University of New York, Staten Island, USA

Mode Interactions Between Superlattice Patterns
Pakwan Riyapan, University of Leeds, United Kingdom; Alastair M. Rucklidge, University of Leeds, United Kingdom

Numerical Study of Existence, Stability and Collision Properties of Dark-Bright Discrete Solitons
Azucena Alvarez and Francisco Romero, Universidad de Sevilla, Spain
Riemann Problems for Multiphase Flow with Several Thermodynamic Equilibria
Julio Daniel M. Silva and Dan Marchesin, Instituto Nacional de Matematica Pura e Aplicada, Brazil

Modelling Gang Membership in Trinidad and Tobago As An Epidemic
Joanna Sooknanan, Balswaroop Bhatt, and Donna Comissiong, University of The West Indies, Trinidad & Tobago

The Effect of Network Structure on the Path to Synchronization in Large Systems of Coupled Oscillators
John E. Stout, North Carolina State University, USA; Matthew Whiteway, University of Oklahoma, USA; Edward Ott, Michelle Girvan, and Thomas Antonsen, University of Maryland, USA

Dynamics of Actuators and Actuator Arrays
Randall Tagg, University of Colorado, Denver, USA; Vinnie Basile, Westminster High School, USA; Rod Cruz, Kearney Middle School, USA

Real-Valued Complex Chaotic Spreading Sequences with Constant Power in Complex CDMA
Ryo Takahashi, Kyoto University, Japan

Blowup Solutions of the Korteweg-De Vries Equation
Vincent Timperio, University of Leiden, The Netherlands; Vivi Rottschäfer, Leiden University, Netherlands

Synchronization of Stochastic Oscillators
Ralf Toenjes, Ochanomizu University, Japan

Pulses in Singularly Perturbed Two Component Reaction-Diffusion Equations
Arjen Doelman and Frits Veerman, Leiden University, Netherlands

An Analytical Method to Compute Bifurcation Curves for Neural Networks with Space Dependent Delays
Romain Veltz, INRIA Sophia Antipolis, France

Mathematical Modelling of Membrane Separation
Frank Vinther, Technical University of Denmark, Denmark

Pattern Formation on Small World Networks
Thomas Wagenknecht and Nick McCullen, University of Leeds, United Kingdom

Rigid Phase Shifts in Periodic Solutions of Network Systems and Network Symmetry
Yunjiao Wang, Ohio State University, USA

Slow Variable Dominance in Beta-Cell Models
Margaret A. Watts, Joel Tabak, and Richard Bertram, Florida State University, USA

Traveling Waves in a Neural Field Model of Binocular Rivalry
Matthew Webber, University of Oxford, United Kingdom; Paul C. Bressloff, University of Utah, USA and University of Oxford, United Kingdom

Spiral Defect Chaos and Skew-Varicose Instability of 2D Generalized Swift-Hohenberg Model Equations
Jinendra A. Welivita, University of Leeds, United Kingdom; Alastair M. Rucklidge, University of Leeds, United Kingdom; Steve Tobias, University of Leeds, United Kingdom

An Equationless Approach to Studying the Organizing Principles of a Multifunctional Central Pattern Generator
Jeremy Wojcik, Andrey Shilnikov, and Robert Clewley, Georgia State University, USA

Phase-Locking in Chains of Half-Center Oscillators: Mechanisms Underlying Phase Constancy in the Crayfish Swimmeret System
Jiawei Zhang and Timothy Lewis, University of California, Davis, USA

Augmented Graph Method for Synchronization in Directed Networks
Ken Zhao and Igor Belykh, Georgia State University, USA

Cardiac Disease Detection by Mostly Conjugacy
Jiongxuan Zheng, Clarkson University, USA

Time-dependent Solutions of a Convection Problem with Temperature Dependent Viscosity
Jezabel Curbelo and Ana María Mancho, Instituto de Ciencias Matematicas, Spain

Ergodic and Non-ergodic Clustering of Inertial Particles
Kristian Gustafsson, University of Gothenburg, Sweden

Persistence of Normally Hyperbolic Invariant Manifolds: The Noncompact Case
Jaap Eldering, Utrecht University, The Netherlands
MS101
Nonlinear Dynamics for Radar and Sonar
8:30 AM-10:10 AM
Room: Ballroom II
Radar has been thought of as linear, but nonlinear dynamics allows many new techniques. Chaotic sources can produce complex patterns in space, and can extend applications such as location. The interaction of chaotic signals with complex targets may be analyzed in phase space, allowing for identification of the targets. Matched filters for broad band chaotic radar signals may be built as hardware, greatly speeding signal processing. The structure of chaotic signals makes us think very differently about radar.
Organizer: Thomas L. Carroll
Naval Research Laboratory, USA
8:30-8:50 Matched Filter for Chaos Radar
Ned J. Corron, Jonathan N. Blakely, and Mark Stahl, US Army RDECOM, USA
8:55-9:15 De-Synchronized Chaos Angle Selective Radiation Systems
Jay Wilson and Bryan James, Comtech AeroAstro, Inc., USA
9:20-9:40 Acoustic Experiments with Multiple Chaotic Signal Sources
Frederic Rachford, Naval Research Laboratory, USA
9:45-10:05 Phase Space Method for Target Identification
Thomas L. Carroll, Naval Research Laboratory, USA

Wednesday, May 25
Registration
8:00 AM-5:30 PM
Room: Ballroom Foyer
MS100
Graph Theoretical Analysis in Systems Biology
8:30 AM-10:10 AM
Room: Ballroom I
Recent developments in systems biology made it crucial to get better insight into the structure and dynamics of networks that are made up of thousands of interacting molecules of DNA, proteins, metabolites, and other components. The goal of this minisymposium is to explore how graph theory methods can be applied to gain better perception of this yet little understood subject. The topics that will be discussed include reconstruction and reverse engineering of biological networks, decomposition of networks into modules and identification of cell signaling regulatory mechanisms. We will explore applications of dynamical modeling and coarse-graining the dynamics of biological networks.
Organizer: Alice Hubenko
University of California, Santa Barbara, USA
8:30-8:50 Synthesizing and Simplifying Biological Networks from Pathway Level Information
Bhaskar DasGupta, University of Illinois, Chicago, USA
8:55-9:15 Protein Kinase Target Discovery from Genome-wide mRNA Expression Profiling
Avi Ma’ayan, Mount Sinai School of Medicine, USA
9:20-9:40 Decomposition of Biological Networks
Alice Hubenko and Igor Mezic,
University of California, Santa Barbara, USA
9:45-10:05 Coarse-Graining Dynamics of (and On) Networks
Yannis Kevrekidis, Princeton University, USA; Karthikeyan Rajendran and Andreas Tsoumanis, Princeton University, USA; Constantinos Siettos, National Technical University of Athens, Greece

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<tr>
<th>Room</th>
<th>Time</th>
<th>Session Title</th>
<th>Organizer</th>
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<tr>
<td>Ballroom III</td>
<td>8:30 AM-10:10 AM</td>
<td><strong>MS102 Noise in Neural Systems</strong></td>
<td>Joshua Goldwyn, University of Neurons</td>
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<td><strong>Channel Noise in Hodgkin-Huxley Differential Equation Models for Ion Channels</strong></td>
<td>Joshua Goldwyn, University of Neurons</td>
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<td>Magpie A</td>
<td>8:30 AM-10:10 AM</td>
<td><strong>MS103 Computational Topology and the Dynamics of Computation</strong></td>
<td>Todd D. Mytkowicz, Microsoft Research, USA</td>
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<td><strong>Geometry and Topology of Computer Dynamics</strong></td>
<td>Zachary Alexander, University of Colorado at Boulder, USA</td>
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<td><strong>9:55-9:15 Stochastic Synchrony in Networks With and Without Feedback</strong></td>
<td>Todd D. Mytkowicz, Microsoft Research, USA</td>
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<td><strong>9:30-9:50 The Dynamics of Granular Materials</strong></td>
<td>Miroslav Kramar, Rutgers University, USA</td>
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<td><strong>9:45-10:05 Experimental Determination of the Homology of Invariant Manifolds</strong></td>
<td>Mark Muldoon, Jeremy Huke, and David Broomhead, University of Manchester, United Kingdom</td>
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<td><strong>From Swift-Hohenberg to Plane Couette Flow</strong></td>
<td>Tobias Schneider, Harvard University, USA</td>
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<td>Lennaert van Veen, University of Ontario Institute of Technology, Canada</td>
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Wednesday, May 25

MS105
Waves in Stratified Flows
8:30 AM-9:45 AM
Room Wasatch A

The idea of this minisymposium is to bring together people who study waves in stratified flows from slightly different angles, and we hope to have a dynamical exchange of ideas and synergy of the group combining people at different stages of their careers. Talks will look at waves stratified flows from theoretical numerical and experimental prospective, and will include flows in the ocean, atmosphere and laboratory. More specifically, we will consider internal waves in the ocean, reduced highly nonlinear models of stratified flows and two layer fluids, as well as stability results.

Organizer: Yuri V. Lvov
Rensselaer Polytechnic Institute, USA

Organizer: Roberto Camassa
University of North Carolina at Chapel Hill, USA

8:30-8:50 Generation of Shear Flows by Three-wave Interactions in Stratified Flows
Leslie Smith, University of Wisconsin, USA

8:55-9:15 Reduced Nonlinear Models of Internal Waves
Roberto Camassa, University of North Carolina at Chapel Hill, USA

9:20-9:40 Internal Waves in the Ocean - Observations, Theory and DNS
Yuri V. Lvov, Rensselaer Polytechnic Institute, USA

Wednesday, May 25

MS106
Dynamics of Hearing
8:30 AM-10:10 AM
Room Wasatch B

The auditory organs of mammals form a complex system that processes sound with great frequency and amplitude resolution and with sensitivity at the physical limits. The most intriguing organ is the inner ear that transforms sound into neural signals to be interpreted by the brain. Among the many features of the inner ear the talks will focus on amplification, sharp tuning, compressive nonlinearity and otoacoustic emissions that are signatures of the active process. Naturally, our aim is to demonstrate that techniques of dynamical systems theory play a significant role in understanding the dynamics of hearing.

Organizer: Robert Szalai
University of Bristol, United Kingdom

8:30-8:50 Dynamic Properties of Human Cochlear Processing Investigated with Otoacoustic Emissions
Sarah Verhulst, James Harte, and Torsten Dau, Technical University of Denmark, Denmark

8:55-9:15 The Effect of Tectorial Membrane and Basilar Membrane Longitudinal Coupling in Cochlear Mechanics
Julien Meaud and Karl Grosh, University of Michigan, USA

9:20-9:40 Effects of Coupling on Sensory Hair Bundles
Kai Dierkes, Max Planck Institute for the Physics of Complex Systems, Germany; Jérémie Barral, Institut Curie, France; Benjamin Lindner, Max Planck Institute for the Physics of Complex Systems, Germany; Pascal Martin, Institut Curie, France; Frank Jülicher, Max Planck Institute for the Physics of Complex Systems, Germany

9:45-10:05 A Cochlear Model Using the Time-averaged Lagrangian and the Push-pull Mechanism in the Organ of Corti
Charles Steele, Sunil Puria, and John Oghalai, Stanford University, USA

Wednesday, May 25

MS107
Aubry-Mather Theory
8:30 AM-10:10 AM
Room Maybird

Aubry-Mather Theory started in the study of Hamiltonian twist maps as a variational counterpart of KAM theory. Since then, it has brought forward many powerful techniques for finding quasi-periodic solutions of ODEs and PDEs. This minisymposium aims to give a broad impression of the field by bringing together scientists with different modern perspectives on the topic: 1. The use of gradient flows in lattice Aubry-Mather theory and PDEs. 2. Numerical techniques for computing Aubry-Mather sets and invariant curves 3. Weak KAM theory for the Hamilton-Jacobi equation. 4. Applications of Aubry-Mather theory and examples of Arnol’d diffusion

Organizer: Bob Rink
Free University Amsterdam, Netherlands

Organizer: Blaz Mramor
Vrije Universiteit Amsterdam, The Netherlands

8:30-8:50 Arnold Diffusion Along a Chain of Oscillators
Mark Levi, Pennsylvania State University, USA

8:55-9:15 Aubry-Mather Theory and Ghost Circles
Blaz Mramor, Vrije Universiteit Amsterdam, The Netherlands

9:20-9:40 Weak KAM Theory and Viscosity Solutions of Hamilton-Jacobi Equations
Yifeng Yu, University of California, Irvine, USA

9:45-10:05 Computing the Boundary of Analyticity of Families of Quasi-periodic Solutions
Renato Calleja, McGill University, Canada; Rafael de La Llave, University of Texas, USA
Major advances have recently been made in population biology through the analysis of stochastic dynamical systems. Some examples of applications include the evolution and spread of infectious disease, vaccine effectiveness, population extinction, dynamics of random mutation and selection, and modeling the evolution of drug-resistant cell populations in tumors. The purpose of this minisymposium is to expose the audience to recent progress in the field of population biology as well as to bring together researchers developing new mathematical methods for the analysis of stochastic problems in population biology.

Organizer: Eric Forgoston
Montclair State University, USA

8:30-8:50 Predicting Infectious Disease Extinction
Simone Bianco, University of California, San Francisco, USA; Eric Forgoston, Montclair State University, USA; Leah Shaw, College of William & Mary, USA; Ira B. Schwartz, Naval Research Laboratory, USA

8:55-9:15 The Effects of Stochasticity in the Dynamics of Multi-Strain Diseases
Luis Mier-y-Teran and Derek Cummings, Johns Hopkins Bloomberg School of Public Health, USA

9:20-9:40 Stochastic Dynamics of Tumorigenesis
Jasmine Foo, Harvard University, USA; Rick Durrett, Duke University, USA; Kevin Leder, Harvard University, USA; John Mayberry, University of the Pacific, USA; Franziska Michor, Harvard University, USA

9:45-10:05 Stochastic Extinction in Non-Gaussian Environments with Differential Delay
Ira B. Schwartz, Naval Research Laboratory, USA; Lora Billings, Montclair State University, USA; Thomas W. Carr, Southern Methodist University, USA; Mark I. Dykman, Michigan State University, USA

Enormous resources are devoted to the task of predicting the outcomes of social network dynamics, in domains such as economics, public policy, popular culture, and national security, but the quality of such predictions is often quite poor. Recently, important advances in network theory and dramatic increases in availability of social dynamics data are being combined to yield significant progress in exploring and exploiting the predictability of social processes. The four presentations which make up this minisymposium will characterize the predictability of social dynamics and leverage this understanding to develop mathematically-sound, empirically-grounded methods for formulating useful predictions in real world settings.

Organizer: Richard Colbaugh
Sandia National Laboratories, USA

8:30-8:50 Predictability of Social Network Dynamics: An Appraisal
Richard Colbaugh, Sandia National Laboratories, USA; Kristin Glass, New Mexico Tech, USA

8:55-9:15 Ex-ante Prediction of Cascade Sizes on Networks of Agents Facing Binary Outcomes
Paul Ormerod and Ellie Cooper, Volterra Consulting, LLC, United Kingdom

9:20-9:40 Reachability Analysis of Idea Propagation on Networks with Community Structure
Michael Bencomo, New Mexico Tech, USA

9:45-10:05 Sentiment-Over-Time Analysis of Tweets
Alexander D. George, New Mexico Institute of Mining and Technology, USA
Wednesday, May 25

MS110
Dynamics of Cytoplasm in Amoeboid Cells: Experiments and Mathematical Models
8:30 AM-10:10 AM
Room: White Pine

The true slime mold Physarum polycephalum is a single cell organism reaching up to meters in size. The cell exhibits regular, periodic cytoplasmic streaming through a complex, highly adaptable network formed by the cytoskeleton. Cytoplasmic streaming is essential for locomotion of the cell as well as intracellular communication of chemical and physical signals across the large distances spanned by the cell. This minisymposium will include talks on recent experimental and theoretical advances including whole-cell measurements of cytoplasmic streaming and cytoskeletal rearrangement and mathematical models of cell behavior controlled by the modulation of cytoplasmic rheology, cell shape, and cytoskeletal dynamics.

Organizer: Robert D. Guy
University of California, Davis, USA
Organizer: Toshiyuki Nakagaki
Hokkaido University, Japan

8:30-8:50 Mechanics of Amoeboid Locomotion Driven by Contraction Waves and Friction Control
Toshiyuki Nakagaki and Yoshimi Tanaka
Hokkaido University, Japan

Serge Bielawski, PhLAM/Université Lille I, France; Paul Dely, Université de Lille 1, France; Christophe Szwaj, PhLAM/Université Lille I, France; Eric Lacot, Lab. Spectro, France; Olivier Hugon, Universite Joseph Fourier, France; Toshiyuki Nakagaki, Hokkaido University, Japan

continued in next column

9:20-9:40 Channeling Instabilities in the Cytoplasm of Amoeboid Cells
Robert D. Guy, University of California, Davis, USA; Toshiyuki Nakagaki, Hokkaido University, Japan; Grady B. Wright, Boise State University, USA

9:45-10:05 Transport and Mixing of Cytosol Through the Whole Body of Physarum Plasmodium
Makoto Iima and Toshiyuki Nakagaki, Hokkaido University, Japan

Intermission
10:10 AM-10:15 AM

Wednesday, May 25

CP34
Control Theory
10:15 AM-11:15 AM
Room: Wasatch A
Chair: Genevieve Brown, Northwestern University, USA

10:15-10:30 Feedback Control of Traveling and Standing Waves in the O(2) Equivariant Hopf Bifurcation Problem
Genevieve Brown, Northwestern University, USA; Claire M. Postlethwaite, University of Auckland, New Zealand; Mary C. Silber, Northwestern University, USA

10:35-10:50 Stabilizing Traveling Waves in the One-Dimensional CGLE Using Spatio-Temporal Feedback Control
Tiffany M. Psemeneki and Mary C. Silber, Northwestern University, USA

10:55-11:10 Partial Control of Chaotic Transients and Escape Times
Miguel Sanjuan, Universidad Rey Juan Carlos, Spain
Wednesday, May 25

**CP35**

**Pattern Formation I**

10:15 AM-11:15 AM

Room: Wasatch B

Chair: Alastair M. Rucklidge, University of Leeds, United Kingdom

10:15-10:30 Nonlinear Three-Wave Interactions and Spatio-Temporal Chaos

Alastair M. Rucklidge, University of Leeds, United Kingdom; Anne Skeldon, University of Surrey, United Kingdom

10:35-10:50 Interaction of Faraday Waves and Cross-Waves

Jeff Porter, Ignacio Tinao, and Ana Laveron-Simavilla, Universidad Politécnica de Madrid, Spain

10:55-11:10 Pinning of Rotating Waves in Systems with Imperfect So(2) Symmetry

Francisco Marques, and Alvaro Meseguer, Universitat Politecnica de Catalunya, Spain; Juan M. Lopez and Rafael Pacheco, Arizona State University, USA

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**CP36**

**Neuroscience II**

10:15 AM-11:15 AM

Room: Ballroom II

Chair: Rhonda Dzakpasu, Georgetown University, USA

10:15-10:30 Effect of Nodal Scale on the Analysis of Whole-Brain Anatomical Networks

Adam S. Landsberg, Claremont McKenna, Pitzer and Scripps Colleges, USA; Eric Friedman, Cornell University, USA

10:35-10:50 Manipulating the Excitatory/inhibitory Balance Alters In Vitro Dynamical Patterns in Neuronal Networks

Rhonda Dzakpasu and Xin Chen, Georgetown University, USA; Mark Niedringhaus, Georgetown University Medical Center, USA

10:55-11:10 Multi-bump Standing Pulses in a Firing Rate Model

Yixin Guo, and Dennis Guang Yang, Drexel University, USA

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**CP37**

**Stochastics III**

10:15 AM-11:15 AM

Room: Magpie A

Chair: Sophie Loire, University of California, Santa Barbara, USA

10:15-10:30 Amplitude Equations for the Stochastic Ginzburg-Landau Equation

Wael W. Mohammed, University of Augsburg, Germany; Dirk Blömker, Universitaet Augsburg, Germany

10:35-10:50 Spatial Filter and Backward Time Approach of Probabilistic Method to Advection Diffusion Equation

Sophie Loire and Igor Mezic, University of California, Santa Barbara, USA

10:55-11:10 A Stochastic Boundary Forcing Model for Simulating Wave Turbulence Systems

Warren Towne, Peter R. Kramer, and Yuri V. Lvov, Rensselaer Polytechnic Institute, USA
Wednesday, May 25

**CP38**

**Chaotic Dynamics I**

10:15 AM-11:15 AM

Room: Magpie B

Chair: Jesús Seoane, Universidad Rey Juan Carlos, Spain

10:15-10:30 Transient Chaos in a Damped, Undriven System: The Magnetic Pendulum

György Károlyi, Budapest University of Technology and Economics, Hungary; Tamas Tel, Eotvos University, Hungary; Adilson E. Motter, Northwestern University, USA; Marton Gruiz, Eötvös University, Hungary

10:35-10:50 Phase Control of Escapes and Basin Boundary Metamorphoses

Jesus M. Seoane, Universidad Rey Juan Carlos, Spain

10:55-11:10 Permutation Complexity of Spatiotemporal Dynamics

Samuel Zambrano, Universidad Rey Juan Carlos, Spain; José M. Amigó, Universidad Miguel Hernandez, Spain; Miguel Sanjuán, Universidad Rey Juan Carlos, Spain

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Wednesday, May 25

**CP39**

**Non-smooth Dynamical Systems II**

10:15 AM-11:15 AM

Room: Superior B

Chair: James L. Hook, University of Manchester, United Kingdom

10:15-10:30 Analysis of the Dynamics Near a Degenerate Grazing Point for Rigid Impact Oscillators

Gheorghe Tigan, Jeroen Lamb, and Oleg Makarenkov, Imperial College London, United Kingdom

10:35-10:50 The Moving Average Transformation

James L. Hook, University of Manchester, United Kingdom

10:55-11:10 Border Collision Bifurcations, Organizing Centers, and Continuity Breaking

Viktor Avrutin, University of Stuttgart, Germany; Laura Gardini, University of Urbino, Italy; Albert Granados and Michael Schanz, University of Stuttgart, Germany; Iryna Sushko, National Academy of Science, Ukraine

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Wednesday, May 25

**CP40**

**Waves in Stratified Flows**

10:15 AM-10:55 AM

Room: Maybird

Chair: Claudio Viotti, University of North Carolina, USA

10:15-10:30 Shear Instability in Strongly Non-linear Solitary Waves: Non-parallel Effects

Claudio Viotti, University of North Carolina, USA

10:35-10:50 Title Not Available at Time of Publication

Roxana Tiron, University of North Carolina at Chapel Hill, USA
Wednesday, May 25
CP41
CANCELLED
10:15 AM-11:15 AM

Wednesday, May 25
CP42
Network Dynamics II
10:15 AM-11:15 AM
Room: Ballroom III
Chair: Siu Fai Chow, Northwestern University, USA
10:15-10:30 Dynamically Reorganizing Neural Networks for Stimulus Decorrelation
Siu Fai Chow and Hermann Riecke, Northwestern University, USA
10:35-10:50 Synchronizing Distant Nodes: A Universal Classification of Time-Delayed Networks
Valentin Flunkert, TU Berlin, Germany; Serhiy Yanchuk, Humboldt University at Berlin, Germany; Thomas Dahms, TU Berlin, Germany; Eckehard Schöll, Technische Universität Berlin, Germany
10:55-11:10 Robustness of the Master Stability Function Approach to Network Synchronization
Francesco Sorrentino, Universita degli Studi di Napoli Parthenope, Italy; Maurizio Porfiri, Polytechnic Institute of New York University, USA

Wednesday, May 25
CP43
Global Structures in Stochastic Systems
10:15 AM-11:15 AM
Room: Superior A
Chair: Thomas W. Carr, Southern Methodist University, USA
10:15-10:30 Non-Gaussian Noise and its Effects on Scaling Laws Near Bifurcation Points
Lora Billings, Montclair State University, USA; Ira B. Schwartz, Naval Research Laboratory, USA; Mark I. Dykman, Michigan State University, USA
10:35-10:50 Set-based Corral Control in Stochastic Dynamical Systems
Eric Forgoston, Lora Billings, and Philip Yecko, Montclair State University, USA; Ira B. Schwartz, Naval Research Laboratory, USA
10:55-11:10 Stochastic Extinction in the Presence of Delayed Feedback
Thomas W. Carr, Southern Methodist University, USA; Mark I. Dykman, Michigan State University, USA; Lora Billings, Montclair State University, USA; Ira B. Schwartz, Naval Research Laboratory, USA
Wednesday, May 25

**CP44**

**Engineering Applications I**
10:15 AM-11:15 AM
Room: Ballroom I
Chair: Daniel A. Brake, Colorado State University, USA

10:15-10:30 Equations with Advanced Arguments in a Segway Model
Tamas Insperger and Richard Wohlfart, Budapest University of Technology and Economics, Hungary; Janos Turi, University of Texas at Dallas, USA; Gabor Stepan, Budapest University of Technology and Economics, Hungary

10:35-10:50 Identification of Nonlinear Characteristics Based on Bistability in Delayed Model of Cutting
Gabor Stepan and Zoltan Dombovari, Budapest University of Technology and Economics, Hungary; Jokin Munoa, IK4 Research Alliance, Spain

10:55-11:10 Workspace Estimation of Cooperating Robots after Joint Failure
Daniel A. Brake, Vakhtang Putkaradze, Daniel J. Bates, and Anthony Maciejewski, Colorado State University, USA

Coffee Break
11:15 AM-11:45 AM
Room: Golden Cliff

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Wednesday, May 25

**IP7**

**Pattern Formation and Partial Differential Equations**
11:45 AM-12:30 PM
Room: Ballroom
Chair: Jens Rademacher, CWI, Amsterdam, Netherlands

The research I present is motivated by specific, but ubiquitous pattern in models from physics: Domain and wall patterns the magnetization forms in ferromagnets, the coarsening of the phase distribution in demixing of polymer blends, the roughening of a crystal surface under deposition. Dynamically speaking, the type of models ranges from variational formulations, over (driven) gradient flows to non-gradient systems. The challenge for a rigorous analysis lies in the fact that we are interested in generic behavior of solutions, as expressed by (experimentally and numerically observed) scaling laws, that hold in the limit of large system sizes. We argue that methods from the theory of partial differential equations can be used to provide at least one-sided, optimal bounds on these scaling laws.

Felix Otto
Max Planck Institute for Mathematics in the Sciences, Germany

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

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Wednesday, May 25

**IP8**

**Mathematical Models for Tissue Engineering Applications**
2:00 PM-2:45 PM
Room: Ballroom
Chair: Vered Rom-Kedar, Weizmann Institute of Science, Israel

The broad goal of tissue engineers is to grow functional tissues and organs in the laboratory to replace those which have become defective through age, trauma, and disease and which can be used in drug screening applications. To achieve this goal, tissue engineers aim to control accurately the biomechanical and biochemical environment of the growing tissue construct, in order to engineer tissues with the desired composition, biomechanical and biochemical properties (in the sense that they mimic the in vivo tissue). The growth of biological tissue is a complex process, resulting from the interaction of numerous processes on disparate spatio-temporal scales. Advances in the understanding of tissue growth processes promise to improve the viability and suitability of the resulting tissue constructs. In this talk, I highlight some of our recent mathematical modelling work that aims to provide insights into tissue engineering applications.

Sarah Waters
University of Oxford, United Kingdom

Intermission
2:45 PM-3:00 PM
Wednesday, May 25

**MS111**

Prediction of Noisy Slow-fast Critical Transitions - Part I of II

3:00 PM-4:40 PM

Room: Ballroom I

For Part 2 see MS122

Abrupt transitions to distant attractors have been studied in dynamical systems from the viewpoint of bifurcation theory and singular perturbation theory. One of the most challenging problems in this area is to predict these transitions from data before they occur in the presence of noise. Examples of important applications are climate change, ecological systems, medical applications and financial markets. This mini-symposium is going to bring together theory and applications. Open problems and new techniques are going to be highlighted.

Organizer: Christian Kuehn
Max Planck Institute for Physics of Complex Systems, Germany

Organizer: Jan Sieber
University of Portsmouth, United Kingdom

3:00-3:20 Potential Analysis of Geophysical Time Series
Valerie Livina, University of East Anglia, United Kingdom

3:25-3:45 Transition to Instability in Financial Markets with Many Heterogeneous Agents
Florian Wagener, University of Amsterdam, Netherlands

3:50-4:10 Extreme Events: The Larger, the Better Predictable
Sarah Hallerberg, TU Chemnitz, Germany

4:15-4:35 A Mathematical Framework for Critical Transitions
Christian Kuehn, Max Planck Institute for Physics of Complex Systems, Germany

Wednesday, May 25

**MS112**

Transport in Time-Dependent Flows: Theory, Computation, and Experiment

3:00 PM-4:40 PM

Room: Ballroom II

Aperiodically time-dependent flows are the norm for models of geophysical and industrial dynamical systems. Many standard methods of analysis for dynamical systems fail in the time-dependent setting, and classical notions of equilibria, invariant manifolds, and invariant measures must be suitably generalised. Research on the theory and numerics of time-dependent systems continues apace, creating new mathematical techniques using tools from geometry and ergodic theory. Lagrangian descriptions of flows enable the quantification of fluid transport and a better understanding of time-dependent dynamics. This minisymposium discusses the very latest quantitative methods of analysis for time-dependent flows and the application of these methods to industrial systems and ocean models.

Organizer: Gary Froyland
University of New South Wales, Australia

3:00-3:20 Transport in Time-Dependent Flows -- An Overview
James D. Meiss, University of Colorado at Boulder, USA

Ana M. Mancho, Consejo Superior Investigaciones Cientificas, Spain

3:50-4:10 Set-oriented Numerical Analysis of Time-dependent Transport
Kathrin Padberg-Gehle, Dresden University of Technology, Germany; Gary Froyland, University of New South Wales, Australia

4:15-4:35 Lagrangian Transport Phenomena in 3D Laminar Mixing Flows
Michel Speetjens, Eindhoven University of Technology, Netherlands

Wednesday, May 25

**MS113**

Inertial Particles - Part I of II

3:00 PM-4:40 PM

Room: Ballroom III

For Part 2 see MS124

The motion of inertial particles in a given flow is among the most important one in nature and technology - examples of open scientific and technological issues include rain formation in clouds, pollution dispersion in the atmosphere, optimization and emission reduction in combustion, plankton population dynamics - and constitute a major scientific challenge with immediate practical implications and applications. In this minisymposium we discuss the effect of inertia, collisions, and advection in complex flow geometries.

Organizer: Markus Abel
University of Potsdam, Germany

Organizer: Bernhard Mehlig
University of Gothenburg, Sweden

Organizer: Ulrike Feudel
University of Oldenburg, Germany

3:00-3:20 Aggregation and Fragmentation of Inertial Particles in Random Flows
Ulrike Feudel, University of Oldenburg, Germany

3:25-3:45 Droplet Distributions in Binary Mixtures
Tobias Lapp and Martin Rohloff, Max Planck Institute for Dynamics and Self-Organization, Germany; Juergen Vollmer, Max Planck Institute for Polymer Research, Germany; Bjoern Hof, Max Planck Institute for Dynamics and Self-Organization, Germany

continued on next page
Wednesday, May 25

**MS113**

**Inertial Particles - Part I of II**
3:00 PM-4:40 PM

*continued*

3:50-4:10 A Reactive-flow Model of Phase Separation in Fluid Binary Mixtures with Continuously Ramped Temperature

*Juergen Vollmer*, Max Planck Institute for Polymer Research, Germany; *Izabella Benczik*, and *Jan-Hendrik Trösemeier*, Max Planck Institute for Dynamics and Self-Organization, Germany

**4:15-4:35 Chaotic Motion of Inertial Particles in Finite Domains**

*Tamas Tel*, Eotvos University, Hungary

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**MS114**

**Physical Random Number Generation by Dynamical and Stochastic Systems**
3:00 PM-4:40 PM

*Room: Magpie A*

Random number generators find application in fields ranging from cryptography to Monte Carlo simulations. Although computer-based pseudo-random number generation remains popular, there is an increasing interest using physical dynamical or stochastic systems to produce non-periodic and unpredictable sequences of random numbers. The session will focus on the different approaches (both experimental and numerical) that have been pursued for physical random number generation, and the methods by which the generated numbers have been tested, evaluated or “certified.”

**Organizer:** Thomas E. Murphy  
*University of Maryland, College Park, USA*

**Organizer:** Rajarshi Roy  
*University of Maryland, USA*

**3:00-3:20 Synchronization of Random Bit Generators Based on Coupled Chaotic Lasers and Application to Cryptography**

*Ido Kanter*, Yitzhak Peleg, Meital Zigzag, and Michael Rosenbluh, Bar-Ilan University, Israel; Wolfgang Kinzel, University of Würzburg, Germany

**3:25-3:45 Ultra-fast Physical Random Number Generation based on Chaotic Photonic Integrated Circuits**

*Apostolos Argyris* and *Dimitris Syvridis*, National & Kapodistrian University of Athens, Greece

*continued in next column*
Wednesday, May 25
MS115
Using Phase Response Curves to Understand Neurodynamics - Part I of II
3:00 PM-4:40 PM
Room: Magpie B
For Part 2 see MS126
Phase response curves (PRCs) quantify the response of oscillators to brief external stimuli. Theoreticians have used PRCs extensively to identify mechanisms underlying phase-locking in externally-driven neurons and in networks of coupled neurons. Recently, the use of PRCs to understand neuronal synchronization has received considerable attention from experimental neuroscientists.

This minisymposium brings together theoreticians and experimentalists to discuss recent advances in our understanding of neuronal dynamics by using PRCs. Part I of the minisymposium probes the biophysical and dynamical mechanisms that shape PRCs and therefore determine phase-locking properties. Part II examines how PRCs can be understood to the influence of noise and heterogeneity on neuronal dynamics.

Organizer: LieJune Shiau
University of Houston, Clear Lake, USA
Organizer: Tim Lewis
University of California, Davis, USA
3:00-3:20 Effects of the Frequency Dependence of Phase Response Curves on Network Synchronization
Christian G. Fink, Victoria Booth, and Michal Zochowski, University of Michigan, USA
3:25-3:45 Using PRC’s to Understand How Antiepileptic Drugs and Deep Brain Stimulation Prevent Seizures
Theoden I. Netoff, Bryce Beverlin II and Brendan Murphy, University of Minnesota, USA; Charles Wilson, University of Texas, San Antonio, USA

3:50-4:10 The Role of Transient Potassium Channels in Phase Resetting and Stochastic Synchrony in the Olfactory Bulb
Aushra Abouzeid, University of Pittsburgh, USA; Anne-Marie M. Oswald, Carnegie Mellon University, USA; Roberto F. Galan, Case Western Reserve University, USA; Nathan Urban, Carnegie Mellon University, USA; Bard Ermentrout, University of Pittsburgh, USA
4:15-4:35 Isochrons and Phase Response in Multiple Time-Scale Systems
Eric Sherwood, Boston University, USA

Wednesday, May 25
MS116
Existence and Stability of Nonlinear Waves in Coupled Systems - Part I of III
3:00 PM-4:40 PM
Room: Wasatch A
For Part 2 see MS127
Nonlinear Wave Phenomena is of broad scientific interest. It pertains to the understanding of real water waves, the interaction of light with matter, optical fiber transmission, traffic flow, earthquakes and galaxy formation. At the heart of studying the phenomena of nonlinear waves is the question of existence and stability of solutions of nonlinear equations. The existence study aims at exhibiting the possible behavior of a given system. The goal of stability analysis is to see if a given solution can be realized experimentally.

Our mini-symposium aims at bringing speakers who address these issues using numerical or analytical methods.

Organizer: Stephane Lafortune
College of Charleston, USA
Organizer: Anna Ghazaryan
Miami University and University of Kansas, USA
Organizer: Vahagn Manukian
Miami University, USA
3:00-3:20 Bifurcations of Travelling Waves in the Orefonator Model for the BZ Reaction
Peter L. Simon, Eötvös Loránd University, Hungary
Jeffrey Humpherys, Brigham Young University, USA
continued on next page
Wednesday, May 25

**MS116**

Existence and Stability of Nonlinear Waves in Coupled Systems - Part I of III

3:00 PM-4:40 PM

continued

3:50-4:10 Localized Standing Waves in Inhomogeneous Schrodinger Equations

Robert Marangell and Christopher Jones, University of North Carolina at Chapel Hill, USA & University of Warwick, United Kingdom; Hadi Susanto, University of Nottingham, United Kingdom

4:15-4:35 Existence, Stability and Dynamics of Some Single- and Multi-Component Solitary Waves: From Theory to Experiments

Panayotis Kevrekidis, University of Massachusetts, Amherst, USA

**MS117**

Mutistability and Rhythmogenesis: Basic Motifs and Network Dynamics

3:00 PM-4:40 PM

Room: Wasatch B

Elementary excitatory and inhibitory circuits control dynamics of specialized neuronal systems such as central pattern generators (CPG) and also serve as building blocks of more complex networks found in thalamic, cortical and other brain systems. This mini is focused on the dynamics of such elementary motifs of neuronal networks. We will discuss how different attractor states emerge as a result of intrinsic dynamics of such neuronal motifs and how they interact to lead to more complex emerging behavior. Its goal is to bring together experimental and computational neuroscientists to discuss universal mechanisms of neuronal dynamics.

Organizer: Andrey Shilnikov
Georgia State University, USA

Organizer: Maxim Bazhenov
University of California, Riverside, USA

3:00-3:20 Maintaining Novel Inputs in a Working Memory Model

David H. Terman, Robert McDougal, Kyle Lyman, Brian Myers, and Mustafa Zeki, Ohio State University, USA; Chris Fall, University of Illinois, Chicago, USA

3:25-3:45 Using the Structure of Inhibitory Networks to Unravel Mechanisms of Spatiotemporal Patterning

Collins Assisi and Maxim Bazhenov, University of California, Riverside, USA

continued in next column
Wednesday, May 25

MS119
Oscillatory Dynamics in Delay Differential Equations
3:00 PM-4:40 PM
Room: Superior A

Delay differential equations (DDEs) arise in many applications areas, and non-equilibrium invariant sets such as periodic orbits and tori play a central role in understanding the dynamics of these equations. But, the study of these invariant sets is in general non-trivial due to the fact that DDEs are infinite dimensional systems. The local theory of invariant manifolds is reasonably well-developed for DDEs with constant delays, but extending the theory, for example to state dependent delays, is difficult. In this session we will present the latest results and ongoing work in oscillatory dynamics and related stability and bifurcation theory in DDEs with multiple delays and/or state dependent delays.

Organizer: Tony R. Humphries
McGill University, Canada
Organizer: Renato Calleja
McGill University, Canada

3:00-3:20 Invariant Tori in Scalar State-dependent DDEs
Tony R. Humphries and Renato Calleja, McGill University, Canada

3:25-3:45 Estimating Model Parameters from Time Series by Using Chaotic Synchronization and Speed-gradient Methodology
Elbert E. Macau, Laboratory for Computing and Applied Mathematics and Brazilian Institute for Space Research, Brazil; Ubiratan S. Freitas, Universite de Rouen, France

continued in next column

Wednesday, May 25

MS118
Synchronization of Chaos and its Applications
3:00 PM-4:40 PM
Room: Maybird

Many fundamental processes in nature are based on synchronization of chaos. This phenomenon is also used as building block for the development of applications in technology and for construction of models based on data series. In this mini-symposium theoretical and application issues related to this phenomenon will be considered. In special, it will address the role of noise in inducing synchronization in neuronal models, methodologies that can be applied to convey high speed communication through optical channels, and procedures that lead to model parameter estimation according to the synchronization achieved between data series and a mathematical model.

Organizer: Elbert E. Macau
Laboratory for Computing and Applied Mathematics and Brazilian Institute for Space Research, Brazil
Organizer: Epaminondas Rosa
Illinois State University, USA

3:00-3:20 Competing Chaotic Synchrony: Theory and Experiment
Epaminondas Rosa, Illinois State University, USA

3:25-3:45 Nonlinear Delayed Optical Phase Oscillator for High Performance Chaos Synchronization: Dynamics and Chaos Communication at 10Gb/s
Laurent Larger, Universite de Franche-Comte, France; Lavrov Roman and Maxime Jacquot, FEMTO-ST Institute, France; Vladimir Udaltsov, Vavilov Optical State Institute, Russia

continued in next column
Wednesday, May 25

**MS120**

**Immunity and Infection - Part I of II**

3:00 PM-4:40 PM

Room: Superior B

For Part 2 see MS131

In second half of the twentieth century, the biological and medical communities came to understand that the mammalian immune system is an extremely complex system with thousands of components and tens of thousands of interactions. It recent years they have also been discovering many ways in which the immune system is inherently dynamical. We will highlight examples in which practitioners of applied dynamical systems have been rising to the challenge of modeling and analyzing various components and functions of the system. We begin with a talk about the basic assumptions of the dynamics associated with the immune response.

Organizer: Erik M. Boczko

Vanderbilt University, USA

Organizer: Vered Rom-Kedar

Weizmann Institute of Science, Israel

Organizer: Todd Young

Ohio University, USA

3:00-3:20 Bacterial Infection: From theory to Experiments and Back
Roy Malka and Vered Rom-Kedar,
Weizmann Institute of Science, Israel

3:25-3:45 Non-Invasive Pathogen Profiling and New Prospects for In-Host Monitoring of Infection and Immune Response
Erik M. Boczko, Vanderbilt University, USA; Todd Young, Ohio University, USA; Patrick Norris and Addison May, Vanderbilt University Medical Center, USA

3:50-4:10 Investigating Bacteria-immune Dynamics in Premature Infants
Julia Arciero, Bard Ermentrout, Yoram Vodovozt, and Jonathan E. Rubin, University of Pittsburgh, USA

4:15-4:35 Delayed Immune Response to Plasmodium Infection
Jonathan Mitchell, Hardin-Simmons University, USA; Thomas W. Carr, Southern Methodist University, USA

Wednesday, May 25

**MS121**

**Dynamics of Cardiac Contraction and Mechanical Deformation**

3:00 PM-4:40 PM

Room: White Pine

The heart’s primary function is to pump oxygenated blood efficiently throughout the body. Pumping is effected by contraction, which occurs through a complex series of biochemical processes at the cellular level. Although contraction arises from the dynamics of proteins within the cell, the whole-organ behavior also can be modeled using approximations at the tissue level. In this minisymposium, we will examine how the different spatial and temporal scales involved in contraction can be represented mathematically and how they interact.

Organizer: Flavio H. Fenton

Cornell University, USA

3:00-3:20 Overview of Multi-scale Modeling of Cardiac Contraction
Flavio H. Fenton, Cornell University, USA; Elizabeth M. Cherry, Rochester Institute of Technology, USA; Rupinder Singh and Niels F. Otani, Cornell University, USA

3:25-3:45 An Efficient Spatially-explicit Model of Cardiac Myofilament Dynamics
Stuart G. Campbell, University of Kentucky, USA; Andrew D. McCulloch, University of California, San Diego, USA; Kenneth Campbell, University of Kentucky, USA

3:50-4:10 Modeling Cardiac Electromechanics Using the Immersed Boundary Method
Boyce E. Griffith, New York University, USA

4:15-4:35 Visualizing Patterns of Cardiac Action Potential Propagation Using Ultrasound Images of Contraction
Niels F. Otani and Rupinder Singh, Cornell University, USA
Wednesday, May 25

**MS122**

**Prediction of Noisy Slow-fast Critical Transitions - Part II of II**

5:10 PM-6:50 PM

Room: Ballroom I

For Part 1 see MS111

Abrupt transitions to distant attractors have been studied in dynamical systems from the viewpoint of bifurcation theory and singular perturbation theory. One of the most challenging problems in this area is to predict these transitions from data before they occur in the presence of noise. Examples of important applications are climate change, ecological systems, medical applications and financial markets. This minisymposium is going to bring together theory and applications. Open problems and new techniques are going to be highlighted.

Organizer: Christian Kuehn
Max Planck Institute for Physics of Complex Systems, Germany

Organizer: Jan Sieber
University of Portsmouth, United Kingdom

5:10-5:30 Atmospheric Regimes, Predictability and Climate Change
Christian Franzke, British Antarctic Survey, United Kingdom

5:35-5:55 Recurrent Episodes of Synchrony in a Spatial Neural Network Model
Alexander Rothkegel and Klaus Lehnertz, University of Bonn, Germany

6:00-6:20 Identifying and Characterizing Change Points Using the Informational Approach
Claudie Beaulieu, Princeton University, USA

6:25-6:45 Dynamic Bifurcations with Loss of Local Stability in the Presence of Noise
Steve Shaw, Nicholas Miller, and Mark I. Dykman, Michigan State University, USA; Chris Burgner and Kimberly Turner, University of California, Santa Barbara, USA

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Wednesday, May 25

**MS123**

**Multi-level Modeling of Dynamical Systems**

5:10 PM-6:50 PM

Room: Ballroom II

Biological systems are often described by several mathematical models; each takes into account different features of the system and therefore has a very different level of description. This minisymposium will promote the ideas that: 1) mathematical modeling of biological systems in particular requires a computational framework that enables one to easily move between different levels of description of a system, and that 2) while each level of description provides a different level of understanding, the process of moving between the different levels in itself provides insights about the system. A range of methods and applications that illustrate these ideas will be presented.

Organizer: Alona Ben-Tal
Massey University, New Zealand

Organizer: Robert Clewley
Georgia State University, USA

5:10-5:30 Multi-level Modeling of the Respiratory System
Alona Ben-Tal, Massey University, New Zealand

5:35-5:55 Opening and Closing the Loop in Small Networks: Simulation and Analysis of Multi-Level 'Hybrid' Dynamics
Robert Clewley, Georgia State University, USA

6:00-6:20 An Equation-Free Analysis of Evolution in Collective Migration
Yannis Kevrekidis and Yu Zou, Princeton University, USA; Iain Couzin and Vishwesha Guttal, Princeton University, USA

6:25-6:45 Structure Preserving Reduction of Quasi-Active Neurons
Steven Cox, Rice University, USA

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Wednesday, May 25

**MS124**

**Inertial Particles - Part II of II**

5:10 PM-6:50 PM

Room: Ballroom III

For Part 1 see MS113

The motion of inertial particles in a given flow is among the most important one in nature and technology - examples of open scientific and technological issues include rain formation in clouds, pollution dispersion in the atmosphere, optimization and emission reduction in combustion, plankton population dynamics - and constitute a major scientific challenge with immediate practical implications and applications. In this minisymposium we discuss the effect of inertia, collisions, and advection in complex flow geometries.

Organizer: Markus Abel
University of Potsdam, Germany

Organizer: Ulrike Feudel
University of Oldenburg, Germany

Organizer: Bernhard Mehlig
University of Gothenburg, Sweden

5:10-5:30 Caustics and Collisions in Turbulent Aerosols
Bernhard Mehlig and Kristian Gustavsson, University of Gothenburg, Sweden

Artur Straube, Humboldt University Berlin, Germany

6:00-6:20 PDF Approach for Particles in Turbulent Boundary Layers
Mike Reeks, University of New Castle, United Kingdom

6:25-6:45 Clustering of Particles in a Deterministic Intermittent Flow
Markus Abel, University of Potsdam, Germany
Wednesday, May 25

**MS125**  
**Dynamics of Networks with Time-delayed Coupling**  
5:10 PM-6:50 PM  
Room: Magpie A

Networks of coupled systems are ubiquitous in nature. Time-delayed coupling is physically unavoidable in many such real-life systems and accounts for finite propagation time of signals like in optically coupled semiconductor lasers, reaction time in chemical reactions, synaptic transmission delays in neural networks etc. Recently there has been great interest in network dynamics with time delayed coupling. This mini-symposium will focus on the rich variety of organized states of delay-coupled systems and their important applications. The speakers will cover a range of topics including theoretical modeling, numerical solutions and applications to actual physical systems.

Organizer: Eckehard Schöll  
*Technical University of Berlin, Germany*

Organizer: Gautam C. Sethia  
*Institute for Plasma Research, India*

5:10-5:30 On the Role of Delay for the Symmetry in the Dynamics of Networks  
**Otti D’Huys**, Vrije Universiteit Brussels, Belgium

5:35-5:55 Synchronizing Coupled Optical Oscillators with Time Delay  
**Rajarshi Roy**, University of Maryland, College Park, USA

6:00-6:20 Chaos Synchronization of Networks with Time-delayed Couplings  
**Wolfgang Kinzel**, University of Würzburg, Germany

6:25-6:45 Stability and Resonance in Networks of Delay-Coupled Delay Oscillators  
**Johannes M. Hoefener**, Max Planck Institute for Complex Systems, Germany

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**MS126**  
**Using Phase Response Curves to Understand Neurodynamics - Part II of II**  
5:10 PM-6:50 PM  
Room: Magpie B

For Part I see MS115

Phase response curves (PRCs) quantify the response of oscillators to brief external stimuli. Theoreticians have used PRCs extensively to identify mechanisms underlying phase-locking in externally-driven neurons and in networks of coupled neurons. Recently, the use of PRCs to understand neuronal synchronization has received considerable attention from experimental neuroscientists. This minisymposium brings together theoreticians and experimentalists to discuss recent advances in our understanding of neuronal dynamics by using PRCs. Part I of the mini-symposium probes the biophysical and dynamical mechanisms that shape PRCs and therefore determine phase-locking properties. Part II examines how PRCs can be used to understand the influence of noise and heterogeneity on neuronal dynamics.

Organizer: Tim Lewis  
*University of California, Davis, USA*

Organizer: LieJune Shiau  
*University of Houston, Clear Lake, USA*

5:10-5:30 Using Dynamic Clamp as a Tool to Study Neuronal Synchronization  
**John White**, University of Utah, USA

5:35-5:55 Effects of Variability on Hybrid Circuits of Two Pulse Coupled Neurons  
**Carmen Canavier**, Louisiana State University, USA

6:00-6:20 A Stochastic Dynamics Approach to Understanding the Mean and Variance of Phase Response Curves  
**Todd Troyer**, University of Texas, San Antonio, USA

6:25-6:45 Cellular Mechanisms Underlying Spike-Time Reliability  
**Roberto F. Galan**, Case Western Reserve University, USA
Wednesday, May 25

**MS128**

**Sprite Discharges – Towards a Quantitative Understanding of Lightning Dynamics**

5:10 PM-6:50 PM

Room: Wasatch B

Sprite discharges are enormous “lightning strokes” that develop at 40 to 90 km altitude high above active thunderclouds. Among lightning phenomena, they are the first whose nonlinear growth dynamics we now start to understand quantitatively. The minisymposium will proceed from an overview of observations and basic understanding through simulations to the nonlinear analysis of the observed phenomena. The nonlinear analysis concerns the (in)stability both of the propagating ionization front and of the current carrying state behind the front.

Organizer: Ute Ebert
Centrum voor Wiskunde en Informatica (CWI), Netherlands

5:10-5:30 An Introduction to Sprites: Observations and Basic Phenomenology
Davis Sentman, University of Alaska, USA

5:35-5:55 Quantitative Simulations of Sprite Streamer Discharges
Ningyu Liu, Florida Institute of Technology, USA

6:00-6:20 Halo’s and Sprites: A Sequence of Instabilities and Dynamic Attractors
Ute Ebert, Centrum voor Wiskunde en Informatica (CWI), Netherlands

6:25-6:45 Stability of Simple Translating States in Laplacian Flows with Regularization
Saleh A. Tanveer, Ohio State University, USA

**MS129**

**Recent Advances in Nonautonomous Dynamics**

5:10 PM-6:50 PM

Room: Maybird

Over the past few years, nonautonomous dynamics has developed into a highly active field related to, yet recognisably distinct from classical dynamical systems. This development has been motivated by problems of applied mathematics, as genuinely nonautonomous systems abound e.g. in meteorology (ocean dynamics), life science (dosing strategies), economics, and many other disciplines. The rise of nonautonomous dynamics has in turn influenced other areas of mathematics such as spectral, stability, and bifurcation theory. This minisymposium will provide a cross section of intriguing recent work on nonautonomous dynamics, including finite-time behavior, discretization theory, stability and bifurcation problems, as well as applications thereof.

Organizer: Christian Poetzsche
Munich University of Technology, Germany

5:10-5:30 General Theory for Monotone and Concave Skew-product Semiflows
Carmen Núñez, and Rafael Obaya and Ana Sanz, University of Valladolid, Spain

5:35-5:55 An Alternative Approach to Sacker-Sell Spectral Theory
Martin Rasmussen, Imperial College London, United Kingdom; Fritz Colonius, University of Augsburg, Germany; Peter Kloeden, Johann Wolfgang Goethe University, Frankfurt am Main, Germany

6:00-6:20 Dynamics in Finite Time - Concepts and Applications
Arno Berger, University of Alberta, Canada

6:25-6:45 Equivalence, Spectra and Nonautonomous Bifurcations
Christian Poetzsche, Munich University of Technology, Germany

**Wednesday, May 25**

**MS130**

**Models and Applications of Network Dynamics**

5:10 PM-6:50 PM

Room: Superior A

Modeling of the structure and dynamics of complex systems has become one of the central topics in the study of dynamical systems. In recent years, mathematical development has led to many exciting applications for real-world problems in mathematical, biological, physical, and information sciences. In this minisymposium researchers from different application areas will give an overview of the state-of-the-art of several important problems in network dynamics and applications, including social competition, mobility dynamics, intracellular networks, and information propagation.

Organizer: Jie Sun
Northwestern University, USA

Organizer: Alexander Gutfraind
Los Alamos National Laboratory, USA

5:10-5:30 Modeling the Dynamics of Social Competition
Daniel Abrams and Haley Yaple, Northwestern University, USA; Richard Wiener, University of Arizona, USA

5:35-5:55 Effect of Human Motion on Dynamic Contact Networks
Joseph Skufca and Daniel Ben-Avraham, Clarkson University, USA

6:00-6:20 Propagation of Epidemics on Dynamically-adapting Networks
Christian Poetzsche, Munich University of Technology, Germany

6:25-6:45 Network Analysis and Dynamical Modeling of Cancer Cells
Michael Schnabel, Max Planck Institute for Dynamics and Self-Organization, Germany; Nir Yungster, Dirk Brockmann, Adilson E. Motter, and William Kath, Northwestern University, USA
Wednesday, May 25
MS131
Immunity and Infection - Part II of II
5:10 PM-6:50 PM
Room: Superior B
For Part 1 see MS120
In second half of the twentieth century, the biological and medical communities came to understand that the mammalian immune system is an extremely complex system with thousands of components and tens of thousands of interactions. It recent years they have also been discovering many ways in which the immune system is inherently dynamical. We will highlight examples in which practitioners of applied dynamical systems have been rising to the challenge of modeling and analyzing various components and functions of the system. We begin with a talk about the basic assumptions of the dynamics associated with the immune response.
Organizer: Erik M. Boczko
Vanderbilt University, USA
Organizer: Vered Rom-Kedar
Weizmann Institute of Science, Israel
Organizer: Todd Young
Ohio University, USA
5:10-5:30 Inflammation, Immunity, and Age: Insights from An In-Host Model of Influenza
Ian Price, University of Pittsburgh, USA
5:35-5:55 Modeling Signaling Pathways in Macrophages
Hannah Callendar, University of Minnesota, USA; Mary Ann Horn, Vanderbilt University, USA, and National Science Foundation, USA
continued in next column
Wednesday, May 25

**PD2**

**Forward Looking Panel Discussion**

8:30 PM-9:30 PM

**Room: Ballroom II**

*Chair: Alan R. Champneys, University of Bristol, United Kingdom*

The aim of this session is to discuss promising directions for future research in Dynamical Systems and its applications. Each panelist will be invited to answer provocative questions from the chair about the future of our community, and then to take follow-ups from the audience. It is hoped that the debate will be lively, stimulating and just possibly controversial.

**Carson Chow**
National Institutes of Health and University of Pittsburgh, USA

**Yannis Kevrekidis**
Princeton University, USA

**Mason Porter**
University of Oxford, United Kingdom

**Mary Silber**
Northwestern University, USA

**James Yorke**
University of Maryland, USA

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**Thursday, May 26**

**Registration**

8:00 AM-12:30 PM

**Room: Ballroom Foyer**

**MS133**

**Inference in Dynamical Networks**

8:20 AM-10:00 AM

**Room: Ballroom I**

Dynamical processes interplay within complex networks. Understanding the behavior of such networks requires inference about their topology as well as their dynamics. Especially in the neurosciences this promises to gain deeper insights into the functioning or non-functioning of the prototypical example of a network, the human brain. This minisymposium aims at covering different aspects of network inference. Various topics ranging from first principle modeling towards the analysis in the inverse problem will be discussed.

**Organizer: Björn Schelter**
University of Freiburg, Germany

**8:20-8:40 Multi-Layered Networks and Emergency of Spatio-temporal Order in Ecological Systems**

**Celso Grebogi**, King’s College, University of Aberdeen, United Kingdom

**8:45-9:05 Direction of Information Flow in Networks**

**Linda Sommerlade**, Jens Timmer, and Björn Schelter, University of Freiburg, Germany

**9:10-9:30 Modelling Brain States by Adaptive Multiple-Time-Scale Networks**

**Marco Thiel**, King’s College, University of Aberdeen, United Kingdom; Björn Schelter, University of Freiburg, Germany

**9:35-9:55 Dynamics of Large-Scale Epileptic Brain Networks**

**Klaus Lehnertz**, Marie-Therese Kuhnert, and Stephan Bialonski, University of Bonn, Germany

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**Thursday, May 26**

**MS134**

**Approximation of Stability Spectra**

8:20 AM-10:00 AM

**Room: Ballroom II**

In this minisymposium we report on recent developments in numerical methods for the approximation of Lyapunov and other stability spectra for dynamical systems. Such stability spectra are important when determining stability properties of time dependent processes that occur in many areas of science and engineering. The types of models considered include ordinary and functional differential equations. Attention is focused on the development, error estimation and convergence analysis of different techniques. Connections are made to other fundamental aspects such as underlying theoretical issues and perturbation analysis.

**Organizer: Dimitri Breda**
University of Udine, Italy

**8:20-8:40 Stability Spectra: Approximation and Perturbation Theory**

**Erik Van Vleck**, University of Kansas, USA

**8:45-9:05 Perturbation Theory for the Approximation of Stability Spectra by QR Methods for Products of Linear Operators**

**Mohamed Badawy and Erik Van Vleck**, University of Kansas, USA

**9:10-9:30 Detecting Exponential Dichotomy on the Real Line**

**Cinzia Elia**, University of Bari, Italy


**Dimitri Breda**, University of Udine, Italy
Thursday, May 26

**MS135**

**Functional Roles of Neural Dynamics During Olfactory Sensory Processing**

8:20 AM-10:00 AM

*Room: Ballroom III*

Recent experimental research on the rodent olfactory bulb and the insect antennal lobe has provided critical insights into the functional role of these sensory-processing neural structures. These systems can robustly recognize vast arrays of complex odors despite the inherent nonlinearities of the sensory inputs and the continuous ongoing neural network remodeling induced by olfactory neurogenesis. Understanding the complex olfactory dynamics requires sophisticated computational models, reviewed or presented in the minisymposium, that examine the functional role of neural rhythms, the effect that connectivity and synaptic changes have on odor representations and other aspects of information processing within the olfactory neural networks.

Organizer: Remus Osan
*Boston University, USA*

Organizer: Eric Sherwood
*Boston University, USA*

8:20-8:40 **Functional Aspects of Olfactory Processing: Neural Rhythms, Dynamics of Input/output Neural Activity and Overview of Related Olfactory Models**

*Remus Osan and Eric Sherwood, Boston University, USA*

8:45-9:05 **Network Adaptation Through Activity-dependent Restructuring: Neurogenesis Enhances Olfactory Pattern Separation**

*Hermann Riecke and Siu Fai Chow, Northwestern University, USA*

continued in next column

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Thursday, May 26

**MS136**

**Central Pattern Generators - Part II of II**

8:20 AM-10:00 AM

*Room: Magpie B*

For Part 1 see **MS16**

Neuronal circuits called central pattern generators (CPGs) underlie many rhythmic motor outputs in animals. CPGs incorporate many features that render them attractive for dynamical systems analysis. While their outputs are dynamically complex and emerge through interactions among network components, their structure makes CPG models amenable to mathematical analysis. In this session, speakers will discuss dynamics of neurons and networks in CPGs for locomotion, respiration, and digestion, including issues of multistability, feedback, and network topology effects.

Organizer: Justin Dunmyre
*University of Pittsburgh, USA*

Organizer: Jonathan E. Rubin
*University of Pittsburgh, USA*

8:20-8:40 **Instability of Twinned Orbits in a Coupled Respiratory Bursting Neuron Model**

*Casey O. Diekman, Ohio State University, USA; Peter Thomas and Chris Wilson, Case Western Reserve University, USA*

8:45-9:05 **Network Bursting: Interactions of the CAN and NaP Currents**

*Justin Dunmyre, University of Pittsburgh, USA; Christopher Del Negro, College of William & Mary, USA; Jonathan E. Rubin, University of Pittsburgh, USA*

9:10-9:30 **Multiple Bursting Mechanisms in Heterogeneous Neural Populations with Metabotropic Glutamate Receptors and NaP and CAN Currents**

*Yaroslav Molkov, Patrick Jasinski, and Natalia Shevtsova, Drexel University College of Medicine, USA; Ilya A. Rybak, Drexel University, USA*


*Natalia Toporikova and Robert Butera, Georgia Institute of Technology, USA*
Recent studies have shown that biological systems respond not only to the presence or magnitude of a stimulus, but also to perturbations in the level of that stimulus over time. Numerous biological systems function as change detectors; however, the underlying dynamics that generate this behavior are only beginning to be explored. Typically, change detection emerges as a result of specifically organized interactions, including positive and negative feedbacks and delayed responses among system agents. This minisymposium will gather researchers who are studying biological systems as change detectors that respond not only to magnitudes, but also to changes in stimulation.

Organizer: Peter S. Kim
University of Utah, USA
Organizer: Sharon A. Bewick
NIMBioS and University of Tennessee, Knoxville, USA

8:20-8:40 Biological Change Detection: Relating Information Acquired to Mechanism Employed
Sharon A. Bewick, NIMBioS and University of Tennessee, Knoxville, USA

8:45-9:05 A Control-Oriented Model for Immune Regulatory Response: Pid Control with Switching
Matthew M. Peet, Illinois Institute of Technology, USA; Peter S. Kim, University of Utah, USA; Peter Lee, Stanford University, USA

continued in next column

Routing Yang, University of California, Santa Barbara, USA; Sharon A. Bewick, NIMBioS and University of Tennessee, Knoxville, USA; Mingjun Zhang, University of Tennessee, Knoxville, USA

9:35-9:55 T Cell State Transitions Produce an Emergent Change Detector
Peter Lee, Stanford University, USA; Peter S. Kim, University of Utah, USA

9:10-9:30 Existence and Stability of Nonlinear Waves in Coupled Systems - Part III of III
8:20 AM-10:00 AM
Room: Wasatch A
For Part 2 see MS127

Nonlinear Wave Phenomena is of broad scientific interest. It pertains to the understanding of real water waves, the interaction of light with matter, optical fiber transmission, traffic flow, earthquakes and galaxy formation. At the heart of studying the phenomena of nonlinear waves is the question of existence and stability of solutions of nonlinear equations. The existence study aims at exhibiting the possible behavior of a given system. The goal of stability analysis is to see if a given solution can be realized experimentally. Our minisymposium aims at bringing speakers who address these issues using numerical or analytical methods.

Organizer: Stephane Lafortune
College of Charleston, USA
Organizer: Anna Ghazaryan
Miami University and University of Kansas, USA
Organizer: Vahagn Manukian
Miami University, USA

8:20-8:40 Existence of Defects in Swift-Hohenberg Equations
Mariana Haragus, Universite de Franche-Comte, France; Arnd Scheel, University of Minnesota, Minneapolis, USA

8:45-9:05 On the Traveling Waves of Gray-Scott Model
Vahagn Manukian, Miami University, USA

8:45-9:05 On the Traveling Waves of Gray-Scott Model
Vahagn Manukian, Miami University, USA

9:10-9:30 Stability Analysis for Closed Curve Solutions to the Vortex Filament Equation
Stephane Lafortune, College of Charleston, USA

Russel Jackson, US Naval Academy, USA
Thursday, May 26

**MS139**

**Nonlinear Dynamics of Laser Systems: Modelling and Applications**

8:20 AM-10:00 AM

Room: Wasatch B

This minisymposium addresses experimental and mathematical approaches to study the nonlinear dynamics of laser systems, such as networks of coupled lasers, and laser with time-delayed optoelectronic feedback. Lasers are oscillators with fundamental nonlinear properties that are also found in other systems in physics engineering and biology. They exhibit very complex dynamics and have a wide range of applications, including optical communication and signal processing, fast random number generation, or sensing. Many of these applications require a detailed understanding of the underlying nonlinear properties of lasers, which leads to interesting questions in dynamical systems theory.

Organizer: Hartmut Erzgraber
University of Exeter, United Kingdom

8:20-8:40 Broadband Chaos Generated by an Optoelectronic Oscillator
Lucas Illing, Reed College, USA;
Kristine Callan, Zheng Gao, and Daniel Gauthier, Duke University, USA

8:45-9:05 Optimal Topologies for Synchronization in a Network of Chaotic Optoelectronic Oscillators
Bhargava Ravoori, University of Maryland, College Park, USA;
Rajarshi Roy, University of Maryland, USA

9:10-9:30 Multiple Injection Dynamics in Two-mode Lasers
Andreas Amann, Simon Osborne, Patrycja Heinricht, Benjamin Wetzel, and Stephen O’Brien, University College Cork, Ireland

9:35-9:55 From Phase Locking to Optical Turbulence in Coupled Lasers
Nicholas Blackbeard, Hartmut Erzgraber, and Sebastian M. Wieczorek, University of Exeter, United Kingdom

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Thursday, May 26

**MS140**

**Applications of Stochastic Dynamical Systems**

8:20 AM-10:00 AM

Room: Maybird

Stochastically modeled processes are common in many areas of contemporary science, such as molecular dynamics, genetics, neuroscience, nonlinear optics, and geosciences, among others. Key topics of stochastic modeling for complex systems will be brought together in this interdisciplinary session. Two speakers will communicate their work in nonlinear optics, where stochastic framework is used to model spatial anisotropy of the medium, resulting in nondeterministic effects in light polarization and signal errors in optical fibers. Two other participants will use novel methods to quantify average behavior of stochastic geoscience-related applications to estimate vital dynamics parameters and predict statistical behavior under external perturbation.

Organizer: Rafail Abramov
University of Illinois, Chicago, USA

8:20-8:40 Estimating Error Probabilities in Noise-Perturbed Nonlinear Optical Systems
Gino Biondini, State University of New York, Buffalo, USA

8:45-9:05 Stochastic Integrable Dynamics in Active Optical Media
Gregor Kovacic, Rensselaer Polytechnic Institute, USA;
Ethan Atkins, Courant Institute of Mathematical Sciences, New York University, USA;
Ilidar Gabitov, University of Arizona and Los Alamos National Laboratory, USA;
Peter R. Kramer, Rensselaer Polytechnic Institute, USA

9:10-9:30 Sub-sampling in Parametric Estimation of Effective Stochastic Models from Discrete Data
Ilya Timofeyev, University of Houston, USA

9:35-9:55 Improved Linear Response for Stochastically Driven Systems
Rafail Abramov, University of Illinois, Chicago, USA

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Thursday, May 26

**MS141**

**Vortex Dynamics: Analysis and Simulation**

8:20 AM-10:00 AM

Room: Superior A

This minisymposium will focus on cutting edge techniques being developed in the direct numerical simulation and the stability analysis of vortex dynamics in 2D, 3D, and spherical geometries and for both inviscid and viscous fluids. The topics presented here will include new higher order vortex methods which allow the vortex particles to deform under the flow, as well as rigorous stability analysis of relative equilibria. These talks will provide a unique opportunity for both mathematicians, applied mathematicians, and engineers to come together to discuss both the numerical and analytical approaches to understanding the complex behavior of vorticity.

Organizer: David T. Uminsky
University of California, Los Angeles, USA

Organizer: Paul Newton
University of Southern California, USA

8:20-8:40 Point Vortex Equilibria and Optimal Packings of Circles on a Sphere
Paul Newton, University of Southern California, USA

8:45-9:05 Relative Equilibria of the (1+N)-vortex Problem
Anna Barry, Glen R. Hall, and C. Eugene Wayne, Boston University, USA

9:10-9:30 Multi-moment Vortex Methods for 2D Viscous Fluids
David T. Uminsky, University of California, Los Angeles, USA;
C. Eugene Wayne, Boston University, USA;
Alethea Barbaro, University of California, Los Angeles, USA;
Vitalii Ostrovskyi, University of Southern California, USA

9:35-9:55 High Order Three Dimensional Lagrangian Methods Based on Deforming Ellipsoids
Louis F. Rossi and Claudio Torres, University of Delaware, USA
Thursday, May 26

**MS142**

*Stochastic Dynamics, Agent-based Models and Networks*

*8:20 AM-10:00 AM*

*Room: Superior B*

Network science at the intersection of applied math, computer science and statistical information theory is undergoing a profound revolution with the availability of social interaction data such as on Twitter and Facebook and the recent advance in experimental techniques. This MS will focus on the statistical equilibrium and non-equilibrium stochastic dynamics of agent-based models and other network models that arise in opinion dynamics, linguistics, protein folding and community detection.

**Organizer:** Chjan C. Lim
*Rensselaer Polytechnic Institute, USA*

*8:20-8:40 Isolated and Composite Networks*

*H. Eugene Stanley, Boston University, USA*

*8:45-9:05 Dynamic Centrality in Real World Networks*

*Peter Csermely, Miklos Antal, Huba Kiss, Istvan Kovacs, Agoston Mihalik, Gabor Simko, and Kristof Szalay, Semmelweis University, Hungary*

*9:10-9:30 Network Synchronization in a Noisy Environment with Time Delays*

*Gyorgy Korniss, David Hunt, and Boleslav Szymanski, Rensselaer Polytechnic Institute, USA*

*9:35-9:55 Center Manifolds, Bifurcations and Noise in Stochastic Network Dynamics*

*Chjan C. Lim and Weituo Zhang, Rensselaer Polytechnic Institute, USA*

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Thursday, May 26

**MS143**

*Symbolic and Computational Algorithms for Chaos Explorations*

*8:20 AM-10:00 AM*

*Room: White Pine*

This minisymposium is focused on recent advances in computational methods for exploration of complex behaviors in universal systems including the exemplary Lorenz, Rossler, and Hindmarsh-Rose models. These methods, including but not limited to Lyapunov exponents, chaos indicators, spike-counting techniques, etc, combined with the generic bifurcation tools (like CONTENT, MATCONT, XPP and AUTO) and using state-of-the-art numerical ODE solvers, reveal parametric patterns that give new insights into the origin of complexity in the deterministic systems including such phenomena as hereroclinic T-points, shrimps formation, and other nonlocal transformations that shape chaotic dynamics in various systems from neurodynamics, nonlinear optics, chemical physics etc.

**Organizer:** Roberto Barrio
*University of Zaragoza, Spain*

*8:20-8:40 Painting Chaos: Computational Methods for Exploration of Complex Behaviors*

*Roberto Barrio, University of Zaragoza, Spain; Andrey Shilnikov, Georgia State University, USA*

*8:45-9:05 Parameter Space Classification of Stable Solutions of Flows*

*Jason Gallas, Instituto de Fisica da UFRGS, Brazil*

*9:10-9:30 Complex Spontaneous Oscillations and Response Properties of Sensory Hair Cells*

*Alexander Neiman, Ohio University, USA; Andrey Shilnikov, Georgia State University, USA*

*9:35-9:55 The Hindmarsh-Rose Neuron Model: Understanding the Bifurcation Scenario by Combining Continuation and Brute-force Computational Methods*

*Marco Storace and Daniele Linaro, University of Genoa, Italy*

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Thursday, May 26

**Intermission**

*10:00 AM-10:05 AM*

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Thursday, May 26

**CP45**

*Biological Applications II*

*10:05 AM-11:25 AM*

*Room: Ballroom I*

**Chair:** David Swigon, University of Pittsburgh, USA

*10:05-10:20 Stretch-Dependent Proliferation in a One-Dimensional Elastic Continuum Model of Cell Layer Migration*

*Tracy L. Stepien and David Swigon, University of Pittsburgh, USA*

*10:25-10:40 A Multicomponent Model for Heterogeneous Biofilms*

*Brandon S. Lindley, Naval Research Laboratory, USA; Qi Wang, University of South Carolina, USA; Tianyu Zhang, Montana State University, USA*

*10:45-11:00 Continuum Model of Collective Cell Migration in Wound Healing and Colony Expansion*

*David Swigon, Julia Arciero, and Qi Mi, University of Pittsburgh, USA*

*11:05-11:20 Modeling Compressive Nonlinearity of Mammalian Hearing*

*Robert Szalai, Alan R. Champneys, and Martin Homer, University of Bristol, United Kingdom*
Thursday, May 26

**CP46**

**Cardiac Modelling**
10:05 AM-11:05 AM
Room: Ballroom III
Chair: John Alford, Sam Houston State University, USA

10:05-10:20 Models of Unidirectional Propagation in Heterogeneous Excitable Media
John G. Alford, Sam Houston State University, USA

10:25-10:40 Spatiotemporal Dynamics of Calcium-Driven Alternans in Cardiac Tissue
Per Sebastian Skardal and Juan G. Restrepo, University of Colorado at Boulder, USA; Alain Karma, Northeastern University, USA

10:45-11:00 Bifurcation and Chaotic Dynamics in a Cardiac Model with Memory
Linyuan Jing and Abhijit Patwardhan, University of Kentucky, USA

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Thursday, May 26

**CP47**

**Oscillators II**
10:05 AM-11:05 AM
Room: Wasatch B
Chair: Ernest Barreto, George Mason University, USA

10:05-10:20 Breaking the Symmetry of the Bimodal Kuramoto System
Ernest Barreto, Bernard C. Cotton, and Paul So, George Mason University, USA

10:25-10:40 What Does Thermodynamic Limit Tell Us About Chimera States?
Oleh Omel’chenko and Matthias Wolfrum, Weierstrass Institute for Applied Analysis and Stochastics, Germany

10:45-11:00 A Transport Equation for Pulse-Coupled Phase Oscillators and a Lyapunov Function for Its Global Analysis
Alexandre Mauroy, and Rodolphe Sepulchre, Université de Liège, Belgium

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Thursday, May 26

**CP48**

**Neuroscience II**
10:05 AM-11:25 AM
Room: Ballroom II
Chair: Michal Zochowski, University of Michigan, USA

10:05-10:20 A Mechanism of Abrupt Transitions Between Firing Frequency Regimes in Entorhinal stellate Cells
Horacio G. Rotstein, New Jersey Institute of Technology, USA; Tilman Kispersky, Brandeis University, USA; John White, University of Utah, USA

10:25-10:40 Crawling Without (CPG): A Neuromechanical Model
Paolo Paoletti and L. Mahadevan, Harvard University, USA

10:45-11:00 Multiple Phase Locked States in Half-Center Oscillators
Sajiya Jalil, Igor Belykh, and Andrey Shilnikov, Georgia State University, USA

11:05-11:20 Astrocyte Mediated Modifications in Functional Neuronal Network Structure
Sarah Feldt, Jane Wang, Elizabeth Shtrahman, Eva Olariu, and Michal Zochowski, University of Michigan, USA
Thursday, May 26

**CP49**

Chaotic Dynamics II  
10:05 AM-11:25 AM  
Room: White Pine  
Chair: Renate Wackerbauer, University of Alaska, Fairbanks, USA  

10:05-10:20 Synchronization of Spatiotemporal Chaos in Rayleigh-Bénard Convection
   Alireza Karimi and Mark Paul, Virginia Polytechnic Institute & State University, USA  
10:25-10:40 Length Scale of Interaction in Spatiotemporal Chaos
   Renate A. Wackerbauer and Dan Stahlke, University of Alaska, Fairbanks, USA  
10:45-11:00 Designing a Computing System Based on a Chaotic Dynamical System by Use of Numerical Analysis
   Behnam Kia, Mark Spano, and William Ditto, Arizona State University, USA  

11:05-11:20 Chaotic Properties in Violin Sounds
   Masanori Shiro, National Institute of Advanced Industrial Science and Technology, Japan; Yoshito Hirata, University of Tokyo, Japan; Kazuyuki Aihara, JST/University of Tokyo, Japan

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Thursday, May 26

**CP50**

Applications in Physics  
10:05 AM-11:25 AM  
Room: Magpie B  
Chair: Korana Burke, University of California, Merced, USA  

10:05-10:20 Quantum Chaotic Scattering in Graphene Systems
   Rui Yang, Liang Huang, and Ying-Cheng Lai, Arizona State University, USA; Celso Grebogi, King’s College, University of Aberdeen, United Kingdom  
10:25-10:40 Chaotic Ionization of Bidirectionally Kicked Rydberg Atoms
   Korana Burke and Kevin A. Mitchell, University of California, Merced, USA; Barry Dunning, Brendan Wyker, and Shuzhen Ye, Rice University, USA  
10:45-11:00 A New Experimental Probe for Investigating the Dynamics of Relativistic Electrons in Storage Rings
   Christophe Szwaj, PhLAM/Université Lille I, France  
11:05-11:20 Quantum Scars in Graphene Billiards
   Liang Huang and Ying-Cheng Lai, Arizona State University, USA; Celso Grebogi, King’s College, University of Aberdeen, United Kingdom; David Ferry, Arizona State University, USA

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Thursday, May 26

**CP51**

Pattern Formation II  
10:05 AM-11:25 AM  
Room: Magpie A  
Chair: Luca Giuggioli, University of Bristol, United Kingdom  

10:05-10:20 A New Type of Relaxation Oscillations in a Model for Enzyme Reactions
   Ilona Kosiuk, Max Planck Institute for Mathematics in the Sciences, Germany; Peter Szmolyan, Vienna University of Technology, Austria  
10:25-10:40 Dissipative 3D Vortices, Their Filaments’ Tension and Response Functions
   Irina Biktasheva, University of Liverpool, United Kingdom; Dwight Barkley, University of Warwick, United Kingdom; Vadim N. Biktashev, University of Liverpool, United Kingdom; Andrew J. Foulkes, University of Manchester, United Kingdom  
10:45-11:00 Stability Analysis of Pulsative Solutions of Legiato-Lefever Equation
   Tomoyuki Miyaji, Kyoto University, Japan; Isamu Ohnishi, Hiroshima University, Japan; Yoshihisa Tsutsumi, Kyoto University, Japan  
11:05-11:20 Collective Movement of Animals and the Emergence of Territorial Patterns
   Luca Giuggioli, Jonathan Potts, and Stephen Harris, University of Bristol, United Kingdom
Thursday, May 26

**CP52**
Dynamical Systems III
10:05 AM-11:05 AM
Room: Superior B
Chair: Bruce Rogers, Duke University, USA
10:05-10:20 Microwave Chaotic Oscillators Using Time-Delayed Feedback
Hien Dao, John Rodgers, and Thomas E. Murphy, University of Maryland, College Park, USA
10:25-10:40 Swarm Clustering Arising from Consensus Algorithms
Bruce Rogers, Duke University, USA
10:45-11:00 Effect of Micro Structure Anisotropy on Dynamically Self Assembled Two Dimensional Structures
Gunjan Thakur and Igor Mezic, University of California, Santa Barbara, USA

Thursday, May 26

**CP53**
Nonlinear Waves
10:05 AM-11:05 AM
Room: Maybird
Chair: Grégory Faye, INRIA Sophia Antipolis, France
10:05-10:20 Stability Analysis for Periodic Waves of a Fourth Order Beam Equation
Milena Stanislavova and Aslıhan Demirkaya, University of Kansas, Lawrence, USA
10:25-10:40 Anomalous Thermalization of Nonlinear Wave Systems
Pierre Suret, Université de Lille 1, France; Claire Michel, H.R. Jauslin, and A. Picozzi, Université de Bourgogne, France; Stéphane Randoux, Université de Lille 1, France
10:45-11:00 Bifurcation of Hyperbolic Planforms in a Relation with a Model of Texture Perception
Grégory Faye, INRIA Sophia Antipolis, France; Pascal Chossat, CNRS and University of Nice, France; Olivier Faugeras, INRIA Sophia Antipolis, France

Thursday, May 26

**CP54**
Engineering Applications II
10:05 AM-11:25 AM
Room: Superior A
Chair: Michal Odyniec, NST, USA
10:05-10:20 Chaos Control in a Transmission Line Model
Ioana A. Triandaf, Naval Research Laboratory, USA
10:25-10:40 Dynamical Systems in Circuit Designer’s Eyes
Michal Odyniec, NST, USA
10:45-11:00 Satisfiability of Elastic Demand in the Smart Grid
Dan-Cristian Tomozei, Technicolor Paris Research Lab, France; Jean-Yves Le Boudec, EPFL, France
11:05-11:20 Modelling and Parameters Identification of Permanent Synchronous Motors
Paolo Mercorelli, Ostfalia University of Applied Sciences, Germany
Thursday, May 26

**CP55**

**Dynamical Systems IV**

10:05 AM-11:25 AM

Room: Wasatch A

Chair: Peter L. Varkonyi, Budapest University of Technology and Economics, Hungary

10:05-10:20 Forecasting Bifurcations for Sensing Applications

Bogdan I. Epureanu, University of Michigan, Ann Arbor, USA

10:25-10:40 Dynamic Stability of Rigid Objects with Frictional Supports

Peter L. Varkonyi, Budapest University of Technology and Economics, Hungary; David Gontier, Ecole Normale Superieure de Paris, France; Joel W. Burdick, California Institute of Technology, USA

10:45-11:00 Unfolding the Catastrophe of the Elastic Web of Links

Róbert K. Németh and Attila G. Kocsis, Budapest University of Technology and Economics, Hungary

11:05-11:20 Heteroclinic Breakdown Beyond All Orders in Generic Analytic Unfoldings of the Hopf-Zero Singularity

Tere M. Seara, Immaculada Baldoma, and Oriol Castejon, Universidad Politecnica de Catalunya, Spain

**Coffee Break**

11:25 AM-11:55 AM

Room: Golden Cliff

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Thursday, May 26

**IP9**

**Moving Pattern Formation from the Real World to the Lab, and the Reverse**

11:55 AM-12:40 PM

Room: Ballroom

Chair: Jonathan Dawes, University of Bath, United Kingdom

This talk will describe three pattern formation experiments where natural systems were imported directly into the laboratory. The overall shape and subsequent rippling instability of icicles is a complex free-boundary growth problem. It has been linked theoretically to similar phenomena in stalactites. We grew laboratory icicles determined the motion of their ripples. Washboard road is the result of the instability of a flat granular surface under the action of rolling wheels. The rippling of the road sets in above a threshold speed and leads to waves which travel down the road. We studied these waves both in the laboratory and using 2D molecular dynamics simulation. Columnar joints are uncanny formations of ordered cracks in certain lava flows. We studied these both in a lab analog system and in the field. Each of these three cases nicely illustrates the pleasures and pitfalls of such “naturalistic” pattern formation experiments. Collaborators: Antony Szu-Han Chen, Nicolas Taberlet, Jim McElwaine, Lucas Goehring and L. Mahadevan

Stephen Morris

*University of Toronto, Canada*

**Closing Remarks**

12:40 PM-12:50 PM

Room: Ballroom
Nonlinear Waves in Integrable and Nonintegrable Systems
Jianke Yang
Mathematical Modeling and Computation 16

Presents cutting-edge developments in the theory and experiments of nonlinear waves, with first-of-its-kind comprehensive coverage of analytical methods for nonintegrable systems. The book also covers in great depth analytical methods for integrable equations, and comprehensively describes efficient numerical methods for all major aspects of nonlinear wave computations. In addition, this book presents the latest experiments on nonlinear waves in optical systems and Bose–Einstein condensates, especially in periodic media.

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Differential Dynamical Systems
James D. Meiss
Mathematical Modeling and Computation 14

Combines much of the material found in a traditional course on ordinary differential equations with an introduction to the modern theory of dynamical systems. Applications to physics, biology, chemistry, and engineering are shown through examples in such areas as population modeling, fluid dynamics, electronics, and mechanics.

2007 · xvi + 412 pages · Softcover · ISBN 978-0-898716-35-1
List Price $79.00 · SIAM Member Price $55.50 · MM14

Elementary Calculus of Financial Mathematics
A. J. Roberts
Mathematical Modeling and Computation 15

Introduces the fascinating area of financial mathematics and its calculus in an accessible manner geared toward undergraduate students. Using little high-level mathematics, the author presents the basic methods for evaluating financial options and building financial simulations.

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May 22 - 26, 2011
Snowbird Ski and Summer Resort
Snowbird, Utah  USA

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May 22 - 26, 2011
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Snowbird, Utah USA
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Abbot, Dorian S., MS34, 8:30 Mon
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Abel, Markus, MS124, 5:10 Wed
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Abramov, Rafail, MS140, 8:20 Thu
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Ayati, Bruce P., MS61, 5:35 Mon
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Ayers, Joseph, MS32, 5:10 Sun
Azad, Abul K., PP1, 8:30 Tue
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Beck, Margaret, MS7, 8:20 Sun
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Best, Janet, MS15, 3:25 Sun
Bewick, Sharon A., MS137, 8:20 Thu
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Bhavaraju, Sripadmavati, CP17, 10:15 Mon
Bianco, Simone, MS108, 8:30 Wed
Bibo, András, CP1, 10:25 Sun
Bielawski, Sergei, MS110, 8:55 Wed
Biktashev, Vadim N., MS33, 5:10 Sun
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Billings, Lora, CP43, 10:15 Wed
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Boatto, Stefanelia, MS18, 3:00 Sun
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Boccaletti, Stefano, MS30, 5:35 Sun
Boczo, Erik M., MS120, 3:00 Wed

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Bollt, Erik, MS73, 8:30 Tue  
Bollt, Erik, MS84, 3:00 Tue  
Bondarenko, Vladimir E., MS44, 9:45 Mon  
Booth, Victoria, MS79, 3:00 Tue  
Booth, Victoria, MS79, 3:00 Tue  
Booth, Victoria, MS90, 5:10 Tue  
Borisyuk, Alla, MS4, 9:35 Sun  
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Bornholdt, Stefan, MS63, 5:10 Mon  
Borondo, Florentino, MS17, 3:50 Sun  
Bose, Amitaba, MS79, 3:50 Tue  
Bose, Amitaba, MS90, 5:10 Tue  
Bose, Amitabha, MS79, 3:50 Tue  
Bourouiba, Lydia, MS6, 9:10 Sun  
Bozorgmagham, Amir E., CP28, 10:15 Tue  
Brøns, Morten, CP5, 10:25 Sun  
Bradley, Elizabeth, PP1, 8:30 Tue  
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Brake, Daniel A., CP44, 10:55 Wed  
Breda, Dimitri, MS134, 8:20 Thu  
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Bressloff, Paul C., MS87, 3:00 Tue  
Broomhead, David, MS41, 9:20 Mon  
Brown, Genevieve, CP34, 10:15 Wed  
Bruder, Andrea, MS69, 8:30 Tue  
Bruder, Andrea, MS80, 3:00 Tue  
Bruder, Andrea, MS91, 5:10 Tue  
Brunton, Steven L., MS23, 6:25 Sun  
Bryce, Robert, CP26, 10:55 Tue  
Buckalew, Richard, CP23, 10:15 Tue  
Budd, Chris, MS96, 5:10 Tue  
Budisic, Marko, MS49, 3:00 Mon  
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Budisic, Marko, MS60, 5:10 Mon  
Buice, Michael, MS76, 9:20 Tue  
Burke, John, MS71, 8:30 Tue  
Burke, John, MS71, 8:30 Tue  
Burke, Korana, CP50, 10:25 Thu  
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Busch, Michael, CP9, 10:25 Sun  
Caldas, Iberê L., MS31, 5:35 Sun  
Callaway, Duncan, MS89, 5:10 Tue  
Calleja, Renato, MS107, 9:45 Wed  
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Callendar, Hannah, MS131, 5:35 Wed  
Camassa, Roberto, MS105, 8:30 Wed  
Camassa, Roberto, MS105, 8:55 Wed  
Campbell, Stuart G., MS121, 3:25 Wed  
Canavier, Carmen, MS126, 5:35 Wed  
Canner, Judith, MS80, 3:25 Tue  
Carr, Thomas W., CP43, 10:55 Wed  
Carroll, Thomas L., MS101, 8:30 Wed  
Carroll, Thomas L., MS101, 9:45 Wed  
Catlla, Anne, MS50, 3:50 Mon  
Champneys, Alan R., MS82, 3:00 Tue  
Champneys, Alan R., MS96, 5:10 Tue  
Chandrasekaran, Lakshmi, PP1, 8:30 Tue  
Cherry, Elizabeth M., MS44, 3:00 Sun  
Cherry, Elizabeth M., MS44, 3:00 Sun  
Chertkov, Michael, IP6, 2:00 Tue  
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Chertkov, Michael, MS89, 5:10 Tue  
Chicone, Carmen, MS127, 5:10 Wed  
Childs, Lauren M., PP1, 8:30 Tue  
Chini, Greg, MS1, 9:10 Sun  
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Chirilus-Bruckner, Martina, MS57, 6:00 Mon  
Chong, Christopher, MS75, 8:55 Tue  
Chong, Christopher, MS92, 5:10 Tue  
Chow, Carson C., MS87, 4:15 Tue  
Chow, Carson C., PD2, 8:30 Wed  
Chow, Siu Fai, CP42, 10:15 Wed  
Christov, Ivan C., MS25, 6:00 Sun  
Christov, Ivan C., MS47, 3:00 Mon  
Chuter, Anna M., CP13, 10:15 Mon  
Cioaba, Sebastian, MS4, 9:10 Sun  
Clercx, Herman, MS25, 5:10 Sun  
Clewley, Robert, MS123, 5:10 Wed  
Clewley, Robert, MS123, 5:35 Wed  
Cogan, Nick, MS71, 8:55 Tue  
Cohen, Adam B., MS86, 3:50 Tue  
Colbaugh, Richard, MS109, 8:30 Wed  
Colbaugh, Richard, MS109, 8:30 Wed  
Colizza, Vittoria, MS29, 6:25 Sun  
Colombo, Alessandro, MS96, 5:35 Tue  
Comboul, Maud, MS59, 6:25 Mon  
Conway, Jessica M., MS18, 3:50 Sun  
Corron, Ned J., MS101, 8:30 Wed  
Cox, Steven, MS123, 6:25 Wed  
Criado, Regino, CP4, 10:25 Sun  
Csermely, Peter, MS142, 8:45 Thu  
Curbelo, Jezabel, PP1, 8:30 Tue  
Cushing, Jim M., MS80, 3:00 Tue  
Cvitanovic, Predrag, MS17, 3:00 Sun  
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Davidsen, Jörn, MS33, 6:25 Sun
de Swart, Huib, MS21, 3:25 Sun
Deane, Jonathan, MS47, 4:15 Mon
Del Castillo-Negrete, Diego, MS31, 6:25 Sun
Demirkaya, Aslihan, CP53, 10:05 Thu
Dena, Angeles, PP1, 8:30 Tue
Denker, Manfred, MS48, 3:00 Mon
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Desroches, Mathieu, MS5, 9:35 Sun
DeVille, Lee, MS8, 9:35 Sun
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D’Huys, Otti, MS125, 5:10 Wed
Di, Liu, MS8, 8:45 Sun
Di Bernardo, Mario, MS19, 3:00 Sun
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Di Carlo, Dino, MS66, 5:35 Mon
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Diniz Behn, Cecilia, MS90, 9:15 Tue
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Doelman, Arjen, MS46, 3:50 Mon
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Durian, Douglas, MS20, 3:25 Sun
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Fenton, Flavio H., MS121, 3:00 Wed
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Fonoberov, Vladimir, CP23, 10:55 Tue
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Forget, Gael, MS13, 3:25 Sun
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Franzke, Christian, MS122, 5:10 Wed
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Galan, Roberto F., MS126, 6:25 Wed
Galanthay, Theodore E., CP9, 10:05 Sun
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Galtier, Mathieu N., CP19, 10:55 Mon
Garcia, Ricardo, MS74, 8:55 Tue
Garland, Joshua T., CP22, 10:15 Mon
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Gorochowski, Thomas, MS30, 5:10 Sun
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Grebogi, Celso, MS95, 5:10 Tue
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Griffith, Boyce E., MS121, 3:50 Wed
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Haller, George, MS12, 3:00 Sun
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Houghton, Steve, MS82, 4:15 Tue
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Humphreys, Jeffrey, MS116, 3:25 Wed
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Humphries, Tony R., MS119, 3:00 Wed
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Kang, Yun, MS91, 5:10 Tue
Kanter, Ido, MS114, 3:00 Wed
Kantsler, Vasily, MS94, 6:00 Tue
Kaper, Tasso J., MS5, 8:45 Sun
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Kareva, Irina, MS80, 3:50 Tue
Karimi, Alireza, CP49, 10:05 Thu
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Kawahara, Genta, MS104, 8:55 Wed
Kelly, Scott D., MS66, 5:10 Mon
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Kevrekidis, Panayotis, MS14, 3:00 Sun
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Khadr, Anmar, MS56, 5:10 Mon
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Kilpatrick, Zachary, PP1, 8:30 Tue
Kim, Jung Eun, PP1, 8:30 Tue
Kim, Peter S., MS137, 8:20 Thu
Kim, Peter S., MS137, 9:35 Thu
Kimura, Masayuki, PP1, 8:30 Tue
Kinzell, Wolfgang, MS125, 6:00 Wed
Kiss, Istvan, MS95, 6:00 Tue
Kitajo, Keiichi, MS88, 3:00 Tue
Kitajo, Keiichi, MS99, 5:10 Tue
Kitajo, Keiichi, MS99, 5:10 Tue
Kitzbichler, Manfred G., MS43, 9:20 Mon
Kjerland, Marc, PP1, 8:30 Tue
Klepel, Konrad, PP1, 8:30 Tue
Knowles, James, PP1, 8:30 Tue
Kocsis, Attila G., CP1, 10:45 Sun
Kogan, Irina, MS11, 8:20 Sun
Kogan, Irina, MS11, 9:35 Sun
Kori, Hiroshi, MS10, 8:45 Sun
Korniss, Gyorgy, MS142, 9:10 Thu
Kosiuk, Ilona, CP51, 10:05 Thu
Kostelich, Eric J., MS13, 3:00 Sun
Kostelich, Eric J., MS13, 4:15 Sun
Kostelich, Eric J., MS24, 5:10 Sun
Kottos, Tsampikos, MS2, 9:35 Sun
Kovacic, Gregor, MS140, 8:45 Thu
Kraenkel, Roberto A., MS29, 5:10 Sun
Kraenkel, Roberto A., MS29, 5:35 Sun
Kramar, Miroslav, MS103, 9:20 Wed
Kramer, Mark, MS5, 9:10 Sun
Kramer, Peter R., MS38, 9:45 Mon
Kramer, Peter R., MS83, 3:00 Tue
Kramer, Peter R., MS94, 5:10 Tue
Kramer, Sean, PP1, 8:30 Tue
Krauskopf, Bernd, MS70, 9:45 Tue
Krechetnikov, Rouslan, CP15, 10:15 Mon
Krogh-Madsen, Trine, MS132, 6:00 Wed
Krueger, Helge, MS60, 6:25 Mon
Kuehn, Christian, MS111, 3:00 Wed
Kuehn, Christian, MS111, 4:15 Wed
Kuehn, Christian, MS122, 5:10 Wed
Kulkarni, Varsha S., CP26, 10:35 Tue
Kumar, Ashok L., MS65, 5:10 Mon
Kumar, Ashok L., MS76, 8:30 Tue
Kumar, Ashok L., MS76, 8:55 Tue
Kundu, Soumya, PP1, 8:30 Tue
Kurths, Juergen, MS19, 3:00 Sun
Kurths, Juergen, MS19, 3:25 Sun
Kurths, Juergen, MS30, 5:10 Sun

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Lindenberg, Katja, MS14, 3:50 Sun
Lindley, Brandon S., CP45, 10:25 Thu
Lipinski, Douglas M., CP28, 10:35 Tue
Liu, Chin-Yueh, MS98, 5:35 Tue
Liu, Chun, MS46, 4:15 Mon
Liu, Ningyu, MS128, 5:35 Wed
Liu, Rongsong, MS6, 8:20 Sun
Liu, Rongsong, MS6, 9:35 Sun
Livina, Valerie, MS111, 3:00 Wed
Lloyd, David, MS93, 5:10 Tue
Lloyd, David, MS93, 6:00 Tue
Lore, Sophie, CP37, 10:35 Wed
Lomeli, Hector E., MS97, 5:10 Tue
Lomeli, Hector E., MS97, 5:10 Tue
Long, Yunhan, PP1, 8:30 Tue
Lopez, Juan M., CP5, 10:45 Sun
Lopez, Juan M., MS42, 8:30 Mon
Lopour, Beth A., MS90, 5:35 Tue
Lu, Wenlian, MS26, 5:35 Sun
Lvov, Yuri V., MS105, 8:30 Wed
Lvov, Yuri V., MS105, 9:20 Wed
Ly, Cheng, MS99, 6:00 Tue
Ma, Yiping, MS82, 3:25 Tue
Ma’ayan, Avi, MS100, 8:55 Wed
Macau, Elbert E., MS118, 3:00 Wed
Macau, Elbert E., MS118, 4:15 Wed
Mader, Wolfgang, PP1, 8:30 Tue
Mahoney, John R., CP28, 10:55 Tue
Malka, Roy, MS120, 3:00 Wed
Maloney, Craig, MS20, 4:15 Sun
Mancho, Ana M., MS112, 3:25 Wed
Manore, Carrie A., MS91, 5:35 Tue
Manukian, Vahagn, MS116, 3:00 Wed
Manukian, Vahagn, MS127, 5:10 Wed
Manukian, Vahagn, MS138, 8:20 Thu
Manukian, Vahagn, MS138, 8:45 Thu
Marangell, Robert, MS116, 3:50 Wed
Marchesin, Dan, MS36, 9:20 Mon
Marella, Sashi, MS102, 8:55 Wed
Marino, Simeone, MS131, 6:00 Wed
Mariño, Ines P., MS118, 3:50 Wed
Marques, Francisco, CP35, 10:55 Wed
Maruskin, Jared M., MS22, 3:00 Sun
Maruskin, Jared M., MS22, 3:50 Sun
Masuda, Naoki, MS65, 5:35 Mon
Matsuzawa, Hiroshi, MS127, 6:00 Wed
Mattingly, Jonathan C., MS49, 4:15 Mon
Mauroy, Alexandre, CP47, 10:45 Thu
McCalla, Scott, MS93, 5:10 Tue
McCalla, Scott, MS93, 5:10 Tue
McCullen, Nick, CP9, 10:45 Sun
McGehee, Richard, MS34, 8:30 Mon
McGehee, Richard, MS34, 8:55 Mon
McKinley, Scott, MS38, 8:30 Mon
McLaughlin, Richard, MS1, 9:35 Sun
Meaud, Julien, MS106, 8:55 Wed
Medvedev, Georgi S., MS4, 8:20 Sun
Medvedev, Georgi S., MS4, 8:20 Sun
Medvedev, Georgi S., MS15, 3:00 Sun
Medvedev, Georgi S., MS26, 5:10 Sun
Meerkamp, Philipp, MS70, 9:20 Tue
Mehlig, Bernhard, MS113, 3:00 Wed
Mehlig, Bernhard, MS124, 5:10 Wed
Mehlig, Bernhard, MS124, 5:10 Wed
Meiss, James D., MS103, 8:30 Wed
Meiss, James D., MS112, 3:00 Wed
Mellard, Jarad, MS21, 4:15 Sun
Mercorelli, Paolo, CP54, 11:05 Thu
Mezic, Igor, MS60, 5:10 Mon
Mier-y-Teran, Luis, MS108, 8:55 Wed
Miller Neilan, Rachael, MS69, 8:30 Tue
Miller Neilan, Rachael, MS80, 3:00 Tue
Miller Neilan, Rachael, MS91, 5:10 Tue
Miller Neilan, Rachael, MS91, 5:10 Tue

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Nakagaki, Toshiyuki, MS110, 8:30 Wed
Nakao, Hiroya, MS10, 8:20 Sun
Nakao, Hiroya, MS10, 9:10 Sun
Nan, Pingyu, PP1, 8:30 Tue
Ncube, Israel, CP7, 10:45 Sun
Neiman, Alexander, MS143, 9:10 Thu
Németh, Róbert K., CP55, 10:45 Thu
Nepomnyashchy, Alexander, MS77, 8:30 Tue
Netoff, Theoden I., MS115, 3:25 Wed
Nevai, Andrew, MS61, 6:25 Mon
Newby, Jay M., PP1, 8:30 Tue
Newhall, Katherine, MS98, 9:10 Tue
Newton, Paul, MS141, 8:20 Thu
Newton, Paul, MS141, 8:20 Thu
Ngo, Duc, MS14, 4:15 Sun
Nguyen, Toan, MS7, 8:20 Sun
Nguyen, Toan, MS127, 5:35 Wed
Ni, Xuan, CP22, 10:55 Mon
Nielsen, Kenneth Hagde M., PP1, 8:30 Tue
Nishikawa, Takashi, MS54, 3:00 Mon
Nishikawa, Takashi, MS54, 3:00 Mon
Nordmark, Arne, MS96, 6:25 Tue
Novak, Chris, MS47, 3:50 Mon
Núñez, Carmen, MS129, 5:10 Wed
Nykamp, Duane, MS76, 8:30 Tue

Odom, Stephen E., PP1, 8:30 Tue
Odyniec, Michal, CP54, 10:25 Thu
Ogawa, Yutaro, PP1, 8:30 Tue
Ohnishi, Isamu, CP51, 10:45 Thu
Olivar, Gerard, CP29, 10:55 Tue
Olsson, Peter, MS20, 3:50 Sun
Olver, Peter, MS11, 8:45 Sun
Omel’chenko, Oleh, CP47, 10:25 Thu
Omran, Ashraf, CP15, 10:35 Mon
Onnela, Jukka-Pekka, MS73, 8:55 Tue
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Orosz, Gabor, MS62, 5:10 Mon
Orosz, Gabor, MS62, 5:10 Mon
Osin, Remus, MS135, 8:20 Thu
Osin, Remus, MS135, 8:20 Thu
Otani, Niels F., MS121, 4:15 Wed
Ott, Edward, MS2, 8:20 Sun
Ott, Edward, MS2, 8:45 Sun
Otto, Felix, IP7, 11:45 Wed
Otto, Kevin, MS40, 9:20 Sun
Overbye, Thomas, MS89, 5:35 Tue

Padberg-Gehle, Kathrin, MS112, 3:50 Wed
Pais, Darren, MS84, 4:15 Tue
Paley, Derek A., MS35, 8:30 Mon
Paley, Derek A., MS35, 8:30 Mon
Paoletti, Paolo, CP48, 10:25 Thu
Park, Choongseok, MS55, 3:00 Mon
Park, Choongseok, PP1, 8:30 Tue
Parshad, Rana D., CP33, 10:35 Tue
Patrick, George, MS22, 3:00 Sun
Paul, Ujjayan, CP5, 10:05 Sun
Pavliotis, Greg, MS8, 8:20 Sun
Pavliotis, Greg, MS8, 8:20 Sun
Payton, Oliver D., MS74, 8:30 Tue
Payton, Oliver D., MS74, 8:30 Tue
Pazo, Diego, MS42, 8:30 Mon
Peckham, Bruce B., CP33, 10:55 Tue
Pecora, Louis M., MS2, 8:20 Sun
Pecora, Louis M., MS2, 8:20 Sun
Peet, Matthew M., MS137, 8:45 Thu
Pego, Robert, MS7, 8:20 Sun
Pei, Keerti, MS23, 6:00 Sun
Pelinovskiy, Dmitry, MS53, 3:50 Mon
Peyla, Philippe, MS83, 3:25 Tue
Phillips, Andrew, MS79, 3:25 Tue
Piapecchi, Slawomir, PP1, 8:30 Tue
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Poetzsche, Christian, MS129, 6:25 Wed
Pogan, Alin, MS93, 6:25 Tue
Porter, Jeff, CP35, 10:35 Wed
Porter, Mason A., MS73, 8:30 Tue
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Postlethwaite, Claire M., MS37, 8:30 Mon
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Proctor, Joshua, MS16, 4:10 Sun
Promislow, Keith, MS27, 6:25 Sun
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Promislow, Keith, MS57, 5:10 Mon
Psemenek, Tiffany M., CP34, 10:35 Wed
Pujals, Enrique, IP5, 11:45 Tue
Putkaradze, Vakhtang, CP1, 10:05 Sun
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Rachford, Frederic, MS101, 9:20 Wed  
Radmaneshfar, Elahe, MS95, 6:25 Tue  
Radons, Gunter, MS42, 9:20 Mon  
Rahaman, Sabiar, CP18, 10:15 Mon  
Rajendran, Karthikeyan, MS100, 9:45 Wed  
Raman, Arvind, MS74, 9:20 Tue  
Ramírez-Ros, Rafael, MS97, 5:35 Tue  
Rangan, Aaditya, MS135, 9:10 Thu  
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Ravooori, Bhargava, MS139, 8:45 Thu  
Reeks, Mike, MS124, 6:00 Wed  
Remington, Karin, PD1, 12:45 Tue  
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Rink, Bob, MS107, 8:30 Wed  
Ritter, Laura, MS39, 8:30 Mon  
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Ritter, Laura, MS61, 5:10 Mon  
Ritter, Laura, MS61, 5:10 Mon  
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Roberts, Anthony J., MS8, 9:10 Sun  
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Rogers, Bruce, CP52, 10:25 Thu  
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Romance, Miguel, CP21, 10:15 Mon  
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Rom-Kedar, Vered, MS131, 5:10 Wed  
Rosa, Epaminondas, MS118, 3:00 Wed  
Rosa, Epaminondas, MS118, 3:00 Wed  
Rosenbaum, Robert, MS65, 5:10 Mon  
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Rosenbaum, Robert, MS76, 8:30 Tue  
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Rosenblum, Michael, MS10, 8:20 Sun  
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Rotstein, Horacio G., CP48, 10:05 Thu  
Rottmann-Matthes, Jens, MS36, 9:45 Mon  
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Roy, Rajarshi, MS114, 3:00 Wed  
Roy, Rajarshi, MS125, 5:35 Wed  
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Rubchinsky, Leonid, MS55, 3:00 Mon  
Rubin, Jonathan E., MS16, 3:00 Sun  
Rubin, Jonathan E., MS65, 6:00 Mon  
Rubin, Jonathan E., MS136, 8:20 Thu  
Rucklidge, Alastair M., MS37, 8:30 Mon  
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Rulkov, Nikolai, MS32, 5:10 Sun  
Rulkov, Nikolai, MS32, 6:00 Sun  
Rypina, Irina, MS60, 6:00 Mon  
Sacré, Pierre, CP20, 10:35 Mon  
Saha, Raj, MS34, 9:20 Mon  
Saintillian, David, MS83, 4:15 Tue  
Saka, Yasushi, MS52, 3:50 Mon  
Sakovitch, Anton, MS92, 6:00 Tue  
Salau, Kehinde, MS80, 4:15 Tue  
Samaey, Giovanni, MS68, 8:30 Tue  
Sander, Evelyn, MS81, 3:50 Tue  
Sandstede, Björn, MS53, 3:00 Mon  
Sanjuan, Miguel, CP34, 10:55 Wed  
Sato, Yuzuru, MS88, 3:00 Tue  
Sato, Yuzuru, MS88, 3:00 Tue  
Sato, Yuzuru, MS99, 5:10 Tue  
Sauer, Tim, MS95, 5:10 Tue  
Sayama, Hiroki, MS63, 5:35 Tue  
Schöll, Eckehard, MS125, 5:10 Wed  
Schechter, Stephen, MS36, 8:30 Mon  
Schechter, Stephen, MS36, 8:30 Mon  
Scheel, Arnd, MS57, 5:10 Mon  
Schelter, Björn, MS95, 5:35 Tue  
Schelter, Bjoern, MS133, 8:20 Thu  
Scheper, Christopher J., CP12, 10:55 Mon  
Schiff, Steven J., MS28, 5:10 Sun  
Schittler Neves, Fabio, MS37, 9:20 Mon  
Schmidt, Deena, MS15, 3:50 Sun  
Schnabel, Michael, MS130, 6:25 Wed  
Schneider, Tobias, MS104, 9:20 Wed  
Schugart, Richard, MS50, 3:00 Mon  
Schwartz, Ira B., MS108, 9:45 Wed  
Scott, Sherry, MS49, 3:25 Mon  
Seara, Tere M., CP55, 10:15 Thu  
Sendina-Nadal, Irene, CP21, 10:55 Mon  
Sentman, Davis, MS128, 5:10 Wed  
Seoane, Jesus M., CP38, 10:35 Wed  
Serrano, Sergio, MS81, 4:15 Tue  
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Shaw, Leah, MS63, 5:10 Mon
Shaw, Leah, MS63, 6:25 Mon
Shaw, Steve, MS122, 6:25 Wed
Shea-Brown, Eric, MS28, 5:35 Sun
Sherwood, Eric, MS115, 4:15 Wed
Sherwood, Eric, MS135, 8:20 Thu
Shew, Woodrow L., MS43, 8:30 Mon
Shew, Woodrow L., MS43, 8:30 Mon
Shiau, LieJune, MS115, 3:00 Wed
Shiau, LieJune, MS126, 5:10 Wed
Shilnikov, Andrey, MS117, 3:00 Wed
Shilnikov, Andrey, MS117, 3:50 Wed
Shimo, Masanori, MS99, 5:35 Tue
Shiro, Masanori, CP49, 11:05 Thu
Shlizerman, Eli, MS87, 3:00 Tue
Shlizerman, Eli, MS87, 3:25 Tue
Shlizerman, Eli, MS98, 5:10 Tue
Shuai, Zhisheng, MS6, 8:20 Sun
Sieber, Jan, CP7, 10:05 Sun
Sieber, Jan, MS111, 3:00 Wed
Sieber, Jan, MS122, 5:10 Wed
Sikorski, Kajetan, MS94, 6:25 Tue
Silber, Mary C., MS45, 5:00 Mon
Silber, Mary C., MS45, 5:30 Mon
Silber, Mary C., PD2, 8:30 Wed
Silva, Julio Daniel M., PP1, 8:30 Tue
Simon, Peter L., MS116, 3:00 Wed
Simpson, David J., MS58, 6:00 Mon
Sinden, David, CP7, 10:25 Sun
Singh, Anuraj, CP18, 10:35 Mon
Sipahi, Rifat, MS30, 6:25 Sun
Skardal, Per Sebastian, CP46, 10:25 Thu
Skufca, Joseph, MS130, 5:35 Wed
Smith, Leslie, MS105, 8:30 Wed
So, Paul, MS30, 6:00 Sun
Solla, Sara A., MS98, 6:25 Tue
Sommerlade, Linda, MS133, 8:45 Thu
Sooknanan, Joanna, PP1, 8:30 Tue
Sorrentino, Francesco, CP42, 10:55 Wed
Spardy, Lucy, MS72, 9:20 Tue
Speetjens, Michel, MS112, 4:15 Wed
Spiller, Elaine, MS24, 5:35 Sun
Stanley, H. Eugene, MS142, 8:20 Thu
Starke, Jens, MS3, 8:45 Sun
Starke, Jens, MS102, 8:30 Wed
Steele, Charles, MS106, 9:45 Wed
Stefanov, Atanas, MS53, 3:00 Mon
Stefanov, Atanas, MS64, 5:10 Mon
Stefanov, Atanas, MS64, 6:25 Mon
Steinbock, Oliver, MS33, 5:35 Sun
Stepan, Gabor, CP44, 10:35 Wed
Stepien, Tracy L., CP45, 10:05 Thu
Stoop, Ruedi, CP21, 10:35 Mon
Storace, Marco, MS143, 9:35 Thu
Stout, John E., PP1, 8:30 Tue
Straube, Artur, MS124, 5:35 Wed
Struchiner, Claudia, MS18, 3:00 Sun
Struchiner, Claudia, MS29, 5:10 Sun
Sturman, Rob, MS47, 3:00 Mon
Sturman, Rob, MS47, 3:00 Mon
Su, Jianzhong, MS39, 8:55 Mon
Sun, Jie, MS84, 3:25 Tue
Sun, Jie, MS130, 5:10 Wed
Surana, Amit, MS40, 9:45 Sun
Surana, Amit, MS40, 8:30 Mon
Surana, Amit, MS51, 3:00 Mon
Suret, Pierre, CP53, 10:25 Thu
Susuki, Yoshihiko, MS60, 5:35 Mon
Swain, Daniel T., MS35, 8:55 Mon
Swigon, David, CP45, 10:45 Thu
Szalai, Robert, MS106, 8:30 Wed
Szalai, Robert, CP45, 11:05 Thu
Szwaj, Christophe, CP50, 10:45 Thu

Italicized names indicate session organizers.
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<tr>
<th>Name</th>
<th>Start</th>
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<td>Towne, Warren</td>
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<td>Triandaf, Ioana A.</td>
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<td>Tricoche, Xavier M.</td>
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<td>Tunc, Ilker</td>
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<td>White, John</td>
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<td>Williams, Matthew O.</td>
<td>4:15 Tue</td>
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<tr>
<td>Willis, Ashley</td>
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<tr>
<td>Wilson, Jay</td>
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<td>Wojcik, Jeremy</td>
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<td>Wrobel, Jacek K.</td>
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<td>Wu, Jian-Young</td>
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<td>Wu, Qiliang</td>
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<td>Wurms, Alexander</td>
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<td>Yoshiyama, Kohei</td>
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<td>Young, Todd</td>
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<td>Young, Todd, MS131</td>
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<td>Zambrano, Samuel</td>
<td>10:55 Wed</td>
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</table>

Italicized names indicate session organizers.
Zeeman, Mary Lou, MS34, 8:30 Mon
Zenkov, Dmitry, MS11, 8:20 Sun
Zenkov, Dmitry, MS22, 4:15 Sun
Zhang, Jiawei, PP1, 8:30 Tue
Zhang, Wenjun, MS70, 8:55 Tue
Zhao, Ken, PP1, 8:30 Tue
Zheng, Jiongxuan, PP1, 8:30 Tue
Zochowski, Michal, CP48, 11:05 Thu
Zou, Yo, MS3, 9:10 Sun
Zschaler, Gerd, MS63, 6:00 Mon
Zuo, Wangda, MS40, 8:30 Sun
## DS11 Budget

### Conference Budget

**SIAM Conference on Dynamical Systems**  
**May 22-26, 2011**  
**Snowbird, Utah, USA**

**Expected Paid Attendance:** 680

<table>
<thead>
<tr>
<th>Revenue</th>
<th>Total</th>
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<tbody>
<tr>
<td>Registration</td>
<td>$186,865</td>
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<tr>
<td>Total</td>
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<table>
<thead>
<tr>
<th>Direct Expenses</th>
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<tbody>
<tr>
<td>Printing</td>
<td>$7,300</td>
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<tr>
<td>Organizing Committee</td>
<td>$4,000</td>
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<tr>
<td>Invited Speaker</td>
<td>$15,500</td>
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<tr>
<td>Food and Beverage</td>
<td>$21,900</td>
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<tr>
<td>Telecomm</td>
<td>$4,000</td>
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<tr>
<td>AV and Equipment (rental)</td>
<td>$22,800</td>
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<tr>
<td>Room (rental)</td>
<td>$1,800</td>
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<td>Advertising</td>
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<tr>
<td>Conference Staff Labor</td>
<td>$27,500</td>
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<tr>
<td>Other (supplies, staff travel, freight, misc.)</td>
<td>$7,400</td>
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**Total Direct Expenses:** $120,900

<table>
<thead>
<tr>
<th>Support Services: *</th>
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<tbody>
<tr>
<td>Services covered by Revenue</td>
<td>$65,965</td>
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<tr>
<td>Services covered by SIAM</td>
<td>$57,114</td>
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</table>

**Total Support Services:** $123,079

**Total Expenses:** $243,979

* Support services includes customer service, accounting, computer support, shipping, marketing and other SIAM support staff. It also includes a share of the computer systems and general items (building expenses in the SIAM HQ).