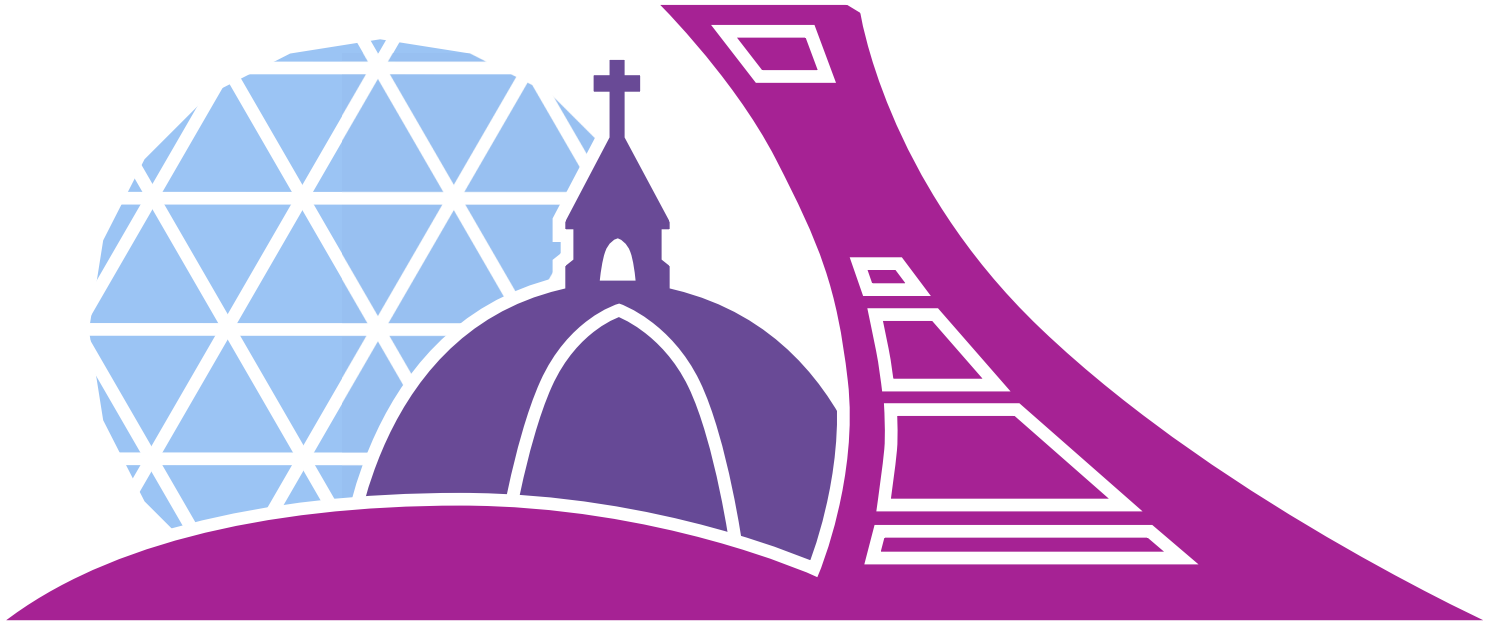


14th U.S. National Congress on Computational Mechanics

POLYTECHNIQUE MONTRÉAL

USACM

Montréal • July 17-20, 2017

Congress Program at a Glance

Sunday, July 16		Monday, July 17	Tuesday, July 18	Wednesday, July 19	Thursday, July 20
Short Course Registration 8:00 am - 9:30 am		Registration 7:30 am - 5:30 pm	Registration 7:30 am - 5:30 pm	Registration 7:30 am - 5:30 pm	Registration 7:30 am - 11:30 am
	8:30 am - 9:00 am	OPENING			
Short Courses 9:00 am - 12:00 pm	9:00 am - 9.45 am	PL: **Tarek Zohdi** Chair: J.T. Oden	PL: **Andrew Stuart** Chair: T. Hughes	PL: **Mark Ainsworth** Chair: L. Demkowicz	PL: **Anthony Patera** Chair: M. Paraschivoiu
	9:45 am - 10:15 am	Coffee Break	Coffee Break	Coffee Break	Coffee Break
	10:15 am - 11:55 am	Technical Session TS1	Technical Session TS4	Technical Session TS7	Technical Session TS10
Lunch Break	11:55 am - 1:30 pm	Lunch Break	Lunch Break	Lunch Break	CLOSING
Short Courses 1:00 pm - 4:00 pm	1:30 pm - 2:15 pm	[a]SPL: **Raúl Tempone**	[a]SPL: **Ron Miller**	[a]SPL: **Eldad Haber**	
		[b]SPL: **Marino Arroyo**	[b]SPL: **Beth Wingate**	[b]SPL: **Margot Gerritsen**	
	2:15 pm - 2:30 pm	Break-out	Break-out	Break-out	
	2:30 pm - 4:10 pm	Technical Session TS2	Technical Session TS5	Technical Session TS8	
Congress Registration 2:00 pm - 8:00 pm	4:10 pm - 4:40 pm	Coffee Break	Coffee Break	Coffee Break	
	4:40 pm - 6:20 pm	Technical Session TS3	**Poster Session TS6**	Technical Session TS9	
Reception **7th floor Terrace** 6:00 pm - 8:00 pm		Opening in **517BC** Plenary Lectures (PL) in **517BC** Semi-Plenary Lectures (SPL): [a]SPL in **517D** [b]SPL in **516BC** Poster Session in **517A**		Cocktail 7:00 pm - 7:30 pm Banquet 7:30 pm - 9:30 pm Fireworks 10:00 pm - 10:30 pm	Coffee Breaks in **517A** Cocktail and Banquet in **517BC** Viewing of Fireworks and Closing Reception on **7th floor Terrace**

On behalf of Polytechnique Montréal, it is my pleasure to welcome, to Montreal, the 14th U.S. National Congress on Computational Mechanics (USNCCM14). Over the years, USNCCM has undeniably become an event of reference in the field of Computational Science and Engineering (CS&E), with participants from academia, government and industry. The congress, which will be held for the first time outside of the US, has selected for its venue the City of Montreal. Excellent choice indeed, as Montreal is a bustling city with many cultural events and summer festivals. In addition to the quality of its universities, Montreal is such an attractive city that it has been recognized in 2017 as the World's best destination for students.

As innovation is increasingly synonymous with competitiveness, growth, and prosperity, it is not surprising that government and industry stakeholders in Canada rely more and more on its research institutions, such as Polytechnique Montréal, to ensure the continuing growth of its knowledge-based economy. Since the digital revolution of the 70s, innovation has greatly benefited from simulation-based engineering and sciences to the point that this field has now permeated every possible industrial sector. Whether it be the development and optimization of chemical processes for the biorefining industry, the large-scale production of nanomedicines for the pharmaceutical industry, the optimization of aircraft designs for the aerospace sector, or the design of effective and minimally-invasive surgeries, CS&E has become an indispensable component of R&D activities in such key sectors of our modern economies. It is also an asset for the development of technologies based on clean and sustainable sources of energy.

CS&E may help provide a clear and decisive edge to all industries. For instance, those that increasingly rely on virtual prototyping and process simulation to improve the quality of their processes and products, and simultaneously reduce their costs, will increase their chances of maintaining or boosting their competitiveness in the global market.

As a leading school of engineering in Canada, Polytechnique Montréal, with the collaboration of other universities from Quebec, Ontario and Northeast US, is extremely proud to host the 14th edition of the USNCCM.

I wish you a great congress and a wonderful experience in Montreal.

Kind regards,

François Bertrand Eng., Ph.D.
Chief Research, Innovation & International Officer

POLYTECHNIQUE MONTRÉAL

We are pleased to welcome you to USNCCM14, the 14th U.S. National Congress on Computational Mechanics, the biennial congress of the U.S. Association for Computational Mechanics (USACM), which is held this year at the Palais des Congrès de Montréal, July 17-20, 2017.

From their inception in 1991, the biennial congresses of USACM have become major scientific events, drawing computational engineers and scientists from government, academia, and industry. The congress provides an excellent forum for researchers and practitioners from all over the world to discuss the latest advancements and future directions in fields pertaining to Computational Engineering and Sciences. The 14th edition will indeed continue the tradition, as the technical program of USNCCM14 features four plenary and six semi-plenary lectures by renown scholars, over eighty mini-symposia, two student poster competitions sponsored by AHPCRC and the Journal of Computers and Mathematics with Applications, and several short courses on various topics in Computational Engineering and Sciences.

Social activities include a welcome and a closing reception on the terrace of the Palais des Congrès, a congress banquet, during which the winners of the student poster competitions will be awarded the prizes and that will be followed by the viewing of the Pyro Rhapsody fireworks of the Festival de l'International des Feux. We also hope you will find time to enjoy the cultural diversity and discover the joie de vivre of Montreal and its surroundings. 2017 is also a special year in Montréal, as the city celebrates its 375th anniversary with activities and events commemorating its history. Moreover, it is internationally recognized for its many summer festivals, fine dining, unique architecture, and hospitality.

We are grateful to the USNCCM14 scientific and local organizing committees, as well as the USACM Council and Steering Committee, for sharing valuable advice on the organization of the congress. We would like to thank of course the USACM staff, in particular Mrs. Ruth Hengst, for their patience and diligence in dealing with our many requests. We thank the mini-symposia organizers for attracting high-quality speakers and scheduling the technical sessions, the student volunteers for their invaluable help, and the sponsors of USNCCM14 for their generous support. At last but not least, we would like to thank all speakers and poster presenters, whose technical contributions will make USNCCM14 a successful congress.

Steven Dufour, Marc Laforest, and Serge Prudhomme
USNCCM14 Co-Chairs
Departement of Mathematics and Industrial Engineering
École Polytechnique de Montréal

Palais des Congrès de Montréal

Congress Information

Registration Location/Hours

The registration desk is located on the 5th floor of the Palais des Congrès de Montreal. Registration hours are as follows:

Sunday:	2:00 pm – 8:00 pm
Monday – Wednesday:	7:30 am – 5:30 pm
Thursday:	7:30 am – 11:30 am

Registration Fees

Your registration fee includes access to all technical sessions, receptions, breaks, poster session, and banquet. Those who are registered as accompanying persons may attend the opening reception and banquet.

Congress App

The congress app may be located by searching for USNCCM14 in your app store. The app is available for all registered participants. To logon to the app use your email used when you registered and the password MONTREAL375.

WiFi Information

SSID: USNCCM14
Password: MONTREAL375

Events

Opening Reception: The Opening Reception will be held on the 7th floor Terrace of the Palais des Congrès on Sunday, July 16, beginning at 6:00 pm. Sponsorship of this event by **École Polytechnique Montréal** is greatly appreciated.

USACM Awards Ceremony: USACM Awards will be given during the Opening Ceremony, beginning at 8:30 am on Monday morning. Join us in honoring our colleagues.

Women's Networking Event: The Women's Networking Event will take place on Tuesday evening, beginning at 5:30 pm on the 7th floor Terrace. Check with the registration desk for more details.

AHPCRC Poster Session: The AHPCRC Poster Session, Tuesday afternoon, will feature over 80 posters. Awards to be announced at the Congress banquet on Wednesday night.

Special Talk by NSF Program Manager: Dr. Siddiq Qidwai will present a special talk, "Mechanics Opportunities at NSF" on Monday, July 17, 5:00 pm - 6:00 pm, in Room 517D.

Exhibitors/Sponsors

We welcome the following exhibitors to USNCCM14: Elsevier, Fraunhofer, Michigan Institute for Computational Discovery and Engineering, Sandia National Laboratories, SIAM, and Wiley. We also thank our sponsors: AHPCRC, ETS, Polytechnique Montréal, and McGill University. A special thanks goes to Tourisme Montréal for their support.
Special support is provided from **AHPCRC** for the student poster session and partial support of the Plenary and Semi-Plenary Speakers travel from **Sandia National Laboratories**.

Plenary Speakers

Tarek Zohdi
University of California, Berkeley
Monday, July 17, 9:00 am, 517BC
Chair: J. Tinsley Oden

Mark Ainsworth
Brown University
Wednesday, July 19, 9:00 am, 517BC
Chair: Leszek Demkowicz

Andrew Stuart
California Institute of Technology
Tuesday, July 18, 9:00 am, 517BC
Chair: Thomas J.R. Hughes

Anthony Patera
Massachusetts Institute of Technology
Thursday, July 20, 9:00 am, 517BC
Chair: Marius Paraschivoiu

Semi-Plenary Speakers

Raúl Tempone
King Abdullah University of Science and Technology
Monday, July 17, 1:30 pm, 517D
Chair: Jim Stewart

Marino Arroyo
Universitat Politècnica de Catalunya (UPC) - BarcelonaTech
Monday, July 17, 1:30 pm, 516BC
Chair: Pedro Díez

Ronald E. Miller
Carleton University
Tuesday, July 18, 1:30 pm, 517D
Chair: Ellad Tadmor

Beth Wingate
University of Exeter
Tuesday, July 18, 1:30 pm, 516BC
Chair: Clint Dawson

Eldad Haber
University of British Columbia
Wednesday, July 19, 1:30 pm, 517D
Chair: Azzeddine Soulaïmani

Margot Gerritsen
Stanford University
Wednesday, July 19, 1:30 pm, 516BC
Chair: Charbel Farhat

USNCCM14 Organization

Steven Dufour
Marc Laforest
Serge Prudhomme

Department of Mathematics and Industrial Engineering
École Polytechnique Montréal

USNCCM14 Local Organizing Committee

Yves Bourgault, University of Ottawa
Suvranu De, Rensselaer Polytechnic Institute
Michel Delfour, Université de Montréal
André Fortin, Université Laval
Eric Laurendeau, École Polytechnique Montréal
Martin Lévesque, École Polytechnique Montréal
Siva Nadarajah, McGill University
Marius Paraschivoiu, Concordia University
Dominique Pelletier, École Polytechnique Montréal
Mark S. Shephard, Rensselaer Polytechnic Institute
Azzeddine Soulaimani, École de Technologie Supérieure
Jean-Yves Trépanier, École Polytechnique Montréal

USNCCM14 USACM Council and Steering Committee

Officers

President: Leszek Demkowicz, UT Austin
Vice-President: John Dolbow, Duke University
Secretary/Treasurer: Yuri Bazilevs, UC-San Diego

Board of Directors

Thomas J.R. Hughes, UT Austin
J.Tinsley Oden, UT Austin

Members at Large

K. Garikipati, University of Michigan
R. Ghanem, USC
E. Kuhl, Stanford University
S. Li, UC-Berkeley
A. Marsden, Stanford University
H. Park, Boston University
N. Sukumar, UC-Davis
J. Zhang, Carnegie Mellon University

USNCCM14 International Scientific Committee

R. Batra, *Virginia Polytechnic Institute and State University*
J.E. Bishop, *Sandia National Laboratories*
R. de Borst, *University of Sheffield*
J.S. Chen, *University of California-San Diego*
A. Coutinho, *COPPE/Universidade Federal do Rio de Janeiro*
S. De, *Rensselaer Polytechnic Institute*
L. Demkowicz, *ICES, UT Austin*
J. Dolbow*, Duke University*
C. Farhat, *Sanford University*
J. Fish, *Columbia University*
R. Ghanem, *University of Southern California*
O. Ghattas, *ICES, UT Austin*
S. Ghosh, *Johns Hopkins University*
S. Govindjee, *University of California-Berkeley*
I. Harari, *Tel Aviv University*
T.J.R. Hughes, *ICES, UT Austin*
P. Ladevèze, *LMT-Cachan*
T. Laursen, *Khalifa University*
S. Li, *University of California-Berkeley*
W.K. Liu, *Northwestern University*
H. Mang, *Vienna University of Technology*
K. Maute, *University of Colorado*
P. Minev, *University of Alberta*
N. Nigam, *Simon Fraser University*
J.T. Oden, *ICES, UT Austin*
E. Oñate, *CIMNE*
M. Ortiz, *California Institute of Technology*
P. Papadopoulos, *University of California-Berkeley*
H. Park, *Boston University*
A. Patra, *University of Buffalo*
G. Paulino, *Georgia Institute of Technology*
S. Prudhomme, *École Polytechnique de Montréal*
M. Puso, *Los Alamos National Laboratory*
E. Ramm, *University of Stuttgart*
J.N. Reddy, *Texas A&M University*
M. Shephard, *Rensselaer Polytechnic Institute*
J. Stewart, *Sandia National Laboratories*
N. Sukumar, *University of California-Davis*
K. Tamma, *University of Minnesota*
T. Tezduyar, *Rice University*
K. van der Zee, *University of Nottingham*
P. Wriggers, *University of Hannover*

Technical Sessions at a Glance

TS1	Technical Session 1	Monday, July 17, 10:15 am – 11:55 am
TS2	Technical Session 2	Monday, July 17, 2:30 pm – 4:10 pm
TS3	Technical Session 3	Monday, July 27, 4:40 – 6:20 pm
TS4	Technical Session 4	Tuesday, July 18, 10:15 am – 11:55 am
TS5	Technical Session 5	Tuesday, July 18, 2:30 pm – 4:10 pm
TS6	**Poster Session 6**	**Tuesday, July 18, 4:30 pm – 6:00 pm**
TS7	Technical Session 7	Wednesday, July 19, 10:15 am – 11:55 am
TS8	Technical Session 8	Wednesday, July 19, 2:30 pm – 4:10 pm
TS9	Technical Session 9	Wednesday, July 19, 4:40 pm – 6:20 pm
TS10	Technical Session 10	Thursday, July 20, 10:15 am – 11:55 am

USNCCM14 Minisymposia Session Times

MS	Title	Sessions
001	Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard	TS1-TS5, TS7, TS10
101	Advances in Computational Biomechanics	TS1-TS3
102	Computational Bioengineering and Medicine	TS4-TS5
103	Computational Biomechanics of Impact and Injury	TS3-TS5, TS7
104	Computational Mechanobiology of Biological Systems	TS1
105	Direct and Inverse Methods for Cardiovascular and Pulmonary Mechanics	TS8-TS10
106	Image-Based Models for Biomedical Applications	TS5
107	Mechanobiology of Cells, Vesicles and Biomembranes	TS8-TS10
108	Multiscale Modeling in Bio-mechanical Systems	TS1-TS4
201	Advances in High-Order Methods for Computational Fluid Dynamics	TS1-TS5

202	Advances in Meshfree Particle Methods for Fluid Mechanics	TS9-TS10
203	Computational Methods for Hydraulics	TS3-TS5
204	Computational Methods in Environmental Fluid Mechanics	TS8-TS10
205	Computational Microfluids	TS1-TS2
206	Model Reduction in Computational Fluid Dynamics	TS7-TS10
301	Advancements in Hydraulic Fracture Simulation	TS3-TS5, TS7-TS10
302	Advances in Computational Methods for Soil Sciences	TS5
303	Computational Geomechanics	TS1-TS5
304	Computational Methods and Design for Impact and Blast Problems	TS1-TS5, TS7
401	Computational Fracture Mechanics	TS4-TS5, TS7-TS10
402	Modeling and Simulation for Complex Material Behavior	TS7-TS10
403	Modeling and Simulation of Damage and Fracture in Brittle and Quasi-Brittle Materials	TS9-TS10
404	Multiscale and Computational Methods in Failure Mechanics	TS4-TS5, TS7-TS8
405	Peridynamic Modeling and Simulations	TS1-TS3
406	Recent Advances in Computational Fracture Mechanics and Failure Analysis	TS1-TS3
501	Computational Fluid-Structure Interaction: Methods and Applications	TS1-TS5
503	Computational Modeling of Contact and Embedded Interfaces	TS1-TS2
504	Flow-Induced Vibrations: Solution Techniques and Models	TS7
505	Fluid-Structure Interaction Algorithms and Applications	TS7-TS9
506	Free and Moving Boundary Problems: Methods and Applications	TS4-TS5, TS7-TS10
507	Phase-field Modeling and Simulation in Fluids, Solids, and Biomechanics	TS7-TS9
508	Stabilized and Multiscale Methods for Interface Mechanics	TS8-TS9
601	Advances in Computational Methods for Inverse Problems	TS1-TS4
602	Advances in Topology Optimization for Manufacturing	TS5, TS7-TS9
603	Bayesian Statistical Inversion in Engineering Mechanics	TS8-TS9
605	New Trends in Topology Optimization	TS3-TS5, TS7-TS9

701	Advanced Computational Methods and Theories for Predicting Material Behaviors at Various Length Scales	TS1-TS3
702	Advances in Adaptive Methods for Modeling Heterogeneous Microstructures	TS1
703	Classical and Non-classical Plate and Shell Models in Computational Mechanics of Multilayered, Sandwich, and Functionally Graded Composites	TS1-TS2
705	Instabilities in Solids Across the Scales	TS9-TS10
706	Modeling and Simulation for Solidification Processes in Manufacturing	TS9
707	Modeling and Simulation in Additive Manufacturing	TS4-TS5, TS7-TS8
708	Modeling and Simulation of Additive Manufacturing Processe	TS1-TS3
709	Modeling Materials with Coupled Physics	TS2-TS3
710	Modeling of Soft Materials	TS4-TS5
801	Adaptivity for Multiscale Problems	TS1-TS2
802	Advances in Atomistic-to-Continuum Coupling Techniques	TS3-TS5, TS7-TS10
803	Advances in the Modelling of Multi-Scale, Multi-Physics and Multi-Uncertainty Problems	TS7
804	Complex Multi-Physics Coupling Techniques: Advances and Applications	TS3-TS4
805	Computational Modeling of Multi-Functional Materials	TS7-TS9
806	Concurrent Multi-Length Scale Modeling: from Finite Elements to Atoms and Electrons	TS1-TS2
807	Coupled Multiphysics Problems: Discretization Approaches and Solution Methods	TS4-TS5
808	Modeling at the Intersection of First Principles Methods, Mechanics and Mathematics	TS5, TS7-TS10
809	Multi-scale and Multi-physics Computations in Fluids and Solids	TS1-TS2
812	Multiphysics Computation and Coupled Effects	TS8-TS9
813	Multiscale Computational Homogenization for Bridging Scales in the Mechanics and Physics of Complex Materials	TS1-TS5
901	Advanced Computational Methods for Complex Geometry Simulations	TS1-TS2, TS4
902	Advances and Applications of the Generalized/eXtended Finite Element Method	TS1-TS3
903	Advances in Numerical Methods for Linear and Non-Linear Dynamics and Wave Propagation	TS1-TS3
904	BIE/BEM and Their Fast Solution Methods	TS8-TS10

905	Cohesive Zone Models – Fundamentals and Multiscale Applications	TS7
908	Finite Element Methods for Wave Propagation	TS8-TS10
910	Isogeometric Methods	TS1-TS3
911	Isogeometric Methods for Complex Geometries and Multi-Physics Systems	TS4-TS5, TS7
912	Meshfree and Particle Methods: New Developments and Applications	TS1-TS5, TS7-TS8
913	Non-standard Formulations and Discretization Methods for Thin-walled Structures	TS4-TS5
914	Peridynamics and Its Applications	TS5, TS7-TS8
915	Polygonal and Polyhedral Discretizations in Computational Mechanics	TS7-TS10
916	Saddle Point and Mixed Discretization of Variational Problems	TS4-TS5, TS7
1001	Building Advanced Capabilities in Scientific Software	TS10
1002	Computational Methods in Image Analysis	TS8
1003	Enabling Technologies and Simulation Practices for Advanced Scientific and Engineering Computation	TS8-TS10
1005	Symposium on Trends in Unstructured Mesh Generation	TS1-TS3
1101	Advances in Adaptive Approaches for Large-scale Deterministic and Stochastic Problems	TS4-TS5, TS7
1102	Advances in Error Analysis and Computational Aspects of Deterministic and Stochastic PDE Eigenvalue Problems	TS8-TS9
1104	A Posteriori Error Estimation and Adaptivity	TS8-TS10
1105	Data Driven Paradigms and Uncertainty Quantification in Computational Mechanics	TS5, TS7-TS10
1107	Stochastic Methods in Computational Mechanics of Random Materials	TS4-TS5
1108	Uncertainty Propagation and Quantification in Multiscale Simulation of Materials Response, Structural Performance, and Failure	TS1-TS3
1109	Uncertainty Quantification and Stochastic Modeling in Biological Systems	TS7

Monday Plenary Speaker

9:00-9:45 am

Tarek Zohdi

University of California, Berkeley

Multiphysical Simulation for Advanced Additive Manufacturing Processes

Room: 517BC

Abstract: Within the last decade, several industrialized countries have stressed the importance of advanced manufacturing to their economies. Many of these plans have highlighted the development of additive manufacturing techniques, such as 3D printing, which are still in their infancy. The objective is to develop superior products, produced at lower overall operational costs. For these goals to be realized, a deep understanding of the essential ingredients comprising the materials involved in additive manufacturing is needed. The combination of rigorous material modeling theories, coupled with the dramatic increase of computational power can potentially play a significant role in the analysis, control, and design of many emerging additive manufacturing processes. Specialized materials and the precise design of their properties are key factors in the processes. Specifically, particle-functionalized materials play a central role in this field, in three main ways: (1) to endow filament-based materials by adding particles to a heated binder (2) to "functionalize" inks by adding particles to freely flowing solvents and (3) to directly deposit particles, as dry powders, onto surfaces and then to heat them with a laser, e-beam or other external source, in order to fuse them into place. The goal of these processes is primarily to build surface structures, coatings, etc., which are extremely difficult to construct using classical manufacturing methods. The objective of this presentation is to introduce the audience to basic techniques which can allow them to rapidly develop and analyze particulate-based materials needed in new additive manufacturing processes. This presentation is broken into two main parts: continuum and discrete element approaches. The materials associated with methods (1) and (2) are closely related types of continua (particles embedded in a continuous binder) and are treated using continuum approaches. The materials in method (3), which are of a discrete particulate character, are analyzed using discrete element methods.

Bio: Tarek I. Zohdi received his Ph.D. in 1997 in Computational and Applied Mathematics from The University of Texas at Austin and his Habilitation in General Mechanics from the Gottfried Leibniz University of Hannover in 2002. He is currently a Chancellor's Professor of Mechanical Engineering, Chair of the Computational and Data Science and Engineering Program at UC Berkeley and holder of the W. C. Hall Family Endowed Chair in Engineering. He also holds a Staff Scientist position at Lawrence Berkeley National Labs. His main research interests are in computational approaches for advanced manufacturing and nonconvex multiscale-multiphysics inverse problems, in particular addressing the issue of how large numbers of micro-constituents interact to produce macroscale aggregate material behavior. He has published over 135 archival refereed journal papers and five books. In 2000, he received the Zienkiewicz Prize and Medal, which are awarded once every two years, to one post-graduate researcher under the age of 35, by The Institution of Civil Engineers in London, to commemorate the work of Professor O. C. Zienkiewicz, for research which contributes most to the field of numerical methods in engineering. In 2002, he received the Best Paper of the Year 2001 Award in London, at the Lord's Cricket Grounds, for a paper published in Engineering Computations, pertaining to modeling and simulation of the propagation of failure in particulate aggregates of material. In 2003, he received the Junior Achievement Award of the American Academy of Mechanics. The award is given once a year, to one post-graduate researcher, to recognize outstanding research during the first decade of a professional career. In 2008, he was elected Fellow of the International Association for Computational Mechanics (IACM) and in 2009 he was elected Fellow of the United Stated Association for Computational Mechanics (USACM). He was elected President of the USACM in 2012, and served from 2012 to 2014.

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 516A	**MS 001**	**Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard** **Chair(s): Kenneth Jansen**		
Keynote Presentation: **J. Tinsley Oden***, Ernesto Lima, Amir Shahmoradi, Barbara Wohlmuth, Thomas Horger, David Hormuth, Thomas Yankeelov	OPAL: Bayesian Framework for Model Selection and Quantifying Model Inadequacy	Reliable Automated Simulation Technologies to Aid in Diagnosing and Treating Heart Disease **Charles Taylor***	Two-Way Integration of Mesh Adaptivity with High-Deformation Multi-Material Simulation **Daniel Ibanez***, Thomas Voth, Glen Hansen	Unstructured and Anisotropic Adaptivity for Complex Stochastic Problems **Onkar Sahni***, Jason Li, Alvin Zhang
Room: 514C	**MS 101**	**Advances in Computational Biomechanics** **Chair(s): Corey P. Neu and David M. Pierce**		
Keynote Presentation: **Ellen Kuhl***, Silvia Budday, Gerhard Sommer, Paul Steinmann, Gerhard A. Holzapfel	Constitutive Modeling of Human Brain Tissue	IMPETUS Interactive MultiPhysics Environment for Unified Simulations **Vi Ha***, George Lykotrafitis	Methodology for Generating Hexahedral Finite Element Meshes of Patient-Specific Cartilage using Image Data from the Osteoarthritis Initiative **David Pierce***, Borja Rodríguez Vila	
Room: 515A	**MS 104**	**Computational Mechanobiology of Biological Systems** **Chair(s): Elisa Budyn**		
Patterning and Morphogenesis of Cortical Folding **Sarah Verner***, Shiva Rudraraju, Krishna Garikipati	Automated Method for Mechanical Properties Characterization in Tissue-Engineered Cartilage **Ophélie Pollet***, Aurélie Levillain, Christel Henrionnet, Astrid Pinzano, Morad Bensidhoum, Caroline Boulocher, Thierry Hoc	Dynamic Tumor Growth Modeling with New Vessel Formation and Drug Delivery **Tae-Rin Lee***, Sung Sic Yoo	Long-Term Study of Bone-on-Chip to Monitor Stem Cell Derived Osteocyte Mechanotransduction **Elisa Budyn***, Samantha Sanders, Morad Bensidhoum, Eric Schmidt, Bertrand Cinquin, Patrick Tauc, Hervé Petite	

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 514B	**MS 108**	**Multiscale Modeling in Bio-mechanical Systems** **Chair(s): Lucy T. Zhang**		
Keynote Presentation: **Franck Vernerey***, Shankar Sridhar, Stephanie Bryant	Computational Modeling of Hydrogel-Based Tissue Engineering: En Route to Personalized Regenerative Medicine	Modeling of the Periodic Axon Membrane Skeleton Structure with Measurement of its Mechanical Properties **Yihao Zhang***, Krithika Abiraman, He Li, David Pierce, Anastasios Tzingounis, George Lykotrafitis	The Structural Changes of Finger 3 in the Mutated Ankyrin Repeat Domain of the Human TRPV4 Channel Alter ATP Binding Ability **Shu-Wei Chang*,** Tsu-Hsin Kao	Per-Residue Energetic Analysis Clarifies the Mechanism of the Binding Strength Inside Microtubes **Ning Liu*,** Ramana Pidaparti, Xianqiao Wang
Room: 520A	**MS 201**	**Advances in High-Order Methods for Computational Fluid Dynamics** **Chair(s): Freddie Witherden**		
Keynote Presentation: **ZJ Wang***, Jingchang Shi, Hong Yan	Improved Wall-Modeling for Large Eddy Simulation using the FR/CPR Method	Three-Dimensional High-Order Simulations of Low-Pressure Turbine Blade Cascades **Arvind Iyer***, Freddie Witherden, Brian Vermeire, Yoshiaki Abe, Ralf-Dietmar Baier, Antony Jameson, Peter Vincent	Higher-Order Multi-Dimensional Limiting Strategy for Subcell Resolution in Unstructured Triangular Meshes **Hojun You***, Chongam Kim	Optimization-Based Anisotropic Mesh-Polynomial Adaptation for High-Order Methods **Nicolas Ringue***, Siva Nadarajah
Room: 520C	**MS 205**	**Computational Microfluidics** **Chair(s): Thomas Gervais**		
Keynote Presentation: **Liviu Clime***, Xuyen Dai Hoa, Keith J. Morton	Numerical Modeling of Inertial Focusing Effects in Curved Microfluidic Flows	Modelling Microfluidic Sample Traps to Optimize Trapping and Culture of Ex Vivo Biological Samples **Nassim Rousset***, Frédéric Monet, Thomas Gervais	Effect of Geometry of Microfluidic on Hydrodynamic Single Cell Trapping **Ahmad Sohrabi Kashani***, Muthukumaran Packirisamy	

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 520E	**MS 303**	**Computational Geomechanics** **Chair(s): WaiChing Sun**		
Face Stability Analysis in Mechanized Tunnelling: A Novel FE Approach Based on Incompatible Modes and Strong Discontinuity Kinematics **Abdullah Alsahly***, Callari Carlo, Gunther Meschke	A Framework for the Modeling of Gypsum Cavity Dissolution within Geomechanical Studies **Farid Laouafa***, Michel Quintard	A Bounding Surface Plasticity Model for Natural Clay Calibration, Validation and Application **Thomas Barciaga***, Tom Schanz	Dynamic Rupture Simulation of a Tunnel Subjected to Fault Displacements using Parallel 3D-FEM **Yuta Mitsuhashi***, Gaku Hashimoto, Hiroshi Okuda, Fujio Uchiyama	
Room: 518C	**MS 304**	**Computational Methods and Design for Impact and Blast Problems** **Chair(s): Miguel Pando**		
Keynote Presentation: **Qing Li***, Guangyong Sun, Jianguang Fang	Computational Design of Hierarchical Structures for Crashworthiness Criteria	Crashworthiness Optimization of Horsetail-Bionic Thin-Walled Structures **Hongbin Fang***, Youye Xiao, Hanfeng Yin, Guilin Wen	Intrinsic Cohesive Modeling of the Impact Cracking of Laminated Glass **Shunhua Chen***, Shinobu Yoshimura, Tomonori Yamada	Assessment of Soil Inertia Effects in Dynamic Analysis of Piles under Impact Loading **Miguel Pando***, Gustavo Pacheco, Luis Suarez
Room: 521BC	**MS 405**	**Peridynamic Modeling and Simulations** **Chair(s): Pablo Seleson**		
Keynote Presentation: **Stewart Silling***	Stabilization of Peridynamic Correspondence Material Models	Peridynamic Models for Anisotropic Media **Pablo Seleson***, Jeremy Trageser, Max Gunzburger	Finite Deformation Constitutive Models and Mechanics of Peridynamic Mixtures **John Foster***, Xiao Xu	

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 518B	**MS 406**	**Recent Advances in Computational Fracture Mechanics and Failure Analysis** **Chair(s): Hiroshi Okada**		
Numerical Modeling of Void Coalescence and Shear Localization in Ductile Solids **Xiaosheng Gao***, Tuo Luo	Evaluation of Elastic-Plastic Fracture Simulation for Compact Tension Specimen Subjected to Low Cycle Fatigue **Yoshitaka Wada***	Parallel Elastic-Plastic Analysis using a Domain Decomposition Method with a Nonlinear Solver **Yasunori Yusa***, Hiroshi Okada, Tomonori Yamada, Shinobu Yoshimura		
Room: 520D	**MS 501**	**Computational Fluid-Structure Interaction: Methods and Applications** **Chair(s): TBD**		
Keynote Presentation: **Romesh Batra***, Yegao Qu	An Immersed Boundary Formulation for Simulating High-Speed Compressible Viscous Flows with Moving Solids	Anderson-Accelerated Spatial Coupling of Lattice Boltzmann and Navier-Stokes Solvers **Philipp Neumann***, Benjamin Uekermann	An Embedded Robin Boundary Method for Incompressible Fluid-Structure Interaction Problems with Large Deformation **Shunxiang Cao***, Alex Main, Kevin Wang	Full-Eulerian XFEM for Fluid-Structure Interaction Analysis **Toshiki Nagai***, Kurt Maute
Room: 520F	**MS 503**	**Computational Modeling of Contact and Embedded Interfaces** **Chair(s): Michael Puso**		
Liquid-Solid Contact: Algorithms for Sticking and Sliding **Roger Sauer***	Multigrid Methods for Crack Propagation and Contact **Cyrill von Planta***, Rolf Krause, Alena Kopanicakova, Patrick Zulian	Modeling Contact Interfaces by Considering Structural Anisotropy and Plasticity **George Michaloudis***, Alexander Konyukhov, Norbert Gebbeken	Frictional Contact on a Rigid Obstacle for the Particle-Difference Method **Tod Laursen***, Tae-Yeon Kim, Dhafer Khalefa Jadaan, Jeong-Hoon Song	Applying Projection-Based Reduced-Order Modeling to the Constrained System with Lagrange Multipliers **Euiyoung Kim***, Maenghyo Cho

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 524C	**MS 601**	**Advances in Computational Methods for Inverse Problems** **Chair(s): Paul Barbone**		
Keynote Presentation: **Chrysoula Tsogka***, Miguel Moscoso, Alexei Novikov, George Papanicoloau	Multifrequency Interferometric Imaging with Intensity-Only Measurements	A Linear Sampling Method for Through-the-Wall Radar Detection **Aihua Wood***, Matthew Charnley	Near-Field Equation for an Elastic Half-Space from the View Point of the Far-Field Properties of Green's Function **Terumi Touhei***, Taizo Maruyama	Characterization of Near-Surface Road Cavity using an Elastic Wave Full-Waveform Inversion Method **Jun Won Kang***, Boyoung Kim, Seungwook Youn, Seong-Hoon Kee, Haesang Jeong
Room: 523A	**MS 701**	**Advanced Computational Methods and Theories for Predicting Material Behaviors at Various Length Scales** **Chair(s): Jeong-Hoon Song**		
Reduced Order Variational Multiscale Enrichment Method (ROVME) for Coupled Thermo-Mechanical Problems **Caglar Oskay***, Shuhai Zhang	Multiscale Thermodynamics: Toward a Precise Description of the Microstructural Evolution of Complex Materials **Jean-Philippe Harvey***, Aimen Gheribi	A Micromorphic Computational Homogenization Framework for Heterogeneous Materials **Leong Hien Poh***, Raja Biswas	A Homogenized Gradient Elasticity Model for Plane Wave Propagation in Bi-Laminate Composites **Swee Hong Tan***, Leong Hien Poh	New Particle Difference Algorithm for Material Nonlinear Problem **Young-Cheol Yoon***, Jeong-Hoon Song
Room: 523B	**MS 702**	**Advances in Adaptive Methods for Modeling Heterogeneous Microstructures** **Chair(s): Yan Azdoud and Coleman Alleman**		
Integrated Computational Materials Engineering **Karel Matous***	Modeling the Effects of Microstructure on Localization in Polycrystalline Stainless Steel **Coleman Alleman***, James Foulk, Alejandro Mota, Hojun Lim, David Littlewood	Recent Advances in the Full Field Modeling of Recrystallization and Grain Growth using the Level Set Approach **Daniel Pino Muñoz***, Marc Bernacki, Nathalie Bozzolo, Thomas Toulorge, Charbel Moussa, Ludovic Maire, Julien Fausty	Developing Physically-Based Three Dimensional Polycrystalline Microstructures **Hojun Lim***, Fadi Abdeljawad, Steve Owen, Jacob Gruber, Garritt Tucker, James Foulk	The Adaptive Wavelet Enhancement of the Crystal Plasticity Finite Element Method **Yan Azdoud***, Jiahao Cheng, Somnath Ghosh

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 525A	**MS 703**	**Classical and Non-classical Plate and Shell Models in Computational Mechanics of Multilayered, Sandwich, and Functionally Graded Composites** **Chair(s): Alexander Tessler**		
A Nonlocal Higher-Order Zig-Zag Theory Based on a Strain Gradient Elasticity **Jun-Sik Kim***	Static Analysis of Sandwich Beams Including the Effect of Adhesive Layers by using the Mixed Refined Zigzag Theory **Marco Gherlone***	Buckling Behavior of Thin Walled Composite Box Beams with Variable Stiffness **Taner Timarci***, Muhsin Gökhan Gunay	A Plate Element Formulation for Modeling Progressive Damage and Failure of Shear Deformable Laminates **Devlin Hayduke***	
Room: 518A	**MS 708**	**Modeling and Simulation of Additive Manufacturing Processes** **Chair(s): Neil Hodge**		
Global Sensitivity Analysis of a Selective Laser Melting Finite Element Model: Identification of Influential Parameters **Claire Bruna-Rosso***, Ali Gokhan Demir, Maurizio Vedani, Barbara Previtali	Modelling Powder Bed Fusion Feature Creation **Mustafa Megahed***, Wolfgang Ottow	A Semi-Analytical Model of Selective Laser Melting Process **Can Ayas***, Yabin Yang	Numerical Simulation of Temperature Fields in Powder Bed Fusion Process by using Hybrid Point and Line Heat Source Model **Zhibo Luo***, Yaoyao Zhao	Temperature and Distortion Simulation for Laser Powder Bed Fusion Parts **Erik Denlinger***, Pan Michaleris
Room: 516D	**MS 801**	**Adaptivity for Multiscale Problems** **Chair(s): Kristoffer Van Der Zee**		
Keynote Presentation: **Eric Chung***	Adaptive Multiscale Methods for Heterogeneous Flows	A Posteriori Error Estimation for Multiscale Computations Based on MsFEM **Frédéric Legoll***, Ludovic Chamoin	A New Paradigm for the Numerical Approximation of Sign-Changing Problems **Simon Lemaire***, Assyr Abdulle	

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 515C	**MS 806**	**Concurrent Multi-Length Scale Modeling: from Finite Elements to Atoms and Electrons** **Chair(s): Qing Peng and Suvranu De**		
Keynote Presentation: **Dandan Lyu***, Shaofan Li	Molecular Dynamics Simulations of a Porous Nano-Fluidic Desalination Device	Scale-Bridging for Multiscale Modeling of Reactive Materials **Tiange Li***, Shaofan Li	Static and Dynamic Applications of Atomistic-Based Boundary Element Method **Xiaojie Wu***, Xiantao Li	
Room: 515B	**MS 809**	**Multi-scale and Multi-physics Computations in Fluids and Solids** **Chair(s):Yozo Mikata**		
Effective Thermal and Elastic Properties of a Composite with Spheroidal and Ellipsoidal Inhomogeneities **Yozo Mikata***	Nano-Motions of FePd Nanorobots Subjected to Applied Magnetic Field by Molecular Dynamics Mode **Minoru Taya***, Takehiro Matsuse	The Schwarz Alternating Method in Solid Mechanics **Alejandro Mota***, Irina Tezaur, Coleman Alleman	Monolithic Linear Equation Solver for Parallel Finite Element Method **Naoki Morita***, Gaku Hashimoto, Hiroshi Okuda	
Room: 516E	**MS 813**	**Multiscale Computational Homogenization for Bridging Scales in the Mechanics and Physics of Complex Materials** **Chair(s): Julien Yvonnet**		
Keynote Presentation: **Dennis Kochmann***, A. Vidyasagar, Wei Lin Tan	Microstructure Evolution in Ferroelectrics by Improved Spectral Methods for Computational Homogenization	Intercalation Driven Porosity Effects in Coupled Continuum Models for the Electrical, Chemical, Thermal and Mechanical Response of Battery Electrode Materials **Zhenlin Wang***, Jason Siegel, Krishna Garikipati	Higher Order Homogenization for Piezoelectric Periodic Composites **Luigi Gambarotta***, Andrea Bacigalupo	Non-Intrusive Local-Global Substitution Method: Extension to Multi-Time and Jump Cycle Coupling for the Fatigue Prediction of Viscoplastic-Structures **Olivier Allix***, Maxime Blanchard, Pierre Gosselet, Geoffrey Desmeure

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 522BC	**MS 901**	**Advanced Computational Methods For Complex Geometry Simulations** **Chair(s): Antonio Gil and Guglielmo Scovazzi**		
Recent Developments and Usage of the Composite Tetrahedral Element in Solid Mechanics Applications **Jakob Ostien***, James Foulk III, Alejandro Mota, Michael Veilleux, Nathan Crane	A Dynamic Variational Multiscale Method for Viscoelasticity using Linear Tetrahedral Elements **Nabil Abboud***, Oriol Colomes, Guglielmo Scovazzi	Variational Multiscale Method for Incompressible Solid Dynamics with Application to Biological Tissues **Ju Liu***, Vijay Vedula, Alison Marsden	F-bar Aided Edge-Based Smoothed Finite Element Method with 4-Node Tetrahedral Elements for Viscoelastic Large Deformation Problems **Yuki Onishi***	
Room: 522A	**MS 902**	**Advances and Applications of the Generalized/eXtended Finite Element Method** **Chair(s): Armando Duarte**		
Keynote Presentation: **David Noble***, Kurt Maute	Assessment of Enriched Finite Element Discretizations for Weak Discontinuities	Higher-Order Conformal Decomposition Finite Element Method (CDFEM) as an Alternative for XFEM **Thomas-Peter Fries***	A Stabilised Cut Finite Element LaTin Method for Multiple Unilateral Contact Problems **Susanne Claus***, Pierre Kerfriden	
Room: 524B	**MS 903**	**Advances in Numerical Methods for Linear and Non-Linear Dynamics and Wave Propagation** **Chair(s): Alexander Idesman**		
Keynote Presentation: **Alexander Idesman***	A New Accurate Numerical Approach to Wave Propagation, Structural Dynamics and Heat Transfer Problems	Heterogeneous Asynchronous Time Integrator for Impact and Contact Dynamics **Anthony Gravouil***, Fatima-Ezzahra Fekak, Michael Brun, Bruno Depale	The Shifted Boundary Method: A New Approach to Embedded Domain Computations **Ting Song***, Alex Main, Guglielmo Scovazzi	Higher-Order Elements for Explicit Solid Dynamics **Stephen Beissel***, Timothy Holmquist

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 524A	**MS 910**	**Isogeometric Methods** **Chair(s): Thomas J.R. Hughes**		
Keynote Presentation: **Alessandro Reali***, John-Eric Dufour, Pablo Antolin, Alessia Patton, Giancarlo Sangalli, Ferdinando Auricchio	A Stress Recovery Procedure for Cost-Effective Isogeometric Analysis of Composite Plates	A Variational Method to Avoid Locking Independent of the Discretization **Bastian Oesterle***, Simon Bieber, Ekkehard Ramm, Manfred Bischoff	Parallelization of Numerical Integration Algorithm for rIGA using a Fast Quadrature **Maciej Wozniak***, Maciej Paszynski	Alternating Direction Isogeometric L2 Projections in Cloud Environment **Grzegorz Gurgul***, Marcin Los, Danuta Szeliga, Maciej Paszynski
Room: 519A	**MS 912**	**Meshfree and Particle Methods: New Developments and Applications** **Chair(s): J.S. Chen**		
A Reproducing Kernel Particle Method Framework for Modeling Failure of Solids Subjected to Blast Loadings **J.S. Chen***, Guohua Zhou, Mike Hillman	Meshfree Modeling of Penetration of a Self-Consolidating High-Strength Concrete **Jesse Sherburn***, William Heard, Sean Wade, Brett Williams	A Nonlocal Updated Lagrangian Particle Hydrodynamics Method and Simulation of Underwater Explosion **Qingsong Tu***, Yumeng Hu, Shaofan Li	Generalization of the Ordinary State Based Peridynamic Model for Isotropic Linear Viscoelasticity **Rolland Delorme***, Ilyass Tabiai, Louis Laberge Lebel, Martin Lévesque	Penetration Modeling of Ultra-High Performance Concrete using a Multiscale Meshfree Method **Paul Sparks***, Jesse Sherburn, William Heard, Brett Williams, Patrick Kieffer
Room: 514A	**MS 1005**	**Symposium on Trends in Unstructured Mesh Generation** **Chair(s): Franck Ledoux**		
Keynote Presentation: **Steven J. Owen***, James W. Foulk, Benjamin Reedlun, Corey Ernst, Coleman Alleman, Hojun Lim	Geometry and Mesh Generation for Representative Volume Elements in Computational Materials Modeling	Hybrid CPU/GPU Parallel Unstructured Mesh Adaptation **François Guibault***, William Bussire	A Scalable Generic Mesh Data Structure for Multicore Architecture **Nicolas Le Goff***, Franck Ledoux	Converting Faceted Data to B-Reps **Paul Stallings***

TS1: MONDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 525B	**MS 1108**	**Uncertainty Propagation and Quantification in Multiscale Simulation of Materials Response, Structural Performance, and Failure** **Chair(s): Jacob Hochhalter**		
Keynote Presentation: **Roger Ghanem***, Loujaine Mehrez, Venkat Aitharaju, William Rodgers	Polynomial Chaos for the Multiscale Characterization of Material Response and Failure under Uncertainty	Efficient Uncertainty Propagation for High Fidelity Crack Growth using Stochastic Reduced-Order Models **James Warner***, Patrick Leser, Jacob Hochhalter	Propagating Stochastic Manufacturing Processes into Risk Predictions for Gas-Turbine Engines **James Sobotka***, Michael Enright, Kwai Chan, Craig McClung, John McFarland, Jonathan Moody	An Adaptive Approach with Local Reduced Basis Approximation for the Solution of PDEs with Uncertain Inputs **Wilkins Aquino***, Zilong Zou

Monday Semi-Plenary Speakers

1:30-2:15 pm

Marino Arroyo

Universitat Politècnica de Catalunya (UPC)
BarcelonaTech

Mathematical Modeling and Simulation of the Cell Envelop, an Active and Adaptable Biological Interface

Room: 516BC

Abstract: The cell envelop is an active and adaptable interface that plays a fundamental role in many biological events. To name a few, it determines cell shape and mechanics, controls the way cells adhere to each other, drives cell division and motility, and controls the structure and remodeling of multicellular tissues. Fundamental mechanical and chemical determinants of its biological function can be described with mathematical models involving partial differential equations on curved surfaces coupled with the geometric evolution laws for those surfaces. In this talk, I will describe instances of such models coupling chemistry, elasticity, hydrodynamics and active force generation, their numerical discretization, and how they can be used to connect with experiments and understand various phenomena in cell mechanobiology.

Bio: Marino Arroyo is Associate Professor at the Universitat Politècnica de Catalunya (UPC), where he is a member of the Laboratory of Computational Methods and Numerical Analysis (LaCaN) group. He is also affiliated to the Institute for Bioengineering of Catalonia (IBEC). Before joining the UPC, he obtained a PhD from Northwestern University and was a postdoctoral scholar at the California Institute of Technology (Caltech). He has been awarded the O. C. Zienkiewicz Award for Young Scientists in Computational Engineering Sciences by ECCOMAS (2010), two ICREA Academia Awards (2009, 2015), and the ASME/BOEING Structures and Materials Award (2003). He was awarded by the European Research Council a Starting Grant in 2009 and a Consolidator Grant in 2016. His research goal is to develop theories and computational methods to understand the small-scale mechanics of materials and biological systems, with a recent emphasis on cell and tissue mechanobiology and bio-inspired materials.

Raúl Tempone

King Abdullah University of Science and Technology

Hierarchical Sampling Methods for Forward and Inverse Problems

Room: 517D

Abstract: We will first recall, for a general audience, the use of Monte Carlo and Multi-level Monte Carlo (MLMC) methods in the context of Forward Uncertainty Propagation. Then, we will move on to Multi-Index Monte Carlo (MIMC) and Multi-Index Stochastic Collocation (MISC) methods for computing statistics of the solution of a Partial Differential Equation with random data. MIMC is both a stochastic version of the combination technique introduced by Zenger, Griebel, and collaborators, and an extension of the Multilevel Monte Carlo (MLMC) method first described by Heinrich and Giles. Instead of using first-order differences as in MLMC, MIMC uses mixed differences to dramatically reduce the variance of the hierarchical differences, thus yielding improved convergence rates. MISC is a deterministic combination technique that also uses mixed differences to achieve better complexity than MIMC, provided enough regularity. Moreover, in the optimal case, the convergence of MISC is dictated by the convergence of the deterministic solver applied to a one-dimensional spatial problem. Throughout the presentation, we will discuss several applications, including some arising from Inverse Problems and Optimal Experimental Design settings.

Bio: Raul Tempone is an applied mathematician, recognized for his contributions to the development and rigorous analysis of numerical methods for deterministic and stochastic problems arising in science and engineering. He is well known for his works on adaptive algorithms for stochastic differential equations, stochastic Galerkin and stochastic collocation methods for random partial differential equations, and multilevel Monte Carlo hierarchical sampling techniques for stochastic problems, among others.

These methods provide substantial computational savings and are crucial for applications described in terms of differential equations and subject to uncertain evolution. Formulations including uncertainty have been increasingly used in many engineering applications, and they are useful in other applications as well, including, among others, finance, biology, social science as well as chemistry and physics.

Raul Tempone graduated as an industrial engineer in 1995 at the University of the Republic, Montevideo, Uruguay. After his graduation he worked on the optimal dispatch of electricity for the Uruguayan system using techniques from nonlinear stochastic programming and visited the Royal Institute of Technology (KTH) in Stockholm, Sweden, to study further numerical analysis. He obtained a Master in Engineering Mathematics in 1999 (inverse problems for incompressible flows, supervised by Jesper Oppelstrup, KTH) and a Ph.D. in Numerical Analysis in 2002 (a posteriori error estimation and control for stochastic differential equations, supervised by Anders Szepessy, KTH). He later moved to ICES, UT Austin, to work as a postdoctoral fellow from 2003 until 2005 in the area of numerical methods for PDEs with random coefficients (supervised by Ivo Babuska and Mary Wheeler). In 2005 he became an assistant professor (joint appointment) with the School of Computational Sciences and the Department of Mathematics at Florida State University, Tallahassee. In 2007 he was awarded the first Dahlquist fellowship by KTH and COMSOL for his contributions to the field of numerical approximation of deterministic and stochastic differential equations. In 2009 he became an Associate Professor (founding faculty) with King Abdullah University of Science and Technology and later in 2015, he was promoted there to the rank of Full Professor in Applied Mathematics. Since 2012, he has directed the KAUST Strategic Research Center for Uncertainty Quantification.

He has received numerous accolades from his peers: he is a highly cited author, is regularly invited as keynote speaker at conferences from several distinct areas and holds honorary appointments as well. For instance, he was elected by Society for Industrial and Applied Mathematics (SIAM) members as the Technical Director of the SIAM Uncertainty Quantification group, a position he held during the term 2013-2014.

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 516A	**MS 001**	**Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard** **Chair(s): Kenneth Jansen**		
Reliable Large Scale Industrial Design at Petascale and Beyond **Martin Berzins***	Barrier-Free Parallel Adaptive Scheme for Asynchronous Spacetime Discontinuous Galerkin Methods **Robert Haber***, Amit Madhukar, Reza Abedi, Volodymyr Kindratenko	Thermal Modelling and Simulation of Selective Laser Melting Additive Manufacturing **Antoinette Maniatty***, Souvik Roy, Mario Juha	Multilevel Decomposition and Compression on Unstructured Grids **Ben Whitney***, Mark Ainsworth	
Room: 514C	**MS 101**	**Advances in Computational Biomechanics** **Chair(s): David M. Pierce and Corey P. Neu**		
Full-Field 4D Measurements of Acceleration-Induced Deformation in the Living Human Brain **Arnold Gomez***, Andrew Knutsen, Dzung Pham, Philip Bayly, Jerry Prince	Simulation of Harmonic Shear Waves in the Human Brain and Comparison with Measurements from Magnetic Resonance Elastography **Nitin Daphalapurkar***, Yang Li, Ruth Okamoto, Andrew Badachhape, Philip Bayly, K.T. Ramesh	Three-Dimensional Elastic Modulus Reconstruction Based on Magnetic Resonance Imaging **Luyao Cai***, Claus B.W. Pedersen, Corey P. Neu	Mechanical Properties of Human Ascending Aorta using Biaxial Tensile Testing **Samaneh Sattari***, Katherine Olsen, Taisyia Sigaeva, Jehangir J. Appoo, Elena S. Di Martino	
Room: 514B	**MS 108**	**Multiscale Modeling in Bio-mechanical Systems** **Chair(s): Ying Li**		
Keynote Presentation: **Zhao Qin***	Multiscale Computational Design of Bio-Inspired Materials with Advanced Mechanical Functions	An Interfacial Zone Model for Intercellular Interaction Modeling in Epithelial Cells **Xiaowei Zeng***, Liqiang Lin	Discrete Particle Techniques For Multiscale Modeling Of Fragmentation of Blood Clots **Debanjan Mukherjee***, Shawn C. Shadden	Simulating Drug-Affected Cardiac Electromechanics **Khalil Elkhodary***, Noha Shalaby, Nejib Zemzemi

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 520A	**MS 201**	**Advances in High-Order Methods for Computational Fluid Dynamics** **Chair(s): Brian Vermeire**		
On the Impact of Number Representation for High-Order Implicit Large Eddy Simulations **Freddie Witherden***, Antony Jameson	High-Fidelity Simulation of a Golf Ball Trajectory using a High-Order Overset Method **Jacob Crabill***, Freddie Witherden, Antony Jameson	Discontinuous Galerkin Method for Predicting Heat Transfer in Hypersonic Environments **Eric Ching***, Yu Lv, Matthias Ihme	A Continuous Mesh Model for Goal-Oriented hp-Adaptation **Ajay Rangarajan***, Georg May	A High-Order Discontinuous Galerkin Method for Variable-Coefficient Advection-Diffusion Problems **Raunak Borker***, Charbel Farhat, Radek Tezaur
Room: 520C	**MS 205**	**Computational Microfluidics** **Chair(s): Liviu Clime**		
2D Continuum Model for Simulating Angiogenesis Studies in Microfluidic Systems **Edmond W. K. Young***, Nikola Kuzmic	Multiphysics Modelling of Very Low Flow Rate Micropump Based on Thermal and Mechanical Actuation **Amine Miled***, Hamza Landari	Characterization of Self-Coalescence in Microfluidic Capillary Flow via Finite Element Method **Samuel Castonguay***, Onur Gôkçe, Yuksel Temiz, Emmanuel Delamarche, Thomas Gervais		
Room: 520E	**MS 303**	**NETComputational Geomechanics** **Chair(s): Pania Newell**		
A Bounding Surface Plasticity Model for Natural Clay Calibration, Validation and Application **Thomas Barciaga***, Tom Schanz	A Coupled Numerical Model for Discrete Fractures in Deformable Geothermal Reservoirs **Saeed Salimzadeh***, Maiya Medetbekova, Hamidreza M. Nick	Modelling Hydraulic Fracturing as a Transition from Diffuse Micro-Cracking to Fracture Localization **Mahdad Eghbalian***, Richard Wan		

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 518C	**MS 304**	**Computational Methods and Design for Impact and Blast Problems** **Chair(s): David C. Weggel**		
Keynote Presentation: **Christopher Eamon***, Ahmad Alsendi	Modeling the Blast Resistance of Reinforced Concrete Bridge Columns under Uncertainty	Use of Finite Element Analysis to Model the Potential Damage Caused to Passenger Railcars by the Use of Explosives **Ian Bruce***, Przemyslaw Rakoczy, Devon Wilson	Internal Explosion Simulation of Earth Covered Composite Arch System; the Comparison between MMALE, PBM and CONWEP+GP Methods **Sze Dai Pang***	Efficient High Fidelity Nonlinear Dynamic Analysis of Light Gauge Steel Walls Subjected to Blast Loading **David Weggel***, Ahmed Khalil, Nabil Rahman, Matt Whelan
Room: 521BC	**MS 405**	**Peridynamic Modeling and Simulations** **Chair(s): Florin Bobaru**		
Realistic Crack Patterns Obtained using an Approach Coupling Finite Element Method and Peridynamics **Mirco Zaccariotto***, Davide Tomasi, Ugo Galvanetto	Multi-Scale Simulation of Rubber Fracture using Space-Time FEM and Non-Ordinary State-Based Peridynamics **Shogo Wada***, Dong Qian	An Intermediate Homogenization Approach for Peridynamic Modeling of Failure in Heterogeneous Materials **Ziguang Chen***, Sina Niazi, Florin Bobaru	Experimental Validation of Elastic State-Based Peridynamic for PMMA and Epoxy Materials **Patrick Diehl***, Ilyass Tabiai, Martin Lévesque	Electromechanical Peridynamic Modeling of Deformation and Damage Sensing in Polymer Bonded Explosive Materials **Gary Seidel***, Naveen Prakash
Room: 518B	**MS 406**	**Recent Advances in Computational Fracture Mechanics and Failure Analysis** **Chair(s): Xiaosheng Gao**		
Development of a Three-Dimensional Crack Analysis System using XFEM and Evaluation of its Accuracy **Toshio Nagashima***	Fatigue Crack Growth Simulation with Crack Closure Effect using S-Version FEM **Yuto Shinozaki***, Akiyuki Takahashi, Yuichi Shintaku	An Edge-Based Smoothed Finite Element Method for Crack Growth Simulation **Wei Xie***, Xudong He		

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 520D	**MS 501**	**Computational Fluid-Structure Interaction: Methods and Applications** **Chair(s): TBD**		
An Integrated Approach for Fluid-Structure Interaction: Uncertainty Quantification, Bayesian Inference, Scalable Algorithms for High Performance Computing and Wind Tunnel Testing **Abhijit Sarkar***, Rimple Sandhu, Leandro Jose Rocha da Costa, Brandon Robinson, Anton Matachniouk, Sandip Chajjed, Philippe Bisaillon, Ajit Desai, Mohammad Khalil, Chris Pettit, Dominique Poirel	FSI Framework for Wind Energy and Aerospace Engineering Applications: from Unsteady Aerodynamics to Damage Prediction **Artem Korobenko***	Analysis of Flapping Motion Considering Kinematic Optimization by Partitioned Iterative FSI Analysis System **Shinobu Yoshimura***, Giwon Hong, Tomonori Yamada, Naoto Mitsume	Wind-Structure Interaction as an Aid to Establish the Design Wind Pressures of Tensile Membrane Structures **J. Gerardo Valdés-Vázquez***, A. David García-Soto, Alejandro Hernández-Martínez, L. Francisco Gay-Alanís	Generation of Inflow Boundary Conditions as Multivariate Stochastic Process for LES of ABl Flows **Girma Bitsuamiak*,** Abiy Melaku
Room: 520F	**MS 503**	**Computational Modeling of Contact and Embedded Interfaces** **Chair(s): Tod Laursen**		
Fundamental Basis for Computational Modeling of Contact in Wire Ropes and Knots **Alexander Konyukhov***	An Embedded Mesh Coupling of Overlapping Lagrange and ALE Meshes with Unilateral Type Contact Constraints **Mike Puso***, Paul Tsuji, Ben Liu, Ed Kokko	Surface Sensing of Atomic Behavior of Polymer Nanofilms via Molecular Dynamics Simulation **Ling Dai***	A Novel Constraint Enforcement Method for Implicit Contact Mechanics **Steven Wopschall***, Mark Rashid	Verification of Contact Stress in Elasticity Using a Surrogate Formulation **Zhaocheng Xuan***
Room: 524C	**MS 601**	**Advances in Computational Methods for Inverse Problems** **Chair(s): Assad Oberai**		
Keynote Presentation: **Kody Law***	Multilevel Monte Carlo Methods for Bayesian Inference	Inverse Monte Carlo Grain Growth Analysis for Process Design **Yixuan Tan***, Antoinette Maniatty, John Wen, Chengjian Zheng	Gradient-Based Methods for Detecting the Effective Dimension of Nonlinear Bayesian Inverse Problems **Olivier Zahm***, Youssef Marzouk, Tiangang Cui, Kody Law	Inverse Problems in Highly Heterogeneous Media **Paul E. Barbone***, Danial Panahandeh, Bojan Guzina

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 523A	**MS 701**	**Advanced Computational Methods and Theories for Predicting Material Behaviors at Various Length Scales** **Chair(s): Caglar Oskay**		
Application of the Particle Difference Method (PDM) for Predicting Solidification of Polycrystalline via Diffusive Interface Approach **Jeong-Hoon Song***, Ashkan Almasi, Tae-Yeon Kim, Young-Cheol Yoon	A Multi-Scale Modeling of Strain Path Effects, Laminar Structure and Texture Evolution in Wire Drawing Process **Guangliang Zhang***	Modeling Heterogeneities Effects on Phase Transformation during Quenching of Large Size Forged Steel Ingots **Yassine Bouissa***, Mohammad Jahazi, Henri Champliaud, Louis-Philippe Lapierre-Boire, Jean-Benoît Morin, Nicolas Poulain		
Room: 525A	**MS 703**	**Classical and Non-classical Plate and Shell Models in Computational Mechanics of Multilayered, Sandwich, and Functionally Graded Composites** **Chair(s): Marco Gherlone**		
Exact Transfer- and Stiffness-Matrix for the Composite Beam-Column with Refined Zigzag Kinematics **Heinz Wimmer***, Karin Nachbagauer	An Inverse Finite Element Method Based on Refined Zigzag Theory for Structural Health Monitoring of Laminated Composite and Sandwich Shell Structures **Alexander Tessler***, Adnan Kefal, Erkan Oterkus	Improved Thermo-Mechanical Analysis of Laminated Composite Structures using the New Enhanced First-Order Shear Deformation Theory **Jang-Woo Han***, Jun-Sik Kim, Maenghyo Cho	Cohesive Fracture of Multilayered Beams Through a Homogenized Structural Theory **Hossein Darban***, Roberta Massab	Numerical Analysis of Plane Problems of Viscoelastic Functionally Gradient Material Based on a Temporally-Piecewise Adaptive Algorithm **Haitian Yang***, Linlin Zhang, Yiqian He, Weian Yao
Room: 518A	**MS 708**	**Modeling and Simulation of Additive Manufacturing Processes** **Chair(s): Robert Ferencz**		
Keynote Presentation: **John Turner***, James Belak, Sudarsanam Babu, Nathan Barton, Curt Bronkhorst, Neil Carlson, Jean-Luc Fattebert, Neil Hodge, Wayne King, Lyle Levine, Christopher Newman, Balasubramaniam Radhakrishnan	Goals of the Exascale Additive Manufacturing Project (ExaAM)	Part-Level Finite Element Simulation of Selective Laser Melting **Neil Hodge***, Robert Ferencz	Mesoscopic Modeling of Powder-Bed-Based Additive Manufacturing **Matthias Markl***, Carolin Körner	A Computationally Efficient Process Modelling Approach for Selective Laser Melting **Yabin Yang***, Can Ayas

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 523B	**MS 709**	**Modeling Materials with Coupled Physics** **Chair(s): Stephan Rudykh**		
Keynote Presentation: **Andreas Menzel***, Dinesh Dusthakar, Bob Svendsen	A Laminate-Based Computational Model for Ferroelectric Single Crystals and Ceramics	Electro- and Magneto-Mechanical Coupling and Instabilities in Dielectric Elastomers and Magnetorheological Elastomers **Stephan Rudykh***, Artemii Goshkoderia	PDE-Constrained Optimization Framework for the Design of Heterogeneous Elastic Acoustic Cloaks **Clay Sanders***, Wilkins Aquino, Timothy Walsh	
Room: 516D	**MS 801**	**Adaptivity for Multiscale Problems** **Chair(s): Frédéric Legoll**		
Adaptivity through Localization in Model Reduction for Parabolic Problems **Felix Schindler***, Mario Ohlberger, Stephan Rave	Certified Computations with PGD Model Reduction in the MsFEM Framework **Ludovic Chamoin***, Frédéric Legoll			
Room: 515C	**MS 806**	**Concurrent Multi-Length Scale Modeling: from Finite Elements to Atoms and Electrons** **Chair(s): Shaofan Li and Qing Peng**		
Scale-Bridging for Multiscale Modeling of Reactive Materials **Jaroslaw Knap***, Kenneth W. Leiter, Brian C. Barnes, Richard Becker, Joshua C. Crone	A Plate Model for Multilayer Graphene Sheets and Its Application to Analyzing Wrinkle Structure **Moonhong Kim***, Seyoung Im	Hydrogen Assisted Cracking in HCP-Zirconium: a Quasi-Continuum Density Functional Theory (QCDFT) Study **Qing Peng***		

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 515B	**MS 809**	**Multi-scale and Multi-physics Computations in Fluids and Solids** **Chair(s): Abhijit Dasgupta**		
Simulation of Steady-State Creep Behavior of Poly-Crystalline Solder Joints Based on an Anisotropic Multi-Scale Approach **Abhijit Dasgupta***, Qian Jiang	Multi-Scale Modeling of Fatigue Crack Initiation in Polycrystalline Titanium Alloys **Deniz Ozturk***, Shravan Kotha, Somnath Ghosh	Compatible Meshfree Discretization for Dense Electrophoretic Suspension Flows **Nathaniel Trask***, Pavel Bochev, Mauro Perego	A Conservative Streamline Method Suitable for Complex Reservoir Flow Simulations **Luiz Sampaio***, Margot Gerritsen, Anthony Kovscek, Marco Thiele	Numerical Simulations of the Richtmyer-Meshkov Instability of the Inverse Chevron Interface **Tao Wang***
Room: 516E	**MS 813**	**Multiscale Computational Homogenization for Bridging Scales in the Mechanics and Physics of Complex Materials** **Chair(s): Kenjiro Terada**		
An Integrated Level Set Methodology for the Generation and Discretization of Complex Heterogeneous RVEs **Thierry J. Massart***, Karim Ehab Moustafa Kamel, Bernard Sonon	Geometrically Nonlinear Simulation of Carbon Nanotubes using a Neural Network-Based Surrogate Modelling Technique **George Soimiris***, Vissarion Papadopoulos, Dimitrios Giovanis	Sparse and Scalable Eigenstrain-Based Reduced Order Homogenization Models for Polycrystal Plasticity **Xiang Zhang***, Caglar Oskay	An Image-Based Finite Element Model for Ni-Based Superalloys using a Two Scale Constitutive Model Accounting for Morphological Distributions of Gamma Precipitates **George Weber***, Maxwell Pinz, Akbar Bagri, Somnath Ghosh	Spatial-Temporal Nonlocal Homogenization Model for Transient Wave Propagation in Viscoelastic Composites **Ruize Hu***, Caglar Oskay
Room: 522BC	**MS 901**	**Advanced Computational Methods for Complex Geometry Simulations** **Chair(s): Guglielmo Scovazzi**		
A Fixed Cartesian Mesh Method for Large-Scale Parallel Simulation of Complex Vehicular Structures **Koji Nishiguch***, Rahul Bale, Shigenobu Okazawa, Makoto Tsubokura	Reduced Order Modeling of Knitted Textiles Geometry and Deformation **Dani Liu***, Daniel Christe, Bahareh Shakibajahromi, Chelsea Knittel, David Breen, Genevieve Dion, Antonios Kontsos	Adaptive Variational Multiscale Method for Turbulent Flows Past Complex Geometries **Ghalia Guiza***, Mehdi Khalloufi, Philippe Meliga, Youssef Mesri, Elie Hachem	Advances in Coupled ALE-AMR for Tetrahedral Grids **Jacob Waltz***, Jozsef Bakoski	Modeling Granular Media and Ice Coupled to Multiphase Flow **Devin O'Conner***, Chris Kees, Arnold Song, Matthew Farthing

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 522A	**MS 902**	**Advances and Applications of the Generalized/eXtended Finite Element Method** **Chair(s): Julia Plews**		
Applications of a Multi-Scale Generalized Finite Element Method to Three-Dimensional Anisotropic Heterogeneous Materials **Patrick O'Hara***, Piyush Gupta, Deniz Ozturk, Haoyang Li	GFEM Computations in Heterogeneous Solids using Optimal Local Bases **Paul Sinz***, Robert Lipton, Michael Stuebner			
Room: 524B	**MS 903**	**Advances in Numerical Methods for Linear and Non-Linear Dynamics and Wave Propagation** **Chair(s): Alexander Idesman**		
Keynote Presentation: **Manfred Bischoff***, Anne-Kathrin Schäuble, Anton Tkachuk	Reciprocal Mass Matrices in Explicit Dynamics Inertia Scaling and Customization	Adaptive Wavelet Algorithm for Solving Coupled Systems of Nonlinear Partial Differential Equations with Error Control **Cale Harnish***, Karel Matous, Daniel Livescu	On the Solution of Free Surface Problems by Lagrangian and Semi-Lagrangian Galerkin Methods **Marta Benítez***, Alfredo Bermúdez, Pedro Fontán	An Efficient Method for Transient Heat Conduction in Periodic Structures **Qiang Gao***, Haichao Cui, Ying Feng
Room: 524A	**MS 910**	**Isogeometric Methods** **Chair(s): Yuri Bazilevs**		
Error Estimates for Adaptive Isogeometric Analysis of Stokes Problem **Trond Kvamsdal***, Abdullah Abdullhaque, Mukesh Kumar, Arne Morten Kvarving	Adaptive Isogeometric Analysis of Thin Plate Problems using Recovery-Based Error Estimation **Knut Morten Okstad***, Trond Kvamsdal, Mukesh Kumar, Kjell Magne Mathisen, Terje Haukaas	A Galerkin Isogeometric Method for Karhunen-Loeve Approximation of Random Fields **Sharif Rahman***	A Two-Node Beam Element using an Isogeometric Approach **Buntara Sthenly Gan***	

TS2: MONDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 519A	**MS 912**	**Meshfree and Particle Methods: New Developments and Applications** **Chair(s): Zhen Chen**		
Keynote Presentation: **Yonggang Zheng***, Mengkai Lu, Jiayong Zhang, Hongwu Zhang, Zhen Chen	Application of a Time Discontinuous Material Point Method to Transient Problems	Recent Advances in Improving the Spatial and Temporal Discretization Schemes of the Material Point Method for Better Simulating Transient Responses **Zhen Chen***, Yong Gan, Yonggang Zheng	Numerical Simulation of Grain-Scale Mechanics in the Dynamic Compaction of Granular Materials **Michael Homel***	The Material Point Method in Offshore Geotechnical Engineering **Markus Bürg***, Andriy Andreykiv, Liang Jin Lim
Room: 514A	**MS 1005**	**Symposium on Trends in Unstructured Mesh Generation** **Chair(s): Mark Shephard**		
Tetmesh Scaling for Solution Verification **William Quadros***, Brian Carnes	Node Creation for Isotropic Refinement of Tetrahedral Meshes **Nick Wyman***, Steve Karman	Use of the Fruchterman-Reingold Graph Embedding Algorithm to Untangle Hybrid Meshes **Suzanne Shontz***, Jake Quinn, Sanjukta Bhowmick	PUMA (Polyhedra Unstructured Mesh Adaption): A Novel Method to Refine and Coarsen Convex Polyhedra **Thomas Gessner***, Sandeep Menon	
Room: 525B	**MS 1108**	**Uncertainty Propagation and Quantification in Multiscale Simulation of Materials Response, Structural Performance, and Failure** **Chair(s): James Warner**		
Estimation of the Remaining Useful Life, using a Microstructure-Based Life Prediction Model and Probabilistic Prognostics **Jacob Hochhalter***, Saikumar Yeratapally, Patrick Leser	Multiscale Methods for Uncertainty Propagation for Polycrystalline Aluminum 6061-T6 **Peter Coffin***, John Emery, Brian Robbins, Jay Carroll	Efficient Uncertainty Propagation for Crack Nucleation in Polycrystalline Aluminum 6061-T6 **John Emery***, Peter Coffin, Brian Robbins, Jay Carroll		

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 516A	**MS 001**	**Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard** **Chair(s): Saikat Dey**		
Boundary Layer Mesh Generation **Romain Aubry***	Hex-Dominant Meshing **Jean-François Remacle***, Jeanne Pelerin, Amaury Johnen, Jonathan Lambrechts	Robust and Efficient Validation of the Linear Hexahedral Element **Amaury Johnen***, Jean-François Remacle, Jean-Christophe Weill, Thomas Toulorge, Christophe Geuzaine	How Many Ways are there to Subdivide a Hexahedron in Tetrahedra? **Jeanne Pellerin***, Jean-François Remacle, Amaury Johnen	
Room: 514C	**MS 101**	**Advances in Computational Biomechanics** **Chair(s): Corey P. Neu and David M. Pierce**		
Cross-Linked Actin Networks: Micro- and Macroscopic Effects **Sandra Klinge***, Serhat Aygn, Robert P. Gilbert, Gerhard A. Holzapfel	Modeling Force-Driven Damage in the Axon from Molecular Mechanisms **Rijk de Rooij***, Ellen Kuhl	Form of Seashells Modeled as Evolving Fronts Driven by Accretive Growth **Krishna Garikipati***, Shiva Rudraraju, Derek Moulton, Alain Goriely	Computational Systems Mechanobiology for Dermal Wound Healing **Adrian Buganza Tepole***	The Cell Differentiation Model for Dental Implants **Ming Jun Li***, Nien-Ti Tsou
Room: 515A	**MS 103**	**Computational Biomechanics of Impact and Injury** **Chair(s): Matthew Panzer**		
Finite Element Based Pelvic Injury Metric Creation and Validation in Lateral Impact for a Human Body Model **Caitlin Weaver***, Alexander Baker, Matthew Davis, Anna Miller, Joel Stitzel	An Inverse Finite Element Approach to Obtain Strain Rate Dependent Material Properties of the Human Intervertebral Disc **Grigoris Grigoradis***, Nicolas Newell, Alexandros Christou, Diagarajen Carpanen, J. Paige Little, Spyros Masouros	Comparing Adult Ribcage Geometries between Populations in the United States and China **Jingwen Hu***, Peiyu Li, Jinhuan Zhang, Matthew Reed	Failed Rib Regions in a Computational Human Model vs. Observed PMHS Fractures: A Comparative Study **Berkan Guleyupoglu***, Ryan Barnard, Scott Gayzik	

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 514B	**MS 108**	**Multiscale Modeling in Bio-mechanical Systems** **Chair(s): Xianqiao Wang**		
Limitations of Multi-Scale and Multi-Physics Modeling **Sheldon Wang***	A Coarse-Grained Brownian Molecular Dynamics Model of von Willebrand Factor Multiscale Response to Flow **Michael Morabito***, Wei Wei, Chuqiao Dong, Alparslan Oztekin, Edmund Webb III, Xuanhong Cheng, Xiaohui Zhang	Abnormal Vascular Dynamics of Nanoworms within Blood Flow **Ying Li***, Huilin Ye	Biomechanical Models for Early Embryonic Brain Morphogenesis **Zi Chen***, Hannah Grover, Wei Zheng, Shicheng Huang, Lina Zang, Yan Li, Nan Hu	
Room: 520A	**MS 201**	**Advances in High-Order Methods for Computational Fluid Dynamics** **Chair(s): Peter Vincent**		
A Class of Mixed Finite Element Methods for the Compressible Navier-Stokes Equations **David Williams***	High-Order Incompressible Computational Fluid Dynamics on GPUs and Co-Processors **Niki Loppi***, Freddie Witherden, Antony Jameson, Peter Vincent	Optimal Runge-Kutta Schemes for Pseudo Time-Stepping with High-Order Methods **Brian Vermeire***, Niki Loppi, Peter Vincent	Higher Order Space-Time Hybridizable Discontinuous Galerkin Methods for Incompressible Flows on Sliding Meshes **Tamas Horvath***, Sander Rhebergen	A Direct Flux Reconstruction Formulation for Advection-Diffusion Problems on Simplex Elements **Joshua Romero***, Freddie Witherden, Antony Jameson
Room: 520B	**MS 203**	**Computational Methods for Hydraulics** **Chair(s): Azzeddine Soulaïmani**		
Accurate Wall-Adapting Local Eddy Viscosity Simulation of a Low-Reynolds Straight-Blade Vertical Axis Wind Turbine **Matin Komeili***, Marius Paraschivoiu	Experimental and Numerical Investigation of the Turbulent Flow over D-Shaped Bluff Body **Alla Eddine Benchikh Lehocine***, Jay Lacey, Sébastien Poncet	A New Godunov-Type Scheme for the Two-Dimensional Lagrangian Hydrodynamics **Théo Corot***, Bertrand Mercier		

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 520C	**MS 301**	**Advancements in Hydraulic Fracture Simulation** **Chair(s): Anthony Peirce**		
Hydraulic Fracture Simulation **Robert Gracie***, Egor Dontsov, Denis Esipov, Anthony Peirce, Armando Duarte, Erfan Sarvaramini, Sergey Cherny	Combined Segregated-Fully Coupled Hydro-Mechanical Cracking of Concrete using XFEM in 3D **Simon-Nicolas Roth***, Azzeddine Soulaïmani, Pierre Léger	Microseismic Wave Simulation using GFEM Enriched Phantom Node Method **Mohammad Komijani***, Robert Gracie	Effect of Loading Rate and In-Situ Stress Anisotropy on Fracture Patterns in a Tight Formation **Reza Abedi***, Omid Omidi, Philip Clarke, Robert Haber	
Room: 520E	**MS 303**	**Computational Geomechanics** **Chair(s): Craig Foster**		
Numerical Assessment of Jointed/Faulted Caprock Integrity During CO2 Sequestration **Pania Newell***, Mario Martinez	Dynamic Rupture Simulation of a Tunnel Subjected to Fault Displacements using Parallel 3D-FEM **Yuta Mitsuhashi***, Gaku Hashimoto, Hiroshi Okuda, Fujio Uchiyama	Domain Decomposition for Numerical Integration of Green's Functions for Layered, Transversely Isotropic Soil Media **Josue Labaki***	Cement Sheath Failure and Interface Debonding Driven by Temperature and Pore Pressure Effects in a Cased and Cemented Wellbore **Dmitry Kuznetsov***, Sergey Golovin, Nicolas Flamant, Alexander Valov, Tatiana Rotanova	
Room: 518C	**MS 304**	**Computational Methods and Design for Impact and Blast Problems** **Chair(s): Qian Wang**		
Crash Analysis and Evaluation of Vehicular Impacts on W-Beam Guardrails Placed behind Curbs using Finite Element Simulations **Matthew Gutowski***, Emre Palta, Howie Fang	Pyramid and Degenerate Elements for Lumped Mass Explicit Methods in Nonlinear Solid Dynamics **Kent Danielson***, Mark Adley	A Reliability Analysis Method for Assessment of Concrete Barriers under Vehicle Crashes **Qian Wang***, Hongbing Fang, Hanfeng Yin	A Cell-Centered Method for Solving 2D-Axisymmetric Updated Lagrangian Hyper-Elastoplasticity Equations **Rémi Chauvin***, Isabelle Bertron, Patrick Le Tallec, Pierre-Henri Maire	Computational Analysis of the Process of Metal Material Free-Surface Instability, Fragmentation, and Ejecta under Shock **Jingsong Bai***

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 521BC	**MS 405**	**Peridynamic Modeling and Simulations** **Chair(s): Michael Parks**		
Matching Boundary Conditions for State-Based and Bond-Based Peridynamics **Clint Nicely***, Dong Qian	A Multi-Time-Step Method for Partitioned Time Integration of Peridynamics **Michael Parks***, Payton Lindsay,	Effect of Discretization and Stochastic Material Distribution on Crack Initiation in Peridynamics **Martin Rädel***, Christian Willberg, Jochen Schmidt	Wave Characteristics of 1D and 2D State-Based Peridynamics in Comparisons with Nonlocal General Gradient Theory **Senthilkumar Vaiyapuri***	
Room: 518B	**MS 406**	**Recent Advances in Computational Fracture Mechanics and Failure Analysis** **Chair(s): Toshio Nagashima**		
Energy Methods and Harvesting in Damage Detection of Structures with Ultrasonic Waves **Philippe Destuynder***	A 3D Numerical Limit Analysis Approach for Strength Predictions of Cross-Laminated Timber Plates **Mingjing Li***, Josef Füssl, Markus Lukacevic, Josef Eberhardsteiner	Energy Release Rate Approximation for Surface Cracks using Topological Derivatives **Kazem Alidoost***, Meng Feng, Philippe H. Geubelle, Daniel A. Tortorelli	Evaluation of J- and Interaction Integrals for Fracture Problems of Welded Joints **Hiroshi Okada***, Masahiro Ono, Koichiro Arai, Yasunori Yusa	
Room: 520D	**MS 501**	**Computational Fluid-Structure Interaction: Methods and Applications** **Chair(s): TBD**		
Splitting Schemes for the Stress Formulation of the Incompressible Navier-Stokes Equations **Peter Minev***, Petr Vabishchevich	Aerodynamic Mitigation of Tall Buildings using Local and Global Shape Optimization **Ahmed Elshaer***, Girma Bitsuamlak	A Numerical Tornado Model Unifying the Existing Experimental Tornado Simulators **Anant Gairola***, Zoheb Nasir, Girma Bitsuamlak	Numerical Modeling of Tornado-Like Vortex and its Interaction with Low-Rise Building **Zoheb Nasir***	

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 524C	**MS 601**	**Advances in Computational Methods for Inverse Problems** **Chair(s): Cedric Bellis**		
A Distributed-Memory Newton-Krylov Solver for Inverse Transport Problems **Andreas Mang***, Amir Gholami, George Biros	Multiscale Optimization using Generalized Mortar Methods **Daniel Seidl***, Bart van Bloemen Waanders, Tim Wildey	Adaptive Mesh Refinement and Domain Decomposition in Elasticity Imaging **Li Dong***, Nicholas Hugenberg, Dhruv Patel, Tom Seidl, Paul Barbone, Assad Oberai	Nondestructive Measurement of Thermal Diffusivity of Bodies of Arbitrary Shape **Ryszard Bialecki***, Wojciech Adamczyk, Tadeusz Kruczek, Ziemowit Ostrowski	Development of Origin-Destination Matrix Estimation Method for Microscopic Traffic Simulator as Quadratic Programming **Kazuki Abe***, Hideki Fujii, Shinobu Yoshimura
Room: 519B	**MS 605**	**New Trends in Topology Optimization** **Chair(s): Glaucio H. Paulino**		
Keynote Presentation: **Philip Buskohl***	Topology Optimization of Origami Structures with Multi-Stability	Uncertainty Aware Topology Optimization via a Stochastic Reduced-Order Model Approach **Miguel Aguilo***, James Warner	Multidisciplinary Topology Optimization using Hierarchical Distributed Computing **David Weinberg***, Nam-Ho Kim	Sequential Convex Methods for Large-Scale Topology Optimization **Graeme Kennedy***
Room: 523A	**MS 701**	**Advanced Computational Methods and Theories for Predicting Material Behaviors at Various Length Scales** **Chair(s): Jeong-Hoon Song**		
Strain Field Approximation and Crack Tracking using the Particle Difference Approximation **Andrew Beel***, Athanasios Iliopoulos, John Michopoulos, Jeong-Hoon Song	Deformation of Polycrystals at Multiple Scales: Linking 3D-XRD to CPFE Modelling **Hamidreza Abdolvand***, Jonathan Wright, Angus Wilkinson	An Anisotropic Distribution Dislocation Loop Model for Simulation of Nanoindentation of Single Crystals **Y. P. Chen***	Modeling Ni/Al High Energy Ball Milled Composites using the Sharp Volumetric Billboard Method **Dewen Yushu***, Sangmin Lee, Karel Matous	Multiscale Modeling of Dislocation Kinetics in BCC Iron **Akiyuki Takahashi***, Kazuki Takahashi

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 518A	**MS 708**	**Modeling and Simulation of Additive Manufacturing Processes** **Chair(s): Neil Hodge**		
Experience and Challenges with Part-Scale Modeling of Select Laser Melting Additive Manufacturing **Robert Ferencz***, Neil Hodge, Rishi Ganeriwala, Ryan Vignes	Direct Energy Deposition Simulation using Truchas **Ondrej Certik***, Neil Carlson, Terry Haut	A Workflow for Thermal-Mechanical Modeling of Additive Manufacturing **Michael Veilleux***, Michael Stender, Lauren Beghini, Joshua Sugar, Samuel Subia		
Room: 523B	**MS 709**	**Modeling Materials with Coupled Physics** **Chair(s): Stephan Rudykh**		
Numerical Modeling of High-Temperature Superconductors using the Discontinuous Galerkin Method **Yann-Meing Law-Kam Cio***, Steven Dufour	Multiphysics Life Prediction Damage Model of a Turbine Engine Blade Disk Attachment **Samir Naboulsi***			
Room: 516D	**MS 802**	**Advances in Atomistic-to-Continuum Coupling Techniques** **Chair(s): David Chen**		
Coupled Continuum-Atomistic Simulations of Incommensurate to Commensurate Transformations in Twisted Graphene Bilayers **Ellad Tadmor***, Kuan Zhang	Out-of-Plane Deformation Behavior of 3D Graphene Honeycomb Structures: Atomistic Simulations and Continuum Modeling **Fanchao Meng***, Jun Song			

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 515C	**MS 804**	**Complex Multi-Physics Coupling Techniques: Advances and Applications** **Chair(s): Scott Roberts and Tyler Voskuilen**		
Simulating Interfacial Multi-Physics Problems using a Meshfree Approach **Lindsay Erickson***, Jeremy Templeton, Karla Morris	Locally Conservative Essentially Non-Oscillatory Solution Transfer for Multiphysics Coupling **Xuebin Wang***, Xiangmin Jiao, Qiao Chen	Multiphysics Design Optimization using an Adjoint Sensitivity Approach **Stuart Walker***	Modeling and Simulation of Residual Stress Development in a Resistance Forge Weld **Kevin Manktelow***	
Room: 516E	**MS 813**	**Multiscale Computational Homogenization for Bridging Scales in the Mechanics and Physics of Complex Materials** **Chair(s): Maenghyo Cho**		
Dynamic Mechanical Characterization of Random 3D Structural Polymeric Foams **Axinte Ionita***, Brittany Branch, Brian M. Patterson, Brad E. Clements, Dana M. Datellbaum, Alexander H. Mueller	Characterization and Prediction of Random Short-Fiber Reinforced Composite Properties **Mason Hickman***, Prodyot Basu	Homogenization Based on Realization-Dependent Hashin-Shtrikman Functionals of Piecewise Polynomial Trial Polarization Fields **Nicolas Venkovic***, Lori Graham-Brady	Computational Homogenization Accounting for Size Effect via Interface Elasticity at the Micro-Scale **Saba Saeb***, Paul Steinmann, Ali Javili	
Room: 522A	**MS 902**	**Advances and Applications of the Generalized/eXtended Finite Element Method** **Chair(s): Patrick O'Hara**		
A Scale-Bridging Generalized Finite Element Method for Parallel Simulations of Spot Welds in Large Structures **Armando Duarte***, Haoyang Li	A Multi-Scale Coupled Fluid-Thermal-Structural Interaction Analysis Framework using the Generalized Finite Element Method **Piyush Gupta***, Haoyang Li, Armando Duarte, Abhijit Gogulapati, Jack McNamara, Patrick O'Hara, Brian Gockel	Toward a Hierarchically Task-Parallel, Multiscale Generalized Finite Element Method **Julia Plews***		

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 524B	**MS 903**	**Advances in Numerical Methods for Linear and Non-Linear Dynamics and Wave Propagation** **Chair(s): Alexander Idesman**		
Reduced-Order Models and Optimization of Elastomer Damping Devices **Antoine Legay***, Jean-François Deü, Benjamin Morin, Sylvain Burri	Nonlinear and Random Vibrations of a Tensioned Cable Net **Reyolando Brasil***, Márcia Helena Yamamoto Sato	Attenuation of Acoustic Waves and Mechanical Vibrations at Low Frequencies by a Nonlinear Dynamical Absorber **Deborah Lavazec***, Gwendal Cumunel, Denis Duhamel, Christian Soize	Dynamic Finite Element Analysis of Underwater Pipeline under Regular and Irregular Waves **Hyun-Seok Kim***, Byoung Wan Kim, Bo-Woo Nam, Kangsu Lee	Nonlinear Dynamic Analysis of Space Tethered Solar Power Station **Zhiqin Cai***, Xuefu Li, Jinying Wu
Room: 524A	**MS 910**	**Isogeometric Methods** **Chair(s): Trond Kvamsdal**		
U-Splines: Splines over Unstructured Meshes **Derek Thomas***, Kevin Tew, Michael Scott	U-Splines: Application as a Basis for Isogeometric Analysis **Michael Scott***, Derek Thomas, Kevin Tew, Michael Borden, Zhihui Zou	Adaptive Refinement of Hierarchical T-Splines **Lin Chen***, René de Borst		
Room: 519A	**MS 912**	**Meshfree and Particle Methods: New Developments and Applications** **Chair(s): Michael Hillman**		
Keynote Presentation: **Dongdong Wang***, Junchao Wu	A Nesting Sub-Domain Gradient Smoothing Integration Scheme for Meshfree Methods	Non-Conforming Naturally Stabilized Nodal Integration **Michael Hillman***, J.S. Chen	Recent Advances in Numerical Integration in Meshfree Galerkin Methods **Alejandro Ortiz-Bernardin***	Numerical Analysis of Fracture Evolution using Nonlocal Models **Prashant Jha***, Robert Lipton

TS3: MONDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 514A	**MS 1005**	**Symposium on Trends in Unstructured Mesh Generation** **Chair(s): Steven Owen**		
A Frame-Guided Quadrilateral Mesh Generation Algorithm for CAD Models **Franck Ledoux***, Katherine Lewis, Walt Nissen	Geometric Meshing of Discrete Surfaces **Patrick Laug***, Houman Borouchaki	Quadrilateral Mesh Adaptation using Approximate Convex Scaffolding **Chaman Singh Verma***, Krishnan Suresh	Unstructured All-Quadrilateral Mesh Generation on Complicated 3D Surface **James Baeder***, Zihao Zhu	Distributed Mesh Infrastructure for Particle-in-Cell Simulations **Mark Shephard***, Eisung Yoon, Kaushik Kalyanaraman, Seegyoung Seol
Room: 525B	**MS 1108**	**Uncertainty Propagation and Quantification in Multiscale Simulation of Materials Response, Structural Performance, and Failure** **Chair(s): Joseph Bishop**		
Bayesian Methods to Capture Inherent Material Variability in Additively Manufactured Samples **Jeremy Templeton***, Francesco Rizzi, Brad Boyce, Reese Jones, Jakob Ostien	Nondeterministic Parameter Calibration for Crystal Plasticity Models **Geoffrey Bomarito***, Timothy Ruggles, Saikumar Yeratapally, Patrick Leser, James Warner, Jacob Hochhalter	Verification and Validation of Thermo-Mechanical Shock Modeling of High Energy Ball Milled Materials with Uncertainty Quantification **Sangmin Lee***, Waad Subber, Alberto Salvadori, Karel Matous	A Novel Fast Model Predictive Control Method for Large-Scale Stochastic Dynamic Systems **Haijun Peng***, Sheng Zhang, Zhigang Wu	

Tuesday Plenary Speaker

9:00-9:45 am

Andrew Stuart

California Institute of Technology

Derivative-Free Methods for Inverse Problems

Room: 517BC

Abstract: Many problems in the sciences and engineering require the determination of an unknown field (the parameter) from a finite set of indirect measurements. Examples include carbon sequestration, hydrology, oceanography and weather forecasting. At the heart of most formulations is a least squares functional measuring the model output mismatch with the data. To avoid over-fitting, minimization of this mismatch needs to be regularized. I will describe a set of algorithms which address this issue in contexts where the derivative of the parameter to output map is not readily available. In particular I will demonstrate that ideas from the Ensemble Kalman Filter (EnKF) can be adapted to solve such problems: by running multiple interacting copies of the model, and exposing their output to the data, a derivative-free minimization tool is constructed. The EnKF is essentially an optimzation method, despite the original motivation based on Kaman filtering. I will also discuss fully Bayesian inversion, again using derivative-free algorithms, in which a gradient is induced through a Metropolis accept-reject mechanism. Examples including the study of model inadequacy in RANS models of turbulence, and parameter estimation in the human glucose-insulin system, will be used to illustrate the ideas.

Bio: Andrew Stuart is interested in how the current era of data acquisition interacts with centuries of human intellectual development of mathematical models that describe the world around us. As an applied mathematician in the Division of Engineering and Applied Science (EAS), he generates the mathematical and algorithmic frameworks that allow researchers to interface data with mathematical models. His work is informed by—and has applications for—diverse arenas such as weather prediction, carbon sequestration, personalized medicine, and crowd forecasting. Originally from London, Stuart earned his bachelor's degree at Bristol University and then a combined master's/PhD at Oxford University. He worked as a postdoc at MIT in the late '80s, as a lecturer at the University of Bath in England from 1989 to 1992, and then as professor at Stanford University and the University of Warwick in England. He relocated to Southern California this summer.

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 516A	**MS 001**	**Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard** **Chair(s): Assad Oberai**		
Keynote Presentation: **Thomas J.R. Hughes***	Isogeometric Analysis: Past, Present, Future	Mesh Quality of Mixed-Element Bernstein-Bézier Meshes **Luke Engvall***, John Evans	Goal-Oriented Mesh Adaptation Enabled by the Variational Multiscale Method **Assad Oberai***, Brian Granzow	Goal-Oriented Error Estimation and Adaptivity with the DPG Methodology **Brendan Keith***, Ali Vaziri Astaneh, Socratis Petrides, Leszek Demkowicz
Room: 514C	**MS 102**	**Computational Bioengineering and Biomedicine** **Chair(s): Suvranu De**		
A Computational Framework for Tissue-Scale, Patient-Specific Prediction of Prostate Cancer Growth **Guillermo Lorenzo***, Michael Scott, Kevin Tew, Thomas J.R. Hughes, Hector Gomez	A Heterogeneous Tissue Model for Treatment Planning in Laser-Induced Thermal Therapy **Drew Mitchell***, Christopher MacLellan, Samuel Fahrenholtz, John Hazle, Jason Stafford, David Fuentes	Finite Element Modeling Approach for Protein Dynamics **Giseok Yun***, Jaehoon Kim, Jae-Young Lee, Do-Nyun Kim	A Fully Coupled Space-Time Multiscale Modeling Framework for Predicting Tumor Growth **Yusheng Feng***, Mohammad Rahman, Tom Yankeelov, J. Tinsley Oden	Quantifying the Volumetric Growth in an In Vivo Murine Glioma using a Linear Mechanically-Coupled Model **Xinzeng Feng***, David Hormuth, Thomas Yankeelov
Room: 515A	**MS 103**	**Computational Biomechanics of Impact and Injury** **Chair(s): Jingwen Hu**		
Keynote Presentation: **Matthew B. Panzer***, Ahmed Alshareef, Sebastian Giudice, Jason Forman	Comparison of Human Brain Finite Element Models to Whole Brain Sonomicrometry Data	Understanding the Effect of Head Shape on Traumatic Brain Injury Prediction due to Blast Loading **Siddiq Qidwai***, Kirubel Teferra, X. Gary Tan, Athanasios Illiopoulos, John Michopoulos	Cavitation Bubble Effects on Cell Disruption via Shockwave Modeling **Matthew Becton***, Xianqiao Wang	

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 514B	**MS 108**	**Multiscale Modeling in Bio-mechanical Systems** **Chair(s): Zi Chen**		
The Effect of Residual Stress on Stress-Modulated Growth in an Artery **Lucy Zhang***, Jie Cheng	Modeling Interfacial Behavior of Responsive Polyelectrolyte-Grafted Nanoparticles **Xin Yong***, Shiyi Qin			
Room: 520A	**MS 201**	**Advances in High-Order Methods for Computational Fluid Dynamics** **Chair(s): Antony Jameson**		
Keynote Presentation: **Steve Karman***	A Practical Approach to Curving Meshes for Realistic Geometries	High-Order Mesh Generation and Flow Simulation about Complex Geometries **Chris Cantwell***, David Moxey, Mike Turner, Joaquim Peiro, Ayad Kassim, Spencer Sherwin	A Necessary High-Order Meshing Constraint When using the Finite Element Method on Domains with Curved Boundaries **Philip Zwanenburg***, Siva Nadarajah	
Room: 520B	**MS 203**	**Computational Methods for Hydraulics** **Chair(s): Azzeddine Soulaïmani**		
The Earth by TELEMAC **Sébastien E. Bourban***, Michael S. Turnbull, Alan J. Cooper	Capabilities of Shallow Water Equations to Reproduce Real Tsunamis, Cases of Tohoku 2011 and Gisborne 1947 **Riadh Ata***, Marine Le Gal, Damien Violeau	Principal Interval Decomposition Framework for POD Reduced-Order Modeling of Shallow Water Flows **Jean-Marie Zokagoa***, Azzeddine Soulaïmani	Stochastic Uncertainties Analysis in Dam Break Flow Modeling using a Reduced Order Model **Azzedine Abdedou***, Azzeddine Soulaïmani, Jean-Marie Zokagoa	Uncertainty Quantification on a Real Case with TELEMAC-2D **Cédric Goeury***

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 520C	**MS 301**	**Advancements in Hydraulic Fracture Simulation** **Chair(s): Denis Esipov**		
Keynote Presentation: **Erfan Sarvaramini***, Robert Gracie, Maurice Dusseault	A C^{0} Non-Local Model of Hydraulic Fracturing	Coupling Fracture Propagation and Reservoir Simulator **Mary Wheeler***, Benjamin Ganis, Mohamad Jammoul, Sanghyun Lee	Non-Local Formulation for Transport and Damage in Porous Media **Mostafa Mobasher***, Luc Berger-Vergiat, Haim Waisman	Accurate Phase-Field Solution of Sneddons Problem: Main Ingredients and Challenges **Tymofiy Gerasimov***, Laura De Lorenzis
Room: 520E	**MS 303**	**Computational Geomechanics** **Chair(s): Guenther Meschke**		
Inf-sup Stable Computational Methods for Strongly Coupled Porous Media **Christian Linder***, Andreas Krischok, Berkin Dortdivanlioglu	Hybrid Data-Driven Multiscale Computational Geomechanics across Length Scales **WaiChing Sun***, Kun Wang	A Discrete-Continuum Coupling Model for Fractured Porous Media with Embedded Branched-Discontinuities in the Finite Deformation Range **Kun Wang***, WaiChing Sun	Adaptive Arlequin Method for Multiscale Brittle Fracture with Subgrid Length Scales **Eric Bryant***, WaiChing Sun	A Combined Phase Field and Crystal Plasticity Approach for Capturing Thermo-Mechanical Behavior of Polycrystalline Rock Salt **SeonHong Na***, WaiChing Sun
Room: 518C	**MS 304**	**Computational Methods and Design for Impact and Blast Problems** **Chair(s): Navid Allahverdi**		
Keynote Presentation: **Jun Xu***, Binghe Liu	Multi-Physics Coupled Computational Framework for Lithium-Ion Batteries under Mechanical Abusive Loading	Experimental Observation of Multiscale Deformation in Heterogeneous Materials Subjected to Impact Loading **Addis Kidane*,** Suraj Ravindran	Through Thickness Reinforcement for Z-Pinned Composites **Mark Pankow***	Low Order Modeling for Structural Response of Columns under Extreme Loadings **Navid Allahverdi***, Ala Saadeghvaziri

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 518B	**MS 401**	**Computational Fracture Mechanics** **Chair(s): N. Sukumar**		
Keynote Presentation: **Nicolas Moës***, Benoît Le, Gregory Legrain	The Thick Level Set Model for Fracture: A Theory Allowing the Coupling of Cohesive and Diffuse Approaches to Fracture	A Non-Differentiable Energy Formulation with Nitsche Flux for Time-Continuous Cohesive Fracture **M. Reza Hirmand***, Katerina D. Papoulia	Cohesive Polygonal Finite Elements for Modeling Pervasive Fracture **Eric B. Chin***, N. Sukumar, Joe Bishop, Rao Garimella	Modeling of Interfacial Damage in FFT Solvers **Luv Sharma***, Ron Peerlings, Pratheek Shanthraj, Franz Roters, Marc Geers
Room: 521BC	**MS 404**	**Multiscale and Computational Methods in Failure Mechanics** **Chair(s): Caglar Oskay**		
Keynote Presentation: **Haim Waisman***, Miguel Arriaga	Stability Analysis of Metals Capturing Brittle and Ductile Fracture through a Phase Field Method and Shear Band Localization	Three-Dimensional Computational Framework with Embedded Weak Discontinuities for Shear Localization under Dynamic Loading Conditions **Tao Jin***, Hashem Mourad, Curt Bronkhorst	Two-Scale Computational Modeling of Dynamic Failure in Brittle Solids: Branching Instabilities **Cristian Dascalu***	An Agile Computational Approach to Crystal Plasticity **David Littlewood***, Coleman Alleman, Guy Bergel, James Foulk, Alejandro Mota, Hojun Lim
Room: 520D	**MS 501**	**Computational Fluid-Structure Interaction: Methods and Applications** **Chair(s): TBD**		
Keynote Presentation: **Yuri Bazilevs***	A Flexible FSI Framework with Applications	Coupled CFD/CSD Simulations of Dust Production by Fragmenting Charges using Stabilized Linear Tetrahedral Elements **Orlando Soto***, Joseph Baum, Rainald Löhner, Robert Frank	Analysis of Free-Surface Flow Interacting with an Elastic Beam using Mesh-free Particle Method and Finite Element Method **Naoto Mitsume***, Tomonori Yamada, Shinobu Yoshimura	Large Scale Coupled Analysis of Gas-Liquid-Solid Interaction using ALE Mesh and Level Sets **Tatsuhiro Shono***, Gaku Hashimoto, Hiroshi Okuda

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 520F	**MS 506**	**Free and Moving Boundary Problems: Methods and Applications** **Chair(s): TBD**		
Keynote Presentation: **Florin Ilinca***, Bruno Blais, Kintak Raymond Yu	On the Solution of 3D Free Surface Flows using Enriched Pressure Shape Functions	A Volume-Conserving Level Set Method on Unstructured Meshes using a Control Volume Finite Element Formulation **Stephen Lin***, Jinhui Yan, Gregory Wagner	Turbulent Boiling Multiphase Flows using Variational Multiscale FEM **Mehdi Khalloufi***, Youssef Mesri, Rudy Valette, Elisabeth Massoni, Elie Hachem	Shock Wave-Free Interface Interaction **Roman Frolov***, Peter Minev, Rouslan Krechetnikov
Room: 524C	**MS 601**	**Advances in Computational Methods for Inverse Problems** **Chair(s): Wilkins Aquino**		
From Full-Field Measurements to Material Properties of Composite Materials **Cédric Bellis***, Manel Trabelsi, Flavien Fremy	Gradient-Based Optimization Algorithms for the Modified Error in Constitutive Equation Approach to Inverse Problems **Olalekan Babaniyi***, Clay Sanders, Wilkins Aquino	Early Detection of Breast Cancer through an Inverse Problem Approach to Stiffness Mapping: Preliminary Results from Tissue Phantom Experiments **Lorraine Olson***, Robert Throne, Adam Nolte, Kaelyn Griffin, Nicolae Iovanac, Xiaoyin Ling, Tressa Lauer, Michael Samp, Brendan Smyth, Jiaojiao Wang	Inverse Method for Determination of Hardening Parameters of Ductile Materials by a Hardness Test: Numerical and Experimental Aspects **Lucas Q. Machado***, Lucival Malcher	An Unified Inverse Framework for Identification and Model Updating of Mechanical Structures Involving Non-Linear Behaviors **Basile Marchand***, Ludovic Chamoin, Christian Rey
Room: 519B	**MS 605**	**New Trends in Topology Optimization** **Chair(s): Miguel Aguilo**		
Keynote Presentation: **Tomas Zegard***, Yang Jiang, William Baker, Glaucio Paulino	New Methods for Grid-shell Form-Finding	Topology Optimization of Viscoelastic Damping Layers for Transient Vibration Reduction of Shell Structures **Kyeong-Soo Yun***, Sung-Kie Youn	Layout Optimization of Magnetorheological Fluid Patches in Plate Structures by using Semi-Active Control **Xiaopeng Zhang***, Akihiro Takezawa, Zhan Kang	Structural Dynamic Analysis of an Optimized Flapping Wing Micro Air Vehicle **Van Tien Truong*,** Quoc Viet Nguyen, Marco Debiasi, Heow Pueh Lee

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 518A	**MS 707**	**Modeling and Simulation in Additive Manufacturing** **Chair(s): Albert To**		
Solidification Analysis of Ni Based Superalloy Melted by Electron Beam for Additive Manufacturing **Yuichiro Koizumi***, Yushi Ohno, Zhao Yufan, Akihiko Chiba	Molten Pool Behavior and Solidification Microstructure of Co-Cr-Mo Alloy in Powder-Bed Electron Beam Additive Manufacturing **Yufan Zhao***, Yuichiro Koizumi, Kenta Aoyagi, Kenta Yamanaka, Daixiu Wei, Akihiko Chiba	Quantitative Prediction of Epitaxial Columnar Grain Texture from Process Parameters in Metal Additive Manufacturing **Albert To***, Jian Liu, Erica Stevens, Markus Chmielus	Large Scale Simulations of Solidification Microstructures in Long and Short Freezing Alloys under Additive Manufacturing Conditions **Bala Radhakrishnan***, Sarma Gorti, Jean-Luc Fattebert, Tahany El-Wardany, Ranadip Acharya, Alexander Staroselsky	
Room: 525A	**MS 710**	**Modeling of Soft Materials** **Chair(s): Stephan Rudykh**		
Multiphysics Modeling the Urea-Induced Responsive Behavior of the Urea-Sensitive Hydrogel **Kek Boon Goh***, Hua Li, Khin yong Lam	A Thermodynamically Consistent Large Deformation Constitutive Model for Thermal Curing of Polymers **Shawn Chester***, Trisha Sain	Anomalous Diffusion and its Applications **Weihua Deng***, Eli Barkai	Designing Morphology Evolution Pathways in Organic Thin Films **Olga Wodo***, Prosenjit Bhattacharya	An Anisotropic Lagrangian Plasticity Model for Semi-Crystalline Polymers at Finite Strains **Martin Kroon***
Room: 516D	**MS 802**	**Advances in Atomistic-to-Continuum Coupling Techniques** **Chair(s): Jaime Marian**		
Keynote Presentation: **Vikram Gavini***, Phani Motamarri	Large-Scale Real-Space Electronic Structure Calculations	Simulations of Fracture of Amorphous Solids by Multiscale Cohesive Zone Model **Shingo Urata***, Shaofan Li	Coupled Atomistics and Discrete Dislocations in 3d (CADD-3d) **Guillaume Anciaux***, Jaehyun Cho, Till Junge, Jean-François Molinari, William Curtin	Nonlocal Heat Conduction Models in Nano-Scale Materials: First Principle Derivations and Local Approximations **Xiantao Li***

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 515C	**MS 804**	**Complex Multi-Physics Coupling Techniques: Advances and Applications** **Chair(s): Jonathan Clausen and Victor Brunini**		
Keynote Presentation: **Scott Roberts***, Hector Mendoza, Bradley Trembacki, Mark Ferraro, Victor Brunini, David Noble	Use of the Conformal Decomposition Finite Element Method for Coupled Electrochemical-Mechanical Simulations of Lithium-Ion Battery Electrodes	Modeling of the Effects of Microstructure Variations in Li-ion Intercalation Batteries during Impact **Srikanth Allu***, Srdjan Simunovic, Sergiy Kalnaus, Hsin Wang, John Turner	Coupled Electrochemistry and Solid Mechanics of Li-ion Battery Electrodes **Victor Brunini***, David Noble, Brad Trembacki, Mark Ferraro, Scott Roberts	Multi-Physics Coupling Challenges and Approaches for Modeling Thermally Activated Batteries **Tyler Voskuilen***, John Hewson, Harry Moffat, Scott Roberts
Room: 515B	**MS 807**	**Coupled Multiphysics Problems: Discretization Approaches and Solution Methods** **Chair(s): Michael Gee**		
Coupling Bio-Physical Tumor Models With Diffeomorphic Image Registration **Klaudius Scheufele***, Amir Gholaminejad, Andreas Mang, Miriam Mehl, George Biros	Selective Frequency Damping Algorithm for Steady Flow Convergence Acceleration **Frédéric Plante***, Eric Laurendeau	Reduced-Order Finite Element Formulation for Vibroacoustic Analysis of Double-Wall Sandwich Panels with Viscoelastic and Piezoelectric Damping Treatments **Walid Larbi***, Jean-François Deü, Roger Ohayon	Nonlinear Dynamics and Pull-in of Microplate-Based MEMS **Mergen Ghayesh***, Hamed Farokhi	
Room: 516E	**MS 813**	**Multiscale Computational Homogenization for Bridging Scales in the Mechanics and Physics of Complex Materials** **Chair(s): Dennis Kochmann**		
Keynote Presentation: **Kenjiro Terada***, Seishiro Matsubara, Masayasu Kishi, Mayu Muramatsu	Thermo-Mechanical Coupled Numerical Material Testing for Polymeric Composite Materials	Computational Homogenization of the Nonlinear Electrical Behavior of Graphene/Polymer Nanocomposites **Xiaoxin Lu***, Julien Yvonnet, Fabrice Detrez, Jinbo Bai	Multiscale Computational Homogenization Approach of Polymer Nanocomposites Including the Clustered Nanoparticles **Maenghyo Cho***, Hyunseong Shin, Kyungmin Baek, Jin-Gyu Han	Countering the Curse of Dimensionality in Data-Driven Design of Materials and Structures **Miguel A. Bessa***, Wing Kam Liu, Sergio Pellegrino

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 522BC	**MS 901**	**Advanced Computational Methods For Complex Geometry Simulations** **Chair(s): Guglielmo Scovazzi and Xianyi Zeng**		
Keynote Presentation: **Alex Main***, Guglielmo Scovazzi, Nabil Atallah, Ting Song, Kangan Li	The Shifted Boundary Method for Embedded Boundary Computations	An Adaptive Residual-Based Approach for Solving the Penalized Navier-Stokes Equations in Fluid Structure Interaction **Léo Nouveau***, Héloïse Beaugendre, Cécile Dobrzynski, Mario Ricchiuto	Combining ALE Flow Computations and Embedded Boundary Methods for Multi-Physics Problems **Xianyi Zeng***, Kangan Li, Guglielmo Scovazzi	A Cut Cell Finite Element Method for Poisson's Equation on Irregular Planar Domains **Sushrut Pande***, Panayiotis Papadopoulos
Room: 524A	**MS 911**	**Isogeometric Methods for Complex Geometries and Multi-Physics Systems** **Chair(s): John Evans**		
Keynote Presentation: **Ming-Chen Hsu***	Ventricular, Vascular and Valvular Fluid-Structure Interaction	Integrating CAD with Abaqus: A Practical Isogeometric Analysis Software Platform for Industrial Applications **Jessica Zhang***	The Development of Numerical Method for Ship and Wave Interaction Analysis using NURBS **Keng-Wei Chang***, Pai-Chen Guan	
Room: 519A	**MS 912**	**Meshfree and Particle Methods: New Developments and Applications** **Chair(s): Sheng-Wei Chi**		
High Order Gradient Reproducing Kernel Collocation Method for High Order PDEs **Sheng-Wei Chi***, Ashkan Mahdavi	Weighted Reproducing Kernel Collocation Method for Solving Inverse Problems **Judy Yang***, Pai-Chen Guan, Chia-Ming Fan	A Radial Basis Function Method on Problems of Blow-Ups in Nonlinear Parabolic Equations **Guangming Yao***	A Phase-Aware Meshfree Framework for Dynamic Behavior of Materials under Extreme Thermomechanical Conditions **Bo Li*,** Hao Wang, Zongyue Fan	

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 522A	**MS 913**	**Non-standard Formulations and Discretization Methods for Thin-walled Structures** **Chair(s): Manfred Bischoff**		
Keynote Presentation: **Paulo Pimenta***, Sascha Maassen, Nils Viebahn, Jörg Schröder	Simple Finite Elements for Geometrically-Exact Bernoulli-Euler Beams and Kirchhoff-Love Shells	Geometrically Exact Finite Element Formulations for Slender Beams: Kirchhoff-Love Theory vs. Simo-Reissner Theory **Christoph Meier***, Wolfgang A. Wall, Alexander Popp	New Numerical Methods for the Efficient Coupling of Nonlinear Beams and Continua **Ignacio Romero***	
Room: 523B	**MS 916**	**Saddle Point and Mixed Discretization of Variational Problems** **Chair(s): Constantin Bacuta**		
On the DPG Method and Non-Standard Boundary Conditions **Norbert Heuer***, Thomas Führer, Michael Karkulik, Ernst P. Stephan	A New Multigrid Method for Saddle Point Problems **Hengguang Li***	Weak Galerkin Method and its Applications **Xiu Ye***, Lin Mu, Junping Wang	Efficient High-Order Time-Stepping Methods for 3D Incompressible Flows **Kak Choon Loy***, Yves Bourgault	Primal-Dual Weak Galerkin Finite Element Methods for PDEs **Junping Wang***, Chunmei Wang
Room: 514A	**MS 1101**	**Advances in Adaptive Approaches for Large-scale Deterministic and Stochastic Problems** **Chair(s): Jim Stewart**		
Keynote Presentation: **Alireza Doostan***, Hillary Fairbanks, Jerrad Hampton, Akil Narayan	A Bi-Fidelity, Low-Rank Approximation Technique for Uncertainty Quantification	Density Estimation for a Class of Elliptic Problems on Stochastically Perturbed Domains **Jehanzeb Chaudhry***, Donald Estep, Nathanial Burch	An Adaptive Sampling Method Based on Grassmann Manifold Variations **Michael Shields***, Dimitris Giovanis	New High-Order Methods using Gaussian Processes for CFD **Dongwook Lee***

TS4: TUESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 525B	**MS 1107**	**Stochastic Methods in Computational Mechanics of Random Materials** **Chair(s): Lori Graham-Brady and Michael Shields**		
Bayesian Deep Gaussian Processes for Nonlinear Stochastic Dimensionality Reduction **Steven Atkinson***, Nicholas Zabaras	Variational Multiscale Error Estimators for the Uncertainty Quantification of Mesh Discretization Errors **Oriol Colomés***, Guglielmo Scovazzi	A Domain Decomposition Based Hybrid Framework for High Dimensional Stochastic Mechanics Problems **Srikara Pranesh***, Debraj Ghosh	Construction and Identification of Stochastic Constitutive Laws for Soft Biological Tissues **Johann Guilleminot***, Brian Staber	Multiscale Optimization of Carbon-Nanotube Reinforced Polymer Structures **Vissarion Papadopoulos***, Maria Tavlaki, Odysseas Kokkinos, Manolis Papadrakakis

Tuesday Semi-Plenary Speakers

1:30-2:15 pm

Beth Wingate
University of Exeter

Challenges for Climate and Weather Prediction in the Era of Exascale Computer Architectures: Oscillatory Stiffness, Time-parallelism, and the Role of Long-Time Dynamics

Room: 516BC

Abstract: For weather or climate models to achieve exascale performance on next-generation heterogeneous computer architectures they will be required to exploit on the order of hundred-million-way parallelism. This degree of parallelism far exceeds anything possible in today's complex models even though they are highly optimized. In this talk I will discuss one of the mathematical issues that leads to the limitations in space- and time-parallelism for climate and weather prediction models – oscillatory stiffness in the PDE that leads to time scale separation. I will discuss the case when the time scale separation is infinite, including a fast-converging HMM-type parareal method and a time-parallel matrix exponential. In addition I will present new convergence results for the case when the time scale separation is finite.

Bio: Professor Beth Wingate's main research interest is the study of oscillations in fluid mechanics, mathematics, and numerics for high performance computing. Her recent research is focused on physics of the Arctic Ocean, direct numerical simulations, and time-stepping methods for HPC and climate modeling, and the fluid mechanics of the slow/fast manifolds. She did her PhD work at the University of Michigan studying numerics, waves and ocean fluid dynamics. Other interests include spectral element methods, in particular the investigation of near optimal interpolation on triangles. She spent many years at the Los Alamos National Laboratory in New Mexico, USA before moving to the University of Exeter in Devon, UK in 2013.

Ronald E. Miller
Carleton University

Finite Temperature and Finite Deformation: New Tools for More Efficient and Accurate Atomistic Simulation

Room: 517D

Abstract: Two of the important challenges to using atomistic simulation to study material behaviour are modeling the roles of finite temperature and finite deformation. In this presentation I will discuss a new method for finding activation energies for atomistic systems and an improved method for accurately controlling the true stress in molecular dynamics. When studying the deformation of solids at finite temperature, we are regularly confronted with the long time scales associated with activated processes. Diffusion, defect nucleation and dislocation motion are all processes that are often too slow to study with direct atomistic simulations. Instead, we must appeal to models based on transition state theory, whereby we can predict process rates using accurately calculated parameters from key atomic configurations. Specifically, we require knowledge of three atomic configurations: two local minima on the potential energy surface (PES) of the atoms (the "reactant" and "product" states), and the saddle point ("transition" state) configuration between these minima. For complex processes involving many atoms, the challenge is to find these configurations both efficiently and with sufficient accuracy.

In this presentation, I will discuss a new method called TRREAT (the "Transition Rapidly-exploring Random Eigenvector Assisted Tree" method) that we have developed for the purpose of searching the PES for transition and product states. The method is related to methods in the literature (e.g. the nudged elastic band, dimer and activation-relaxation methods) but seems to have advantages for certain applications. Specifically, it can find numerous transition and

product states from knowledge of only the reactant state and does so efficiently by a combination of Monte Carlo search, eigenvector biasing and a method to avoid previously searched regions of the PES. Further, because it works well with only approximate eigenvectors (due to its stochastic nature), it can be applied to large DFT calculations where accurate eigenvectors are prohibitively expensive to compute.

The second challenge I will address, that of finite deformation, is important when studying soft materials or stress-induced phase transformations of crystals. When the stress state needs to be controlled in atomistic simulation of such systems, this is almost universally achieved using the Parrinello-Rahman algorithm or some related technique. However, none of these techniques are able to control the true (Cauchy) stress applied to the system. Instead, they apply an ***approximation*** to the second Piola-Kirchhoff stress (related to the "engineering" stress). The true Cauchy stress that results during such a simulation is dependent on the deformation of the simulation cell. Further, this true stress cannot be known ***a priori***, and it can be significantly different than the apparent applied stress when the deformation is large.

In this presentation, I will discuss an alternative molecular dynamics algorithm that controls the true Cauchy stress applied to the system. The "Cauchystat" is based on the constant stress ensemble presented by Tadmor and Miller ("***Modeling Materials: Continuum, Atomistic and Multiscale Techniques,***" Cambridge University Press, 2011), but with modified equations of motion that update the system boundary conditions in response to the resulting deformation of the simulation cell.

Bio: Ron Miller received his BSc in Mechanical Engineering from the University of Manitoba in 1994, and his PhD in engineering from Brown University in 1997. He was a post-doctoral fellow in the Division of Engineering and Applied Sciences at Harvard University. He is co-author of over 70 scientific articles and two textbooks published by Cambridge University Press. He has been a visiting research professor at EPFL (Lausanne, Switzerland), INPG (Grenoble, France), the Technion (Israel) and Brown University (USA). He is currently Professor and Chair of the Dept. of Mech. and Aero. Engineering at Carleton University.

His research focuses on modeling and simulation of materials at the atomic scale. He has been actively involved in the development of a number of multiscale methods that aim to reduce the computational expense of atomic-scale simulation, and more recently has turned his attention to the development of interatomic potentials and new techniques for exploring energy landscapes to find activation barriers.

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 516A	**MS 001**	**Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard** **Chair(s): Assad Oberai**		
Keynote Presentation: **Kenneth Jansen***, Cameron Smith, Benjamin Matthews, Mark Shephard	Analyst-Guided Adaptive Simulation at Extreme Scale—Beyond In Situ	Tools for Scalable, Parallel Simulation of Problems with Evolving Domains **Saurabh Tendulkar***, Ottmar Klaas, Rocco Nastasia, Mark Beall	Adjoint-Based Sensitivity Analysis and Design of Large-Scale Multidisciplinary Aerospace Applications **Eric Nielsen***	The Impact of Automated, Unstructured Meshing on the Use of CFD in Industry **David Corson***
Room: 514C	**MS 102**	**Computational Bioengineering and Biomedicine** **Chair(s): Yusheng Feng**		
Multi-Physics Modeling of Thermomechanical Response of Ultrasonically Activated Soft Tissue **Rahul***, Suvranu De	Predicting Lung Motion with Autodesk Simulation **Jaesung Eom***	Structural-Based Computational Model of Tendon-to-Bone Insertion **Sergey Kuznetsov***, Hsiao-Ying Shadow Huang	Optimal Sensitivity of Nanowire Field-Effect Troponin Sensors **Amirreza Khodadadian***, Clemens Heitzinger, Kiarash Hosseini, Reza Kalantarinejad, Marjan Hedayati, Ali Manzour-ol-Ajdad	An Optimization Method for Additive-Manufactured Dental Implants **Nien-Ti Tsou***, Shih-Shun Chien, Chang-Wei Huang
Room: 515A	**MS 103**	**Computational Biomechanics of Impact and Injury** **Chair(s): Matthew Panzer**		
Foot and Ankle Injuries in Under-Vehicle Explosions: A Finite Element Study **Grigoris Grigoriadis***, Diagarajen Carpanen, Anthony Bull, Spyros Masouros	Non-Linear Boundary Conditions for a More Realistic Prediction of Femoral Fracture during Side-Fall **Zainab Altai***, Muhammad Qasim, Xinshan Li, Marco Viceconti	Two Finite Element Solvers and Mesh Techniques to Evaluate Lower Leg Protections **Carolyn Hampton***, Michael Kleinberger	Visualization of Vascular Injuries in Extremity Trauma **Joseph Teran***	

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 514B	**MS 106**	**Imaged-Based Models for Biomedical Applications** **Chair(s): Michael Sacks**		
Image-Based Estimation of Mitral Valve Strains in the Beating Heart **Bruno Rego***, Amir Khalighi, Andrew Drach, Joseph Gorman, Robert Gorman, Michael Sacks	Ultrasound Imaging-Based Identification of Thermal Damage in Burnt Tissue **Hanglin Ye***, Rahul, Saurabh Dargar, Suvranu De	CAD-Based Patient-Specific Vascular NURBS Modeling for Isogeometric Analysis **Travis Sanders***, Benjamin Urick, Shaolie Hossain, Jessica Zhang, Thomas J.R. Hughes	Minimum Required Spatial Resolution for Image-Based Simulations of Mitral Valve **Andrew Drach***, Amir Khalighi, Michael Sacks	
Room: 520A	**MS 201**	**Advances in High-Order Methods for Computational Fluid Dynamics** **Chair(s): Freddie Witherden**		
Robust, Efficient, and Geometrically Flexible: Entropy-Stable High-Order Summation-By-Parts Discretizations on Simplex Elements **Jason E. Hicken***, Jared Crean, David C. Del Rey Fernández, David W. Zingg, Mark H. Carpenter	Recent Advances in Methods with the Summation-by-Parts Property **David C. Del Rey Fernández***, David W. Zingg, Mark H. Carpenter, Jason E. Hicken, Pieter D. Boom, Jared Crean	Adjoint-Based Optimization of Time-Dependent Fluid-Structure Systems using a High-Order Discontinuous Galerkin Discretization **Matthew Zahr***, Per-Olof Persson		
Room: 520B	**MS 203**	**Computational Methods for Hydraulics** **Chair(s): Riadh Ata**		
Keynote Presentation: **Azzeddine Soulaïmani***, Mamadou Tour, Adil Fahsi	Stabilized XFEM and FEM for Free Surface Incompressible Flows	Adaptive Meshing Strategy Based on Topo-Metric Data for the Dam Break Inundation Assessments **Mahdi Moslemi***, Azzeddine Soulaïmani, Georges W. Tchamen	Smart Ferro Fluid for Shock Absorber Main Landing Gear **Abolghasem Zare Shahneh***	

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 520C	**MS 301**	**Advancements in Hydraulic Fracture Simulation** **Chair(s): Egor Dontsov**		
Keynote Presentation: **Gunther Meschke***, Ildar Khisamitov, Dirk Leonhart, Beckhuis Sven	Computational Modeling of Fluid-Induced Fracture Propagation: XFEM and Variational Interface Methods	Coupling Strategies for X/G-FEM Simulation of Hydraulic Fracture **Matin Parchei-Esfahani***, Robert Gracie	An Extended Finite Element Model for Studying Shear Dilation in a Pressurized Medium **Endrina Rivas***, Robert Gracie	Modeling Competing Hydraulic Fracture Propagation using Generalized/Extended Finite Element Method **Dakshina Valiveti***, Fushen Liu, Peter Gordon
Room: 522BC	**MS 302**	**Advances in Computational Methods for Soil Sciences** **Chair(s): TBD**		
Keynote Presentation: **Varvara Roubtsova***, Mohamed Chekired	SiGran: A Virtual Laboratory for Geotechnical Applications	Modeling of Packing Processes for Ellipsoidal Particles of Arbitrary Size **Elham Kheradmand Nezhad***, Leince Remson Elysée, Serge Prudhomme, Marc Laforest, Varvara Roubtsova, Mohamed Chekired	A Three-Dimensional DEM-FEM Modeling of Pneumatic Tire-Sand Soil Interaction **Mengyan Zang***, Zumei Zheng	Modeling of Flow and Scouring under Pipelines by Reproducing Kernel Particle Method **On Lei Annie Kwok***, Pai-Chen Guan, Chien-Ting Sun
Room: 520E	**MS 303**	**Computational Geomechanics** **Chair(s): Richard Wan**		
A Plasticity Model for Fiber-Reinforced Geomaterials **Craig Foster***, Persid Koci	Influence of Inter-Particle Properties on the Elastic Moduli of Granular Materials **Kianoosh Taghizadeh***, Behzad Soltanbeigi, Alexander Podlozhnyuk, Vanessa Magnanimo, Stefan Luding	Elastic-Brittle-Plastic Analysis of Hoek-Brown Rock using Mohr-Coulomb Failure Criterion **Shailendra Sharan***		

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 518C	**MS 304**	**Computational Methods and Design for Impact and Blast Problems** **Chair(s): Jasbir Arora**		
Modeling Blast Loading on Structures from Explosions in an Urban Environment **Sergey Medyanik***, Syed Mohammad, Nickolas Vlahopoulos	Optimization of Framed Structures Subjected to Blast Loading **Jasbir Arora***, Mustafa Al-Bazoon	Simulation of Fracture, Fragmentation, and Debris Field Formation in Glass Lites Under Blast Loading using the Applied Element Method **Jonathan Moss***, Adam Howe, Matthew Whelan, David Weggel		
Room: 518B	**MS 401**	**Computational Fracture Mechanics** **Chair(s): Christian Linder**		
High-Fidelity Simulation of Brittle Fracture Problems with Universal Meshes **Adrian Lew***	The Successive Node Snapping Scheme: A Method to Obtain Conforming Meshes for Propagating Cracks and Line Defects **Yongxing Shen***, Yang Wan, Tianju Xue	Mapped Finite Element Methods: Higher-Order Solutions of Problems with Singularities **Maurizio M. Chiaramonte***	A Discontinuous Galerkin / Cohesive Zone Model Approach to Simulating Dynamic Fracture in Very Large Shell Structures **Brandon Talamini***, Raul Radovitzky	The Discontinuity-Enriched Finite Element Method (DE-FEM) **Alejandro M. Aragón***, Angelo Simone
Room: 521BC	**MS 404**	**Multiscale and Computational Methods in Failure Mechanics** **Chair(s): Haim Waisman**		
Multiscale Fracture Analysis of Materials with Periodic Microstructure **Michael Ryvkin***	Multiscale Modeling Technique for Non-Linear Composite Materials **Michael Macri***, Andrew Littlefield	Representative Elementary Volume Modeling of Geopolymer Composites **Amrita Kataruka***, Erman Guleryuz, Seid Koric, Waltraud Kriven, Ange-Therese Akono		

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 520D	**MS 501**	**Computational Fluid-Structure Interaction: Methods and Applications** **Chair(s): TBD**		
Fluid-Structure Interaction of Dacron Aortic Prostheses Conveying Pulsatile Flow **Eleonora Tubaldi***, Marco Amabili, Michael P. Padoussis	Immersed Boundary Method with Spring Network Model for Predicting Vesicle Dynamics in Fluid Flow **Junhong Jo***, Do Wan Kim, Tae-Rin Lee	Fluctuating Hydrodynamic Approaches for Fluid-Structure Interactions Subject to Thermal Fluctuations: Applications in Soft Materials and Fluidics **Ben Gross***, Paul Atzberger	Fluid-Structure Interaction Model of Human Phonation **Pooya Tavakoli-Saberi***, Luc Mongeau	
Room: 520F	**MS 506**	**Free and Moving Boundary Problems: Methods and Applications** **Chair(s): TBD**		
High-Order Diffuse Domain Methods for Partial Differential Equations with Dirichlet Boundary Conditions in Complex Geometries **Fei Yu***, John Lowengrub	A Robust Lagrange-Projection Splitting Scheme for Compressible Multiphase Flows with Viscous and Heat Conduction Effects: Application to the Melting Process **Simon Peluchon***, Gérard Gallice, Luc Mieussens	Improvement of Near Wall Velocity Prediction using Mask in a Penalised Vortex-In-Cell Algorithm **François Morency***, Héloïse Beaugendre	Efficient Moving Mesh Methods for Fourth-Order Partial Differential Equations: Modeling Electrostatic Deflections. **Kelsey DiPietro***, Alan Lindsay	
Room: 524C	**MS 602**	**Advances in Topology Optimization for Manufacturing** **Chair(s): Julian Norato**		
A Topology Optimization Scheme to Distribute Lattice Infill in Additive Manufacturing **Alejandro R. Diaz***, Francesco Campagna	A PDE-Based Overhang Constraint in Topology Optimization for Additive Manufacturing **Emiel van de Ven***, Matthijs Langelaar, Can Ayas, Robert Maas, Fred van Keulen	Computational Design and Additive Manufacturing of Periodic Conformal Metasurfaces by Synthesizing Topology Optimization with Conformal Mapping **Shikui Chen***, Panagiotis Vogiatzis, Ming Ma, Xianfeng David Gu	Three-Dimensional Overhang-Constrained Topology Optimization for Additive Manufacturing **Terrence Johnson***, Andrew Gaynor	A Novel Macro/Micro-Structure Optimization Design Method for Additive Manufactured Structures **Zhao Libin***

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 519B	**MS 605**	**New Trends in Topology Optimization** **Chair(s): Tomas Zegard**		
Keynote Presentation: **Zhan Kang***, Pai Liu	Integrated Topology Optimization of Multi-Component Structures Considering Interface Behaviors	Development of Multi-Scale MPF Topology Optimization to Maximize a Heat Conductivity Assuming a Metallic Crystalline Structure **Junji Kato***, Toshiki Ichibangase, Shun Ogawa, Tomohiro Takaki, Takashi Kyoya	Topology Optimization of an Axisymmetric Adsorbed Natural Gas Vessel with Phase Change Materials **Diego Silva Prado***, Ricardo Cesare Romam Amigo, Emilio Nelli Silva	Lattice Topology Optimization with Design-Dependent Feature Evolution for Heat Conduction Problem **Lin Cheng***, Albert Chi Fu To
Room: 518A	**MS 707**	**Modeling and Simulation in Additive Manufacturing** **Chair(s): Albert To**		
Simulation of Additive Manufacturing and Techniques to Reduce the Computational Time **Andreas Lundbäck***, Andreas Malmelöv, Johan Lindwall, Lars-Erik Lindgren	Phase-Field Modeling of Selective Laser Melting at the Powder Level **Jiqin Li***, Tai-Hsi Fan	Fully Resolved Numerical Simulations of Fused Deposition Modeling **Huanxiong Xia***, Jiacai Lu, Sadegh Dabiri, Gretar Tryggvason	Limited-Memory Finite Element Simulation of Fused Deposition Modeling Process **Aaditya Chandrasekhar***, Buzz Rankouhi, Krishnan Suresh	
Room: 525A	**MS 710**	**Modeling of Soft Materials** **Chair(s): Stephan Rudykh**		
Molecular Modeling of Cross-Linked Phthalonitrile (PN) Polymers: A Study of the Mechanical and Electromagnetic Properties of Cross-Linked PN **Janel Chua***, Qingsong Tu				

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 516D	**MS 802**	**Advances in Atomistic-to-Continuum Coupling Techniques** **Chair(s): Dennis Kochmann**		
Keynote Presentation: **Mauricio Ponga***	Coarse-Grained Accelerated Molecular Dynamics	An Accelerated Diffusive Molecular Dynamics Method for the Simulation of Nonlinear Mass Transport in Nanomaterials **Kevin Wang***, Xingsheng Sun, Pilar Ariza, Michael Ortiz	Free Energy Calculation and Ghost Force Correction for Hot-QC **Woo Kyun Kim***, Ellad Tadmor	
Room: 515B	**MS 807**	**Coupled Multiphysics Problems: Discretization Approaches and Solution Methods** **Chair(s): Guglielmo Scovazzi**		
A Novel Hybrid Additive/Multiplicative Schwarz Preconditioner for Monolithic Solvers of Surface-Coupled Multiphysics Problems **Michael Gee***, Maximilian Noll, Matthias Mayr	Radiation Hydrodynamics with High-Order Finite Elements in the BLAST Code **Vladimir Tomov***, Robert Anderson, Thomas Brunner, Veselin Dobrev, Tzanio Kolev, Robert Rieben	Geometric and Black Box Multigrid on Hybrid Architectures **Luc Berger-Vergiat*,** Raymond Tuminaro	A Parallel Fictitious Domain Method for Fluid-Structure Interaction Based on Pseudo - L^2 - Projections **Rolf Krause***, Maria Nestola, Patrick Zulian	A Novel Solver for Multi-Component/Phase Compressible Flows with Advanced Discretized Schemes on Unstructured Grids **Xi Deng***, Bin Xie, Honghui Teng, Feng Xiao
Room: 515C	**MS 808**	**Modeling at the Intersection of First Principles Methods, Mechanics and Mathematics** **Chair(s): Bill Curtin**		
Keynote Presentation: **John Pask***	Finite Element Methods for Accurate, Large-Scale Quantum Mechanical Materials Calculations: From Classical to Enriched to Discontinuous	Large-Scale All-Electron Density Functional Theory Calculations using an Enriched Finite Element Basis **Bikash Kanungo***, Vikram Gavini	Advanced Finite Element Techniques Applied to Kohn-Sham Density-Functional-Theory: h-adaptive Matrix-Free Finite Element Energy Minimization and h-adaptive Partition-of-Unity Approach **Denis Davydov***, Paul Steinmann	DGDFT for Electronic Structure Calculation **Chao Yang***, Amartya Banerjee, Wei Hu, Lin Lin, John Pask

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 516E	**MS 813**	**Multiscale Computational Homogenization for Bridging Scales in the Mechanics and Physics of Complex Materials** **Chair(s): Luigi Gambarotta**		
Modeling the Nucleation and Growth of Polymer Spherulites **Fabrice Detrez***, Luc Chevalier	Fracture of Nano-Particle Reinforced Polymers: Bridging the Scales from Micro to Macro **Ajay Bangalore Harish***, Peter Wriggers	Lineal-Path Function for Describing Pore Microstructures of Cement Paste and Relations to Mechanical Properties **Tong-Seok Han***, Ji-Su Kim	Sensitivity of Mechanical Properties to the Microstructure of Cement Paste using FOSM Method **Jisu Kim***, Tongseok Han	
Room: 524A	**MS 911**	**Isogeometric Methods for Complex Geometries and Multi-Physics Systems** **Chair(s): Hugo Casquero**		
A Critical Comparison of Coupling Schemes for Non-Matching Isogeometric/Finite Element Discretizations **John Evans***, Eric Peters	Strong C1 Coupling of Multi-Patch 3D PHT-Splines **Chiu Ling Chan***, Cosmin Anitescu, Timon Rabczuk	Time-Domain Multi-Patch Discontinuous Galerkin Methods **Jesse Chan***, John Evans	B++ Spline-Based Extended Isogeometric Analysis for Strong and Weak Discontinuities **Xuefeng Zhu***, Kai Jiang, Ping Hu	
Room: 519A	**MS 912**	**Meshfree and Particle Methods: New Developments and Applications** **Chair(s): C.T. Wu**		
Keynote Presentation: **C.T. Wu***	A Robust Particle Galerkin Method for High-Speed Metal Grinding Simulation	A Conforming Kernel for an Agile Design-to-Simulation Process **Jacob Koester***, J.S. Chen	Numerical Modeling of Suspension Plasma Spray **Ghobad Amini***	Size-Dependent Deformation Behavior of Fluid-Filled Carbon Nanotubes under Electric Field **Hongfei Ye***, Lili Zhou, Junfei Zhao, Yonggang Zheng, Hongwu Zhang, Zhen Chen

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 522A	**MS 913**	**Non-standard Formulations and Discretization Methods for Thin-walled Structures** **Chair(s): Bastian Oesterle**		
Hierarchic Isogeometric Large Rotation Shell Elements Including Linearized Transverse Shear Parametrization **Ekkehard Ramm***, Bastian Oesterle, Renate Sachse, Manfred Bischoff	Applying Isogeometric Blended Shells to U-Spline Surfaces **Zhihui Zou***, Michael Scott, Derek Thomas, Bastian Oesterle, Manfred Bischoff, Thomas J.R. Hughes	Kirchhoff-Love Shell Finite Elements Based on Shallow Shell Theory **Antti H. Niemi***, Tom Gustafsson	Shell Element to Represent Thickness-Stretch for Elastoplastic Problems **Takeki Yamamoto***, Takahiro Yamada, Kazumi Matsui	Rotation-Free Triangle and Its Application in Dynamic Drape Simulation **Yexin Zhou***, Kam Yim Sze
Room: 523A	**MS 914**	**Peridynamics and Its Applications** **Chair(s): Erdogan Madenci**		
Analytical and Computational Investigation of Properties of a Linealy Elastic Peridynamic Material **Adair Aguiar***, Alan Seitenfuss	Peridynamic Modelling of Pit-To-Crack Transition **Erkan Oterkus***, Dennj De Meo, Luigi Russo	Efficient Interlayer Modeling and Dynamic Fracture Analysis for Multilayered Structures with Peridynamics **Tae Sik Ahn***, Youn Doh Ha	GraFEA: A Graph-Based FEA to Study Damage in Brittle Materials **Srinivasa Arun***, Parisa Khodabakshi, Junuthula Reddy	
Room: 523B	**MS 916**	**Saddle Point and Mixed Discretization of Variational Problems** **Chair(s): Hengguang Li**		
Keynote Presentation: **Daniele Boffi***	A Posteriori Finite Element Methods for Mixed Eigenvalue Problems	A Mixed FEM for the Quad-Curl Eigenvalue Problem **Jiguang Sun***	The Macroelement Analysis for Axisymmetric Stokes Equations **Young Ju Lee***, Hengguang Li	A Saddle Point Least Squares Method for First-Order Systems **Constantin Bacuta***, Klajdi Qirko

TS5: TUESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 514A	**MS 1101**	**Advances in Adaptive Approaches for Large-scale Deterministic and Stochastic Problems** **Chair(s): Onkar Sahni**		
Adaptive Stochastic Approximation for Transport Problems with Random Input Data **Jason Li***, Eric Cyr, Eric Phipps, Assad Oberai, Onkar Sahni	Asynchronous Space and Time Algorithm for Localized Uncertainty Quantification **Waad Subber***, Karel Matous			
Room: 524B	**MS 1105**	**Data Driven Paradigms and Uncertainty Quantification in Computational Mechanics** **Chair(s): Jim Stewart**		
Keynote Presentation: **J. Tinsley Oden***, Ernesto Lima, Thomas Horger, Barbara Wohlmuth, Amir Shahmoradi, David Hormuth, Thomas Yankeelov	Selection, Calibration, and Validation of Predictive Multiscale Models of Tumor Growth	A Statistical Surrogate Based Bayesian Approach to Uncertainty Quantification in Brain Injury Criteria **Sandeep Madireddy***, Kumar Vemaganti	Sequential Estimation of Tissue Properties and Boundary Condition Parameters for Large Artery Hemodynamics **C. Alberto Figueroa***	A Bayesian Framework for the Estimation of Regional Methane Fluxes **Cosmin Safta***, Ray Bambha, Hope Michelsen
Room: 525B	**MS 1107**	**Stochastic Methods in Computational Mechanics of Random Materials** **Chair(s): Johann Guilleminot and Kirubel Teferra**		
Developing Mesoscale Probabilistic Characterizations of the Elastic and Inelastic Properties of Random Composites using Statistical Volume Elements **Katherine Acton***, Sarah Baxter, Bahador Bahmani, Reza Abedi	Estimating the Convergence of Apparent Properties and Maximum Response in Computational Homogenization **Kirubel Teferra***, Lori Graham-Brady	Approximating the Fluctuations in Random Heterogeneous Problems **Pierre-Loïk Rothé***, Frédéric Legoll	Quantification and Modelling Geometrical Variability in Composite Fiber Reinforcement Data **Dirk Vandepitte***, Andy Vanaerschot, Ilya Straumit, Stepan V. Lomov	Stochastic Upscaling of Elastic and Damage Behavior of Concrete at Mesoscale **Vasav Dubey*,** Arash Noshadravan

Wednesday Plenary Speaker

9:00-9:45 am

Mark Ainsworth

Brown University

Multi-Grid at Scale?

Room: 517BC

Abstract: Multigrid and multilevel iterative algorithms are often the method of choice for the solution of large-scale systems of linear equations arising from discretisation of partial differential equations using finite element or finite difference methods. The multigrid method is non-trivial in that it involves a number of components including smoothing relaxation, coarse grid solve, prolongation and restriction operators between grids in the multilevel hierarchy, and the convergence behaviour of the method has been extensively analysed in the context of standard computer architectures. However, comparatively little is known about the resilience or fault-tolerance of the algorithm on next generation hardware architectures which are expected to suffer from frequent data corruption and hardware failures. In this talk, we will present a mathematical model for the occurrence of failures and analyse the resiliency, or otherwise, of the standard multigrid method under the model. Numerical examples are presented to illustrate the theoretical developments. This is joint work with Christian Glusa (Brown University).

Bio: Professor Ainsworth obtained his PhD from the University of Durham, United Kingdom in 1989. He is currently Professor of Applied Mathematics at Brown University, and also holds a Joint Faculty Appointment with the Mathematics and Computer Science Group at Oak Ridge National Laboratory, Tennessee. Ainsworth's original research interests are in the numerical approximation of partial differential equations. He is, together with J.T. Oden, the co-author of a monograph on *A Posteriori Error Estimation in Finite Element Analysis.*

Ainsworth has worked in a range of areas relating to the numerical solution of partial differential equations including a posteriori error estimation and adaptive solution of PDEs using high order finite element methods, multigrid and domain decomposition methods for the solution of large scale linear algebra problems, the analysis of dispersive and dissipative behaviour of numerical methods for wave propagation, hierarchical and multiscale modelling. Ainsworth is currently researching in several new areas:

- resiliency of state of the art numerical algorithms such as the multigrid method on emerging architectures such Exascale machines;
- numerical analysis and modelling using fractional partial differential equations;
- compression of scientific data arising from very large scale simulations on leadership computing facilities;
- the use of techniques from Computer Aided Geometric Design and in particular, Bernstein-Bézier polynomials for the analysis and efficient implementation of high order finite element methods.

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 516A	**MS 001**	**Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard** **Chair(s): Daniel Ibanez**		
Keynote Presentation: **William Schroeder***	Addressing Customer Needs Through Open Processes and Software	Adaptive Simulation of Coastal and Hydraulic Fluid-Structure Interaction in the Proteus Toolkit **Chris Kees***, Matthew Farthing, Manuel Quezada de Luna, Alvin Zhang, Tristan de Lataillade, Aggelos Dimakopoulos, Onkar Sahni	On Acoustic Scattering from Elastic Objects in the Free-Field and near a Fluid-Sediment Interface **Saikat Dey***	A Flexible Conservative Remapping Framework for Exascale Computing **Garimella Rao***, Ondrej Certik, Ferenbaugh Charles, Angela Herring, Chris Malone, Chris Sewell
Room: 515A	**MS 103**	**Computational Biomechanics of Impact and Injury** **Chair(s): Kirubel Teferra**		
Computational Simulations of Tertiary Blast Emphasize the Need for Blunt Impact Protection **Jean-Philippe Dionne***, Aris Makris, Jeffrey Levine	System-Level Validation of the Warrior Injury Assessment Manikin Finite Element Model **Nicholas Vavalle***, Matthew Shanaman, Christian Lomicka, Parth Patel	Combat Helmet Design Incorporating Anthropomorphic Fit, Brain Functional Areas and Injury Considerations **Peter Matic***, Robert Saunders, Xiangguang Gary Tan		
Room: 520A	**MS 206**	**Model Reduction in Computational Fluid Dynamics** **Chair(s): Kevin Carlberg**		
Keynote Presentation: **Charbel Farhat***, Kyle Washabaugh	A Parametric Nonlinear Model Order Reduction Framework for Steady-State Flows Past Parametrically Deformed Complex Geometries	Model Reduction for Transport Problems via Nonlinear State Space Transformation **Stephan Rave***, Christoph Lehrenfeld, Mario Ohlberger	Deforming Grid Method for Dimensionality Reduction of Convection Dominated Nonlinear Flows **Maciej Balajewicz***	A Reduced-Order Strategy for Transient Problems with High Moving Gradients **Sergio Idelsohn***, Alejandro Cosimo, Alberto Cardona

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 520C	**MS 301**	**Advancements in Hydraulic Fracture Simulation** **Chair(s): Erfan Sarvaramini**		
Keynote Presentation: **Egor Dontsov***	Hydraulic Fractures Near Tip Behavior: Effects of Fluid Rheology, Turbulence, Stress Variation, and Proppant	Implicit Level Set Algorithms for Modeling Multiscale and Turbulent Effects in Hydraulic Fracture Propagation **Anthony Peirce***, Egor Dontsov	Development of a Fracture Tip Plastic Zone in Semi-Consolidated Sedimentary Rock Georeservoirs during Hydraulic Fracture Propagation **Robert Caulk***, Ingrid Tomac	Modeling Hydraulic Fracture Height Growth and Proppant Transport in a Formation with Stress Drop **Fengshou Zhang***, Egor Dontsov
Room: 518C	**MS 304**	**Computational Methods and Design for Impact and Blast Problems** **Chair(s): TBD**		
Nonlinear Dynamic Analysis of Shell Structures **Takuya Matsumoto***, Shigenobu Okazawa	Three-Dimensional Numerical Simulation of High Velocity Compaction Based on Discrete Element Method **Jun Liu***, Xiaolong Luo, Yonggang Wang, Liming Yang, Huanran Wang			
Room: 518B	**MS 401**	**Computational Fracture Mechanics** **Chair(s): Adrian Lew**		
Keynote Presentation: **Julien Yvonnet***, Liang Xia, Siavash Ghabezloo	Phase Field Modeling of Hydraulic Fracturing with Interfacial Damage in Highly Heterogeneous Fluid-Saturated Porous Media	An Optimization Based Phase Field Model for Continuous-Discontinuous Fracture **Rudy Geelen***, Yingjie Liu, John Dolbow	Modeling Progressive Damage and Fracture of Polymers **Yunwei Mao***, Brandon Talamini, Lallit Anand	Computational Modeling of the Formation and Mechanical Instability of Solid Electrolyte Interphase on Silicon Electrodes in Lithium-Ion Batteries **Xiaoxuan Zhang***, Christian Linder

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 525A	**MS 402**	**Modeling and Simulation for Complex Material Behavior** **Chair(s): Patrick Diehl**		
Keynote Presentation: **Robert Lipton***	Double Well Potentials and Nonlocal Brittle Fracture Modeling	Numerical Analysis of Nonlocal Fracture Models **Prashant Jha***, Robert Lipton	Numerical Implementation Aspects of a Constitutive Model for Concrete with a Deviatoric Shape of Yielding Surfaces Based on Bézier Curves **Paula Folino***	Relaxing the CFL Condition for the Wave Equation on Adaptive Meshes **Roland Maier***, Daniel Peterseim, Mira Schedensack
Room: 521BC	**MS 404**	**Multiscale and Computational Methods in Failure Mechanics** **Chair(s): Haim Waisman**		
Keynote Presentation: **Guglielmo Scovazzi***, Xianyi Zeng, Nabil Abboud, Oriol Colomés	A Variational Multiscale Method for Dynamic Viscoelastic Solid Mechanics	Multi-Objective Optimization of Multi-Scale Finite-Element Analysis for Wear Resistant Steel **Peerapon Wechsuwanmanee***, Junhe Lian, Sebastian Münstermann	Material Properties and Morphology Parameters Sensitivity Analysis in Energetic Material **Xiaoyu Zhang***, Caglar Oskay	
Room: 520B	**MS 504**	**Flow-Induced Vibrations: Solution Techniques and Models** **Chair(s): Rajeev Kumar Jaiman**		
Model-Order Reduction and Control Strategies for Flow-Induced Vibration **Rajeev Kumar Jaiman***	A Study on Dynamic Reduction Method for Acoustic Modal Analysis **Seongmin Chang***, Kang-Heon Lee, Gyu Mahn Lee, Jong-Wook Kim	A Variationally Bounded Scheme for Allen-Cahn Phase Field Equation for Modeling of Two-Phase Flows **Vaibhav Joshi***, Rajeev Jaiman	Techniques for Linking One-Way Coupled and Fully Coupled Simulations of Flow-Induced Vibration **Jerome Solberg***, Kei Mueller	A Partitioned Iterative Interface Force-Correction Scheme for Fluid-Flexible Multibody Interaction **Pardha Gurugubelli***, Ritwik Ghoshal, Anurag Yenduri, Rajeev Kumar Jaiman

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 520D	**MS 505**	**Fluid-Structure Interaction Algorithms and Applications** **Chair(s): Jonathan Pitt**		
A Coupled Overset Mesh and Hybridizable Discontinuous Galerkin Algorithm for Dynamic ALE Formulations **Justin Kauffman***, Jonathan Pitt	Numerical Investigation of Iterative Coupling for Structural Acoustics **Scott Miller***, Gregory Bunting	Basic Study on Hydroelastic Slamming Simulations by a Fully-Lagrangian Coupled MPS Method **Takefumi Higaki***, Abbas Khayyer, Masashi Kashiwagi, Jong-Chun Park	Conservation Error Analysis of a Family of Embedded Boundary Methods for Multi-Material Problems with Evolving Domains and Discontinuities **Zhengyu Huang***, Charbel Farhat	Multiple Program Multiple Data FSI Coupling of Structural Dynamics (Sierra/SD) and UNDEX (NEMO) **Gregory Bunting***, Scott Miller, Jonathan Stergiou
Room: 520F	**MS 506**	**Free and Moving Boundary Problems: Methods and Applications** **Chair(s): TBD**		
Keynote Presentation: **Shahriar Afkhami***	From Mesoscopic to Macroscopic Computations of Dynamic Contact Lines	Experimental Measurement of Contact-Line Mobility using Drop Resonance **Yi Xia***, Paul Steen	A Moving Contact Line Model for Immiscible Multiphase Flow Problems using the Conformal Decomposition Finite Element Method **Alec Kucala***, David Noble, Mario Martinez	Role of Viscosity Stratification in Tear Film Rupture **Mohar Dey***, Atul Vivek, Harish Dixit, Ashutosh Richariya, James Feng
Room: 520E	**MS 507**	**Phase-field Modeling and Simulation in Fluids, Solids and Biomechanics** **Chair(s): Krishna Garikipati**		
Keynote Presentation: **Chao-An Lin***, Tzu-Chun Huang, Chien-Yi Chang	Simulations of Droplet Collision with Cahn-Hilliard Equation on Multi-GPU Cluster	Thermodynamic Consistency and Stable Schemes for Quasi-Incompressible Navier-Stokes-Cahn-Hilliard Models **Kris van der Zee***, Gorkem Simsek, Mahnaz Shokrpour Roudbari, E. Harald van Brummelen	Phase-Field Modeling of Surfactant-Driven Fracture in Particulate Rafts **Christian Peco***, Yingjie Liu, Carter Rhea, John Dolbow, Wei Chen, Mahesh Bandi, Eliot Fried	Phase-Field Free Energy and Boundary Force for Molecular Solvation **Shibin Dai***, Bo Li, Jianfeng Lu

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 524C	**MS 602**	**Advances in Topology Optimization for Manufacturing** **Chair(s): Xu Guo**		
Projection-Based Topology Optimization: Recent Advancements and Connections to Manufacturing **Saranthip Koh*,** Mikhail Osanov, Josephine Carstensen, James Guest	Self-Supporting Structure Design in Additive Manufacturing through Moving Morphable Component/Void (MMC/MMV) Based Explicit Topology Optimization **Xu Guo***, Weisheng Zhang	Topology Optimization of Curved-Plate Structures with Placement Bounds **Julian Norato***, Shanglong Zhang	Explicit Three-Dimensional Topology Optimization via Moving Morphable Component/Void (MMC/MMV) Approach **Weisheng Zhang***, Jishun Chen, Xu Guo	Topology Optimization under Uncertainty via Non-Intrusive Polynomial Chaos Expansion **Vahid Keshavarzzadeh***, Daniel Tortorelli
Room: 519B	**MS 605**	**New Trends in Topology Optimization** **Chair(s): Emilio C.N. Silva**		
Keynote Presentation: **Kai James***, Ziliang Kang	Multimaterial Topology Design for Optimal Stiffness and Thermal Conductivity Response	Multi-Material Continuum Topology Optimization: An Elegant Formulation and Update Scheme **Glaucio Paulino***, Emily Daniels, Miguel Aguilo	Topology-Optimized Design of Architected Materials with Multiple Materials **Josephine Carstensen***, James Guest	Simultaneous Optimization of Topology and Pointwise Constitutive Properties through Multi-Variable SIMP **Tej Kumar***, Krishnan Suresh
Room: 518A	**MS 707**	**Modeling and Simulation in Additive Manufacturing** **Chair(s): Jikai Liu**		
Keynote Presentation: **Wing Kam Liu***	Multi-Physics Modeling of Multiple-Track Defect Mechanisms in EBSM	Fatigue Life Prediction for Critical Microstructures in AM Metals **Orion Kafka***, Cheng Yu, Wing Kam Liu	Data-Driven Process-to-Structure Heuristics for Additively Manufactured Materials **Puikei Cheng***, Wing Kam Liu	

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 516D	**MS 802**	**Advances in Atomistic-to-Continuum Coupling Techniques** **Chair(s): Ron Miller**		
Keynote Presentation: **Vincent Tan***, A.V. Rammohan	An Absorbing Boundary Condition to Minimize Wave Reflection in Atomistic Simulations	Dynamic Multiscale Method and Applications **Chuin-Shan David Chen***	Atomic-Microscale Modeling of Phonons in the Molecular Crystal RDX **Peter Chung***, Francis VanGessel	Modelling of Nanoscale Phononic Crystals **Ralf Meyer***
Room: 516E	**MS 803**	**Advances in the Modelling of Multi-Scale, Multi-Physics and Multi-Uncertainty Problems** **Chair(s): Francisco Pires**		
Multi-Scale Modelling of Structure Evolution in Tungsten under Irradiation and Heat Loads **Hans van Dommelen***, Awital Mannheim, Marc Geers	On the Algorithmic Treatment of a Constitutive Model for Mechanically-Induced Martensitic Phase Transformations **Daniel de Bortoli***, Francisco Andrade Pires, Eduardo de Souza Neto	Micro-Mechanical Modeling of the Yield Behavior of Oriented Semi-Crystalline Polyethylene **Mohsen Mirkhalaf***, Hans van Dommelen, Leon Govaert, Marc Geers	Dislocation Dynamics at High Strain-Rate Inertial and Thermal Effects **Eleanor Mak***, Robert Gracie	
Room: 515B	**MS 805**	**Computational Modeling of Multi-Functional Materials** **Chair(s): Jae Hyun Park**		
A Large Deformation Theory Coupling Photo-Chemical Reaction and Electrochemistry for Light-Responsive Polyelectrolyte Gels **Yuhang Hu***	Mimetic Discretization Methods for Solving Electrical Conduction Problems in Laminated Composites with Cracks **Jose Castillo***, Luis Waldo Escalona Galvis, Johnny Corbino, Satchi Venkataraman	A Multiscale Model for the Oxygen Reduction and Oxidation Reactions in LSCF Based Solid Oxide Cell **Linjian Ma***, N.R. Aluru,		

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 515C	**MS 808**	**Modeling at the Intersection of First Principles Methods, Mechanics and Mathematics** **Chair(s): John Pask**		
Dislocation Cores from First Principles: Ni and Ni3Al for Superalloys **Dallas Trinkle***, Anne Marie Tan	Large Scale Electronic Structure Studies on the Energetics of Dislocations in Al-Mg Materials System and its Connection to Mesoscale Models **Sambit Das***, Vikram Gavini	Capturing the Collaborative Strengthening Effects of Work Hardening and Precipitation Hardening with Dislocation Dynamics **Joshua Crone***, Jaroslaw Knap	Small- and Large-Deformation-Based Peierls-Nabarro and Phase-Field Modeling of the Dislocation Core in fcc Systems and Comparison with Atomistics **Jaber Rezaei Mianroodi***, Bob Svendsen	
Room: 522A	**MS 905**	**Cohesive Zone Models - Fundamentals and Multiscale Applications** **Chair(s): Glaucio Paulino and Kyoungsoo Park**		
3D Fracture Simulation of Reinforced Concrete using Damage Model Based on Fracture Mechanics for Concrete **Mao Kurumatani***, Yuto Soma	Removing Mesh Bias in a Cohesive Surface Element Approach for Two- and Three-Dimensional Mixed-Mode Fracture Analysis **Habeun Choi***, Kyoungsoo Park	Direct and Simultaneous Extraction of Vector Traction-Separation Relations for Interfaces **Kenneth Liechti***, Chenglin Wu, Rui Huang	Frictional-Contact Model Coupled with the Traction-Separation Relationship of the Cohesive Zone Model **Kyoungsoo Park***, Hyunil Baek	
Room: 524A	**MS 911**	**Isogeometric Methods for Complex Geometries and Multi-Physics Systems** **Chair(s): Jessica Zhang**		
Isogeometric Structural Shape Optimization using Bézier Triangles **Cosmin Anitescu***, Jorge Lopez, Navid Valizadeh, Timon Rabczuk	Mixed Bernstein-Bézier Discretizations of Trimmed CAD Surfaces for Isogeometric Analysis **Wei Wang***, Xiaoxiao Du, Gang Zhao, Howie Fang	Isogeometric Analysis for Nonlinear Bending of Microplates **Hoang Nguyen***, Thuc Vo	Mesh Dependency Performance of Nonlinear Solid Analysis using Isogeometric Elements **Yuta Yokoyama***, Shigenobu Okazawa	

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 519A	**MS 912**	**Meshfree and Particle Methods: New Developments and Applications** **Chair(s): Bram Metsch**		
Keynote Presentation: **Almut Eisentraeger***, Joerg Kuhnert, Timo Waechtler	MESHFREE: General Finite Differences for Fluid Flow and Continuum Mechanics with Three Industrial Applications	Advances in Algebraic Multigrid (AMG) for the Finite Pointset Method (FPM) **Bram Metsch***, Fabian Nick	Particle-Based Modeling of Clothes Washing and Drying Processes **Masaaki Suzuki***, Hiroshi Okuda	Accuracy in Meshfree GFDM Schemes for the Incompressible Navier-Stokes Equations **Pratik Suchde***, Joerg Kuhnert, Sudarshan Tiwari
Room: 523A	**MS 914**	**Peridynamics and Its Applications** **Chair(s): Erkan Oterkus**		
Using Peridynamics to Model Biological Materials **Emma Lejeune***, Christian Linder	Peridynamics for Solving Nonlinear Partial Differential Equations **Erdogan Madenci***, Mehmet Dorduncu	The Influence of the Ab Initio Conditions in the Numerical Solution of the Peridynamic Equation **David Miranda***	Peridynamics for Damage Prediction in Composite Laminates due to Thermo-Oxidation **Selda Oterkus***, Erdogan Madenci	
Room: 522BC	**MS 915**	**Polygonal and Polyhedral Discretizations in Computational Mechanics** **Chair(s): N. Sukumar**		
Keynote Presentation: **Gianmarco Manzini***, Konstantin Lipnikov, David J. Moulton, Mikhail Shashkov	The Mimetic Finite Difference Method for Elliptic Problems with Staggered Discretizations of Diffusion Coefficients	A Generalized Mimetic Finite Difference Method and Two-Point Flux Schemes over Voronoi Diagrams **Ivan Yotov***, Omar Al-Hinai, Mary Wheeler	Divergence Free Virtual Elements **Giuseppe Vacca***, Loureno Beiro da Veiga, Carlo Lovadina	On the Mixed Virtual Element Method (VEM) for Finite Deformations **Heng Chi***, Lourenco Beirao da Veiga, Glaucio Paulino

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 523B	**MS 916**	**Saddle Point and Mixed Discretization of Variational Problems** **Chair(s): Constantin Bacuta**		
A Mixed Finite Element Method for the Muscle-Tendon-Aponeurosis Complex **Sebastian Dominguez***, Nilima Nigam	Stability Conditions for Variational Formulations Based on Multi-Field Saddle Point Problems **Andreas Krischok***, Christian Linder			
Room: 514A	**MS 1101**	**Advances in Adaptive Approaches for Large-scale Deterministic and Stochastic Problems** **Chair(s): Jim Stewart**		
Adaptive Multiscale Modeling using Generalized Mortar Methods **Tim Wildey***, Bart Van Bloemen Waanders, Tom Seidl	VMS A Posteriori Error Estimation for Stokes Flow **Guillermo Hauke***, Diego Irisarri	Adaptivity for Active Flow Control on a Vertical Tail Rudder Assembly **Kenneth Jansen***, Michel Rasquin, Cameron Smith, Riccardo Balin, Benjamin Matthews	Parallel Goal-Oriented Adaptive Inelasticity **Brian Granzow***, Assad Oberai, Mark Shephard	Different Flavors of Adaptive Mesh Refinement Use in FLASH **Anshu Dubey***
Room: 524B	**MS 1105**	**Data Driven Paradigms and Uncertainty Quantification in Computational Mechanics** **Chair(s): Alberto Figueroa**		
Keynote Presentation: **Dongbin Xiu***	Approximation Algorithms for Big Data	A Paradigm for Predictive Modeling of Computational Mechanics using Field Inversion and Machine Learning **Karthik Duraisamy***	Manifold Sampling for Data-Driven UQ and Optimization **Christian Soize***, Roger Ghanem	

TS7: WEDNESDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 514B	**MS 1109**	**Uncertainty Quantification and Stochastic Modeling in Biological Systems** **Chair(s): Daniele Schiavazzi**		
Efficient Parameter Estimation via Multi-Fidelity Bayesian Optimization	A Bayesian Approach to Model Calibration, Selection and Surrogate Modeling: Application to Traumatic Brain Injury	Towards a Multi-Fidelity Hemodynamic Model Pipeline for the Analysis of Cardiovascular Flow Under Uncertainty	Uncertainty Quantification in Multi-Scale Simulations of Coronary Artery Bypass Grafts using Multi-Resolution Expansion	Probabilistic Outcomes Prediction in the ICU: Adding Uncertainty to APACHE
Paris Perdikaris*, George Em Karniadakis	**Kumar Vemaganti***, Sandeep Madireddy, Emily Kang	**Casey Fleeter***, Daniele Schiavazzi, Alison Marsden	**Justin Tran***, Daniele Schiavazzi, Abhay Ramachandra, Andrew Kahn, Alison Marsden	**Corey Bryant***

Wednesday Semi-Plenary Speakers

1:30-2:15 pm

Margot Gerritsen

Stanford University

Outstanding Problems in Subsurface Flow

Room: 516BC

Abstract: The subsurface provides a mecca for the computational scientist and engineer. In this talk, we will discuss outstanding (unresolved and quite wonderful) problems in simulation of flow and transport, as well as data analysis. Flow and transport of subsurface fluids are governed by nonlinear processes across a wide range of temporal and spatial scales, under strong uncertainty. We will focus on a particularly interesting case that involves combustion. In this thermal process, sensitivities to numerical and modeling errors are very high and the community still puzzles over the most effective simulation approaches. We will dive a bit deeper into the question of how to upscale kinetics from the observable laboratory scale to the reservoir scale. As in many other fields, data mining and machine learning techniques are increasingly applied to gain additional insights and/or develop faster simulation tools. In the second part of the talk, we will look at examples and discuss areas in which the marriage of subsurface flow and data science may be particularly attractive.

Bio: After receiving her MS degree in Applied Mathematics at the University of Delft, Margot moved to the U.S. in search of hillier and sunnier places. In 1996, she received her Ph.D. in Scientific Computing and Computational Mathematics from Stanford University. Before returning to Stanford in 2001, Margot spent five years in Auckland, New Zealand, as a faculty member in the Department of Engineering Science. Margot is a professor in the Department of Energy Resources Engineering at Stanford, interested in computer simulation and mathematical analysis of engineering processes. Since 2010, she directs the Institute for Computational and Mathematical Engineering and is currently a Senior Associate Dean in Stanford's School of Earth, Energy, and Environmental Sciences. She specializes in renewable and fossil energy production, and is also active in coastal ocean dynamics and yacht design.

Eldad Haber

University of British Columbia

Deep Learning Meets Differential Equations and Optimal Control

Room: 517D

Abstract: In this talk we will review the latest developments in deep learning. We will show that the problem of deep learning can be viewed as an optimal path planning subject to dynamic PDE constraints. We will discuss numerical methods for the solution as well as suggest new algorithms for the solution of the problem.

Bio: Dr. Haber is a scientific an NSERC Industrial Research Chair at the University of British Columbia. Eldad is working in the field of computational inverse problems with applications to geosciences and medical imaging. Over the last 20 years, Eldad has written various commercial software packages that have been widely adopted by industry. Dr. Haber has written or co-authored over 150 peer reviewed publications on computational problems and is a U.S. Department of Energy Career Award recipient. After completing his Ph.D, he spent several years as a research scientist with Schlumberger and nine years at Emory University in Atlanta at the Department of Mathematics and Computer Science. In 2011, Eldad co-founded Computational Geosciences Inc.

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 514C	**MS 105**	**Direct and Inverse Methods for Cardiovascular and Pulmonary Mechanics** **Chair(s): Alberto Figueroa**		
A Formulation for Cardiopulmonary Circulation Hemodynamics: Bridging Analytical Morphometry-Based Arterial Tree Models and Image-Based 3D Models using Impedance Boundary Conditions **Vasilina Filonova***, C. Alberto Figueroa	Parameter Estimation and Design of Experiments for Soft Tissues **Ankush Aggarwal***	Numerical Simulations of In-Stent Restenosis **Jie Cheng***, Lucy Zhang	Advanced Higher Order Methods and Modified Inverse Analysis for Improved Photoacoustic Biomedical Image Reconstruction **Wolfgang A. Wall***, Svenja Schoeder, Martin Kronbichler	
Room: 515A	**MS 107**	**Mechanobiology of Cells, Vesicles and Biomembranes** **Chair(s): Marino Arroyo**		
Diffusion of Band-3 Protein and Vesiculation in the Healthy and Defective Red Blood Cell Membrane **George Lykotrafitis***, He Li, Yihao Zhang, Vi Ha	Soft Matter Modeling and Simulation of Mechanotransduction of Cells **Shaofan Li***	A Theoretical and Computational Framework for the 3D Fully Non-Linear Dynamics of Lipid Bilayers **Alejandro Torres-Sánchez***, Marino Arroyo, Daniel Millán	Divergence-Conforming and Fully-Implicit Simulation of Cell-Scale Blood Flow **Hugo Casquero***, Carles Bona-Casas, Hector Gomez, Yongjie Zhang	Theoretical and Computational Modeling of Lipid Membranes: Effects of Elastic Bending and In-Plane Viscous Flow **Amaresh Sahu***, Yannick Omar, Roger Sauer, Kranthi Mandadapu
Room: 520B	**MS 204**	**Computational Methods in Environmental Fluid Mechanics** **Chair(s): Ethan Kubatko**		
Keynote Presentation: **Kazuo Kashiyama***, Guoming Ling, Junichi Matsumoto	2D and 3D Finite Element Analysis for Tsunami Waves	A Local Discontinuous Galerkin Finite-Element Method for the Richard's Equation **Yilong Xiao***, Ethan Kubatko	Time and Space Adaptivity in Turbidity Current Simulation **Andre Rossa***, Alvaro Coutinho, Jose Camata	

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 520A	**MS 206**	**Model Reduction in Computational Fluid Dynamics** **Chair(s): Charbel Farhat**		
A Spatial Clustering Algorithm for Constructing Local Reduced-Order Bases for Nonlinear Model Reduction **Tina White***, Phil Avery, Charbel Farhat	Space-Time Least Squares Petrov-Galerkin Projection in Nonlinear Model Reduction **Youngsoo Choi***, Kevin Carlberg	An Adaptive Discontinuous Galerkin Reduced-Basis Element Method for CFD **Masayuki Yano***	Projection-Based Model-Order Reduction for Nonlinear Contact Problems **Todd Chapman***, Charbel Farhat	Model-Order Reduction of Dynamic Skeletal Muscle Models **Mylena Mordhorst***, Oliver Röhrle
Room: 520C	**MS 301**	**Advancements in Hydraulic Fracture Simulation** **Chair(s): Egor Dontsov**		
Keynote Presentation: **Denis Esipov***, Dmitriy Kuranakov, Vasily Lapin, Sergey Cherny	Numerical Model of Fracture Initiation from Perforated Wellbore	Fully Three-Dimensional Model of Hydraulic Fracture Propagation **Vasily Lapin***, Sergey Cherny, Denis Esipov, Dmitriy Kuranakov	Modelling of Mechanical Processes Related to Hydraulic Fracturing **Sergey Golovin***, Alexey Baykin, Alexander Valov	Non-Symmetrical Hydraulic Fracture Propagation due to Poroelastic Effects **Alexey Baykin***, Sergey Golovin
Room: 518B	**MS 401**	**Computational Fracture Mechanics** **Chair(s): Christian Linder**		
Keynote Presentation: **Florin Bobaru***, Zhanping Xu, Guanfeng Zhang	Thermally-Driven Oscillatory Cracks and Branching Cracks in Glass: A Peridynamic Analysis	A Concurrent Coupling of Peridynamics and Classical Continuum Mechanics **Alireza Tabarraei***, Xiaonan Wang	A Floating Node Method for the Crack Growth Analysis of Brittle Materials **Sachin Kumar***, L.H. Poh, B.Y. Chen	

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 525A	**MS 402**	**Modeling and Simulation for Complex Material Behavior** **Chair(s): Patrick Diehl**		
An Iterative Method for Multiscale Composite Structures **Michael Stuebner***, Robert Lipton, Paul Sinz	Method of Manufactured Solution for Large Deformation Finite Element Analysis of Hyperelasticity **Takahiro Yamada***			
Room: 521BC	**MS 404**	**Multiscale and Computational Methods in Failure Mechanics** **Chair(s): Caglar Oskay**		
Detailed Finite Element Analysis of E-Defense Shake Table Test of 10-Story Reinforced Concrete Building **Takuzo Yamashita***, Tomoshi Miyamura, Makoto Ohsaki	Validation of Numerical Simulation Results of E-Defense Large Scale Experiment on Soil-Underground Structure Interaction **Mahendra Kumar Pal***, Takuzo Yamashita, Shintaro Ohno, Atsushi Iizuka	Scale Analysis of Damage Evolution in Incipient Spall under Plate Impact **Xiaoyang Pei***, Shi Chen, Hui Peng		
Room: 520D	**MS 505**	**Fluid-Structure Interaction Algorithms and Applications** **Chair(s): Scott Miller**		
A Stable Partitioned FSI Algorithm for Rigid Bodies and Incompressible Flow **J.W. Banks***, W.D. Hensahw, D.W. Schwendeman, Q. Tang	Aeroacoustic Simulation of Nearly Incompressible Flow Coupled with Deformable Solid **Feimi Yu***, Lucy Zhang	Benchmark Results of a Mesh Moving Technique with Minimum-Height-Based Stiffening **Tomonori Yamada***, Giwon Hong, Naoto Mitsume, Shinobu Yoshimura	Development and Validation of FSI Analysis System Considering Active Control **Shigeki Kaneko***, Giwon Hong, Naoto Mitsume, Tomonori Yamada, Shinobu Yoshimura	Open Source, Tightly Coupled, Partitioned Fluid-Structure Interaction Simulation Capability for High Spatiotemporal Resolution during Study of Wave Impact Loads in High-Speed Watercraft **Wensi Wu***, Justyna Kosianka, Christopher Earls

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 520F	**MS 506**	**Free and Moving Boundary Problems: Methods and Applications** **Chair(s): TBD**		
hp-Finite Element Modeling of Silicon Solidification **Brian Helenbrook***	Modeling of Solidification and Thawing Problems with Free Surfaces in Rigid Containers **Bruno Blais***, Florin Ilinca	Computational Models for Molten Corium Flow and Reaction with Concrete **Rekha Rao***, Alec Kucala, Jeremy Templeton, David Noble, Yifeng Wang, Denise Bencoe, David Louie	A Thermodynamically Consistent Level Set Approach for Shock-Induced Alpha-Gamma Phase Transition of RDX **Kartik Josyula***, Rahul, Suvranu De	A Revised Tangle-Free Algorithm for Two-Dimensional Mesh Motion Problems **Justin Droba***, Adam Amar
Room: 520E	**MS 507**	**Phase-field Modeling and Simulation in Fluids, Solids and Biomechanics** **Chair(s): Kristoffer Van Der Zee**		
On Bounds for the Penalty Constant in Irreversibility Constraint for a Phase-Field Formulation of Brittle Fracture **Laura De Lorenzis***, Tymofiy Gerasimov	Modeling Grain Boundary Anisotropy-Driven Microstructural Evolution with Arbitrary Grain Orientation and Plastic Deformation Boundary Driven **Josep Maria Ribot***, Brandon Runnels	Hydraulic Fracturing in Porous Media using a Phase Field Approach **Sanghyun Lee***, Baehyun Min, Sogo Shiozawa, Mary Wheeler	Effective Properties of Cracked Multi-Domain Ferroelastic Materials under Simultaneous Straining and Thermal Cycling **Yun-Che Wang***, Meng-Wei Shen	
Room: 518C	**MS 508**	**Stabilized and Multiscale Methods for Interface Mechanics** **Chair(s): John Dolbow and Isaac Harari**		
Variational Interfacial Coupling in Thermo-Mechanical Field Problems at Finite Strains **Arif Masud***, Pinlei Chen	A Stabilized, Symmetric Nitsche Method for Spatially Localized Plasticity **Timothy Truster***	A Rate-Dependent Interfacial Damage Model for Multiscale Dynamic Fracture **Robert Haber***, Reza Abedi	Spectral Hybrid Localized Orthogonal Decomposition Method **Alexandre Madureira***, Marcus Sarkis	The Shifted Boundary Method: A New Approach to Embedded Boundary Computations **Kangan Li***, Guglielmo Scovazzi, Alex Main, Nabil Atallah, Ting Song

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 524C	**MS 602**	**Advances in Topology Optimization for Manufacturing** **Chair(s): Julian Norato**		
Optimal Design of Fiber-Reinforced Composite Structures that are Fabricated via Additive Manufacturing **Felipe Fernandez***, James Lewicki, Daniel Tortorelli	Optimization of Origami Crease Topology through Cellular Division **Kazuko Fuchi***, Marcelo Kobayashi, Andrew Gillman, Edward Alyanak, Philip Buskohl	Multi-Component Topology Optimization: Historical Developments and Continuous Relaxation **Kazuhiro Saitou***, Yuqing Zhou	Design Optimization of Mechanical Metamaterials for Vibration Control **Timothy Walsh***, Josh Robbins, Chris Hammetter, Wilkins Aquino	Design Optimization Method for Additive Manufacturing Primary Mirror of Large-Aperture Space Telescope **Shuitan Liu*,** Rui Hu
Room: 525B	**MS 603**	**Bayesian Statistical Inversion in Engineering Mechanics** **Chair(s): Abhijit Sarkar**		
Large-Scale Deterministic Inversion and Bayesian Calibration in Land-Ice Modeling **Irina Tezaur***, John Jakeman, Mauro Perego, Stephen Price	A Scalable Sampling-Free Nonlinear State Estimation Algorithm for Large-Scale Models and Data Sets using High Performance Computing **Ajit Desai***, Philippe Bisaillon, Mohammad Khalil, Chris Pettit, Dominique Poirel, Abhijit Sarkar	Determination of Explosive Yields using Nonlinear Bayesian Regression **John Burkhardt***	Predictive Modeling of Wavelet Coefficients for Physical Processes **Mohammad Khalil***, Jina Lee, Maher Salloum	
Room: 519B	**MS 605**	**New Trends in Topology Optimization** **Chair(s): Junji Kato**		
Maximization of Energy Absorption Capacity Applying Elastoplastic Multi-Scale Topology Optimization **Shun Ogawa***, Hiroya Hoshiba, Junji Kato, Takashi Kyoya	Topology Optimization of Elastoplastic Structures under Cyclic Loads **Lei Li***, Guodong Zhang, Kapil Khandewal	Multi-Material Topology Optimization for Energy Absorption Capacity Assuming Finite Elastoplastic Deformation **Hiroya Hoshiba***, Junji Kato, Takashi Kyoya	Topology Optimization of a Crash Box Considering Time-Dependent Crash and Nonlinear Plastic Behaviors using Equivalent Static Loadings **Cheol Kim***, Mohammadmahdi Davoudi	The Quick Continuum Structural Topology Optimization Based on the Changes of Supporting Conditions **Jianjun He***

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 518A	**MS 707**	**Modeling and Simulation in Additive Manufacturing** **Chair(s): Jikai Liu**		
B-Spline Based Topology Optimization for Metal Hybrid Additive-Subtractive Manufacturing **Jikai Liu***, Albert To	Porous Composite with Negative and Positive Thermal Expansion Obtained by Multi-Material Topology Optimization and Additive Manufacturing **Akihiro Takezawa***, Makoto Kobashi	Engineered Architected Materials: Multidirectional Functionally Graded Cellular Solids **Hamid Akbarzadeh***, Hamed Niknam Jahromi, Armin Mirabolghasemi, Denis Rodrigue, Daniel Therriault	Adaptive Optimization of the Topology of Lattices **Antonin Paquette-Rufiange***, Serge Prudhomme, Marc Laforest, Augustin Schmidt	
Room: 516D	**MS 802**	**Advances in Atomistic-to-Continuum Coupling Techniques** **Chair(s): Ellad Tadmor**		
Keynote Presentation: **Lars A.A. Beex***, Pierre Kerfriden	An Equation-Free Multiscale Method: Extension of the Quasicontinuum Method to Irregular Structures	Extended Variational Quasicontinuum Methodology for Modelling of Crack Propagation in Discrete Lattice Systems **Ondrej Rokos***, Ron H.J. Peerlings, Jan Zeman, Lars A.A. Beex	TrussQC: Modeling the Fracture of Coarse-Grained Truss Lattices using the Quasicontinuum Method **Greg Phlipot***, Dennis Kochmann	Network Model of Re-Entrant and Conventional Cellular Materials **Igor Berinskii***
Room: 515B	**MS 805**	**Computational Modeling of Multi-Functional Materials** **Chair(s): Sang-Bok Lee**		
Formulation of Governing Equations in Piezoelectric and Piezomagnetic Materials Directly using the Law of Conservation of Energy **Peng Zhou***	Experimental and Computational Analysis of the Ballistic Properties of SiC Tile Encapsulated Composite Armor System **Iilguk Jo***, Seungchan Cho, Minhyung Lee, Sang-Kwan Lee, Sang-Bok Lee	An Investigation into the Effect of Molybdenum on Interfacial Properties of TiC/Steel Composite through Atomistic Simulation **Seungchan Cho***, Ilguk Jo, Jaekwang Lee, Jae Hyun Park, Sang-Kwan Lee, Sang-Bok Lee	Epsilon-Martensite Start Temperature Modeling using First-Principles Calculation **Jae Hoon Jang***, Heon-Young Ha, Tae-Ho Lee, Dong-Woo Suh	

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 515C	**MS 808**	**Modeling at the Intersection of First Principles Methods, Mechanics and Mathematics** **Chair(s): Amit Acharya**		
Keynote Presentation: **William A. Curtin***	Multiscale Diffusion Method for Simulations of Long-Time Defect Evolution	Prediction from First Principles of the Structure and Composition of Vanadium Carbide Nanoprecipitates in Microalloy Steel **Sebastián Echeverri Restrepo***, Davide Di Stefano, Matous Mrovec, Michael W. Finnis, Anthony T. Paxton	Mechanical Properties of Rhenium Disulfide and Rhenium Diselenide: A First-Principles Study **Pratyaksh Agrawal*,** Chandra veer Singh	
Room: 516E	**MS 812**	**Multiphysics Computation and Coupled Effects** **Chair(s): Dong Qian**		
Keynote Presentation: **Somnath Ghosh***, Shu Guo, Reza Yaghmaie	Computational Framework Involving Spatial and Temporal Multi-Scaling for Coupled Transient Electromagnetics-Mechanical Phenomena	A Finite Element Based Method for Simulating Surfactants Spreading on Liquid Films **Yingjie Liu***, Christian Peco, John Dolbow, Guglielmo Scovazzi	A Multi-Temporal Scale Approach To Thermomechanical Failure And Response Prediction **Rui Zhang***, Lihua Wen, Jinyou Xiao, Dong Qian	
Room: 523B	**MS 904**	**BIE/BEM and Their Fast Solution Methods** **Chair(s): Yijun Liu**		
Keynote Presentation: **Eric Darve***, Toru Takahashi, Pieter Coulier	Preconditioners for the Boundary Element Method based on Hierarchical Matrices	Fast Multipole Method for Poroelastodynamics **Martin Schanz***	Adaptive Cross Approximation in BEM for Elastic Continua **Anita Maria Haider***, Martin Schanz	Solving Large-Scale Nonlinear Eigenvalue Problems in Boundary Element Method by Resolvent Sampling Based Rayleigh-Ritz Method **Jinyou Xiao***, Junpeng Wang, Tao Wang, Lihua Wen

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 524A	**MS 908**	**Finite Element Methods for Wave Propagation** **Chair(s): Jay Gopalakrishnan**		
Recent Progress on DG Methods for Maxwell's Equations in Complex Media **Jichun Li***, Yunqing Huang, Wei Yang	Discontinuous Galerkin Methods for Maxwell's Equations in Nonlinear Polarization Media **Vrushali Bokil***, Yingda Cheng, Yan Jiang, Fengyan Li	Designing Robust Beam Combinable High-Power Fiber Amplifiers **Jacob Grosek***	A DPG Approach to the Full Vectorial Transverse Mode Instability Model of Optical Laser Amplifiers **Leszek Demkowicz***, Sriram Nagaraj, Jacob Grosek	The DPG Method for High Frequency Time-Harmonic Wave Propagation Problems **Socratis Petrides***, Leszek Demkowicz
Room: 519A	**MS 912**	**Meshfree and Particle Methods: New Developments and Applications** **Chair(s): Gary Seidel**		
Modeling of Electromechanical Composite Interfaces in the Material Point Method using Cohesive Zones **Stefan Povolny***, Adarsh Chaurasia, Gary Seidel	A New Particle-In-Cell Technique for Reducing Noise **Craig Schroeder***, Chenfanfu Jiang, Joseph Teran	Dredging Induced Failure Mechanisms of Subaqueous Slopes: An Investigation with Coupled CFD-DEM **Manuela Kanitz***, Jürgen Grabe		
Room: 523A	**MS 914**	**Peridynamics and Its Applications** **Chair(s): Seida Oterkus**		
A New Energy-Based Solder Joint Fatigue Life Prediction Approach for Electronic Packages **Ibrahim Guven***, Forrest Baber	Coupled Iso-Geometric Analysis (IGA) and Peridynamics Method for Ship Structural Analysis **Shih-Mo Kuo***, Pai-Chen Guan			

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 522BC	**MS 915**	**Polygonal and Polyhedral Discretizations in Computational Mechanics** **Chair(s): Joseph Bishop**		
Keynote Presentation: **Mohamed Ebeida***, Ahmed Abdelkader, Ahmad Rushdi	PowerMesh: A New Robust Polyhedral Meshing Technique for Non-Convex Domains	A Constrained Resampling Strategy for Eliminating Short Edges in Voronoi Meshes **Ahmed Mahmoud***, Mohamed Ebeida, Ahmed Abdelkader, Ahmad Rushdi, John Owens	From Digital Images, STL and NURBS to Computational Stress Analysis using Scaled Boundary Polytope Elements **Chongmin Song Song***	Modeling Strong and Weak Discontinuities without Element-Partitioning in the Extended Finite Element Method **N. Sukumar***, Eric B. Chin
Room: 522A	**MS 1002**	**Computational Methods in Image Analysis** **Chair(s): Joao Manuel R.S. Tavares and Renato Natal Jorge**		
Quantifying Microscale Damage through Image-Based Material Testing of Particulate Composites using Micro-Tomography **Katherine Ramos***, Andrew Gillman, Karel Matous	Establishing the Mechanical Properties of Pelvic Floor Muscle by using MRI and an Inverse Method **Renato Natal Jorge***, Elisabete Silva, Sofia Brandão, Teresa Mascarenhas, Marco Parente	Segmentation of Atherosclerotic Plaques in MR Carotid Artery Images **Joao Tavares***, Danilo Jodas, Aledir Pereira	Application of Fourier and Wavelet Methods to an Experimental Tumbling Mill Using 3D Particle Tracking Data **Daramy Kallon*,** Indresan Govender, Aubrey Mainza	
Room: 514A	**MS 1003**	**Enabling Technologies and Simulation Practices for Advanced Scientific and Engineering Computation** **Chair(s): Alvaro Coutinho**		
Keynote Presentation: **Miriam Mehl***, Klaudius Scheufele, Florian Lindner, Benjamin Uekermann	Parallel Numerical Methods for Black-Box Coupling in Surface Coupled Multi-Physics Problems and Beyond	Towards Scalable AMG-Based Preconditioners for MHD and Multifluid Plasma Simulations **Paul Lin***, John Shadid, Edward Phillips, Jonathan Hu, Eric Cyr, Roger Pawlowski	Communication-Free Mesh Multiplication using Pairing Function **Renato N. Elias***, Jose J. Camata, Alvaro L.G.A. Coutinho	

TS8: WEDNESDAY AFTERNOON

02:30 PM	02:50 PM	03:10 PM	03:30 PM	03:50 PM
Room: 516A	**MS 1102**	**Advances in Error Analysis and Computational Aspects of Deterministic and Stochastic PDE Eigenvalue Problems** **Chair(s): Harri Hakula**		
A FEAST-Type Algorithm for Operators **Jeffrey Ovall***, Jay Gopalakrishnan, Luka Grubisic	Optimal Quotient Iterations for Large Generalized Eigenvalue Problems **Vesa Kotila***, Marko Huhtanen	Recursive Integral Eigenvalue Solver with Cayley Transformation **Ruihao Huang***, Jiguang Sun	Spectral Inverse Iteration for Eigenvalue Problems with Random Coefficients **Mikael Laaksonen***, Harri Hakula	Computation of Extremal Eigenvalues of High-Dimensional Lattice-Theoretic Tensors in Tensor-Train Format **Vesa Kaarnioja***
Room: 514B	**MS 1104**	**A Posteriori Error Estimation and Adaptivity** **Chair(s): Serge Prudhomme**		
Keynote Presentation: **Andrea Cangiani***, Emmanuil H. Georgoulis, Tristan Pryer, Oliver J. Sutton	A Posteriori Error Estimation and Adaptivity for the Virtual Element Method	Error Estimation and Adaption in Domain Decomposition Methods **Pierre Gosselet***, Valentine Rey, Christian Rey	An Adaptive hp-Refinement Strategy with Computable Guaranteed Error Reduction Factors **Patrik Daniel***, Alexandre Ern, Iain Smears, Martin Vohralk	Mesh Adaptation Based on a Hierarchical A Posteriori Error Estimator **Thomas Briffard***, André Fortin
Room: 524B	**MS 1105**	**Data Driven Paradigms and Uncertainty Quantification in Computational Mechanics** **Chair(s): Roger Ghanem**		
Data-Driven Probabilistic Boundary Layer Model for Prediction of Airfoil Performance **Alexandre Marques*,** Qiqi Wang, Youssef Marzouk	Data-Interactive Computational Materials Physics: Studies of Precipitate Morphology by a Combination of Experiment, Nonlinear Elasticity and Machine Learning **Gregory Teichert***, Emmanuelle Marquis, Krishna Garikipati	A Bayesian Analysis of Rheological Models for the Simulation of Turbidity Currents **Fernando Rochinha***, Henrique Costa, Zio Souleymane, Gabriel Guerra, Alvaro Coutinho	Uncertainty Quantification in Composite Woven Materials using a Statistically Equivalent Representative Volume Element with Discrete Defects **David Tal***, Jacob Fish	

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 514C	**MS 105**	**Direct and Inverse Methods for Cardiovascular and Pulmonary Mechanics** **Chair(s): Wolfgang Wall**		
Keynote Presentation: **Michael Sacks***, Chung-Hao Lee, Will Zhang	On the In-Vivo Function of the Heart Valve Leaflet: Insights into Tissue-Interstitial Cell Biomechanical Coupling	The Importance of Mechano-Electrical Feedback and Inertia in Cardiac Electromechanics **Francisco Sahli Costabal***, Felipe A. Concha, Daniel E. Hurtado, Ellen Kuhl	The Impact of Myocardium Compressibility in Computational Simulations of the Healthy and Infarcted Heart **Joao S. Soares***, David S. Li, Eric Lai, Joseph H. Gorman III, Robert C. Gorman, Michael S. Sacks	
Room: 515A	**MS 107**	**Mechanobiology of Cells, Vesicles and Biomembranes** **Chair(s): Roger Sauer**		
Keynote Presentation: **Paul Atzberger***, Ben Gross	Hydrodynamic Coupling Within Curved Lipid Bilayer Membranes: The Role of Curvature in the Drift-Diffusion Dynamics of Proteins	Modeling and Simulation of the Dynamics of Soft Adhesion Mediated by Mobile Binders: 2D Variational Modeling **Dimitri Kaurin***, Marino Arroyo	Computational, Three-Dimensional Investigation of Endocytosis **Yannick A.D. Omar***, Kranthi K. Mandadapu, Roger A. Sauer	
Room: 519A	**MS 202**	**Advances in Meshfree Particle Methods for Fluid Mechanics** **Chair(s): Ahmad Shakibaeinia and Tewfik Mahdi**		
A Material Point Method for Simulation of Viscoelastic Flows **Peter Gordon***, Fushen Liu, Holger Meier, Rohan Panchadhara, Vikas Srivastava	Modeling Surface Soil Erosion by Water using SPH **Elizabeth Hernández Zubeldia***, Georgios Fourtakas, Benedict D. Rogers, Márcio M. Farias	Mesh-Free Particle Modeling of Multiphase Granular Continuum **Ahmad Shakibaeinia***		

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 520B	**MS 204**	**Computational Methods in Environmental Fluid Mechanics** **Chair(s): Ethan Kubatko**		
A New Very Large Eddy Simulation of the Flow over a Cylinder at Low Re=3900 **Shuangfeng Wang***, Puxian Ding	A Hybridized Discontinuous Galerkin Method for Fully Nonlinear Irrotational Serre-Green-Naghdi Model **Ali Samii***, Clint Dawson	qADMESH+: An Automatic Quadrangular and Mixed-Element Mesh Generator **Dominik Mattioli***, Ethan Kubatko, Alan Zundel		
Room: 520A	**MS 206**	**Model Reduction in Computational Fluid Dynamics** **Chair(s): Masayuki Yano**		
Keynote Presentation: **Jeff Borggaard***	Reduced-Order Compensators for Estimation and Feedback Flow Control	Calibrated Filtered Reduced Order Modeling **Xuping Xie***, Traian Iliescu	Statistical Mechanics-Based Closures for Galerkin ROMs **Eric Parish***, Karthik Duraisamy	Structure-Preserving Model Reduction for Finite-Volume Discretizations of Conservation Laws **Kevin Carlberg***, Youngsoo Choi, Syuzanna Sargsyan
Room: 520C	**MS 301**	**Advancements in Hydraulic Fracture Simulation** **Chair(s): Robert Gracie**		
High-Performance Computing in the Modeling of Hydraulic Fracturing **Denis Bannikov***, Alexey Tikhonov, Vadim Isaev, Ivan Velikanov, Dmitry Kuznetsov	A Parallel Implementation of the Enhanced Local Pressure Model for the Large Scale Simulation of Hydraulic Fracturing **Ernst W. Remij***, Joris J.C. Remmers, Erik Jan Lingen, Jacques M. Hyughe, David M.J. Smeulders	A Fully Coupled Method for Massively Parallel Simulation of Hydraulically Driven Fractures in 3-Dimensions **Randolph Settgast***, Chandrasekhar Annavarapu		

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 518B	**MS 401**	**Computational Fracture Mechanics** **Chair(s): N. Sukumar**		
Material-Dependent Crack-Tip Enrichment Functions in XFEM for Modeling Bimaterial Interfacial Cracks **Yongxiang Wang***, Haim Waisman	Numerical Analysis for Diffusion-Induced Cracks **Sayako Hirobe***, Kenji Oguni	A Class of Examination of Simulation for Ductile Fracture **Hirofumi Sugiyama***, Kazumi Matsui, Takahiro Yamada	An Adaptive Cohesive Zone Model for Fatigue Crack Growth in the Framework of Generalized Plasticity **Noémie Rakotomalala***, Vincent Chiaruttini	Calculation of T-Stress for Cracks in Two-Dimensional Anisotropic Elastic Media by Boundary Integral Equation Method **Han Tran***
Room: 525A	**MS 402**	**Modeling and Simulation for Complex Material Behavior** **Chair(s): Patrick Diehl**		
In Situ Intra-Bundle Full Field Measurement in a Single Carbon Fiber Bundle Composite under Transverse Load **Ilyass Tabiai***, Damien Texier, Daniel Therriault, Martin Lévesque	Current Efforts in Developing an Optimum Biaxial Tensile Test Specimen Design **Dilp Banerjee***, Mark Iadicola, Adam Creuziger, Evan Rust	Temperature-Dependent Multi Scale Large Deformation Simulation of Cu-Ag Alloy **Ali Gordan***, Amir Reza Khoei		
Room: 521BC	**MS 403**	**Modeling and Simulation of Damage and Fracture in Brittle and Quasi-Brittle Materials** **Chair(s): Reza Abedi**		
Modeling Dynamic Shear Rupture at Weak Interfaces: In Quest of High Resolution and Precision **David Kammer***	A New Hybrid Numerical Scheme For Simulating Fault Ruptures With Near Fault Bulk Inhomogeneities **Ahmed Elbanna***, Setare Hajaroalsvadi	Automated Simulation of the Multiscale Damage Response of Materials with Complex Microstructures **Soheil Soghrati***, Anand Nagarajan, Fei Xiao, Bowen Liang, Hossein Ahmadian, Ming Yang	A Stochastic Approach for Modeling Dynamic Fracture of Quasi-Brittle Materials **Philip Clarke***, Reza Abedi, Robert Haber	

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 520D	**MS 505**	**Fluid-Structure Interaction Algorithms and Applications** **Chair(s): Justin Kaufmann**		
Condition Assessment and Prognosis using Fluid-Structure Interaction within a Reduced-Order Model Tracking Inversion Framework **Justyna Kosianka***, Wensi Wu, Christopher Earls	Large Amplitude Aeroelastic Oscillations of a Cantilever with Structural and Aerodynamic Nonlinearities: Theory and Wind Tunnel Test **Brandon Robinson***, Leandro Jose Rocha da Costa, Dominique Poirel, Chris Pettit, Mohammad Khalil, Abhijit Sarkar	Simulation of a Proposed Fluid-Structure Interaction Validation Case **Jonathan Pitt***	An Arbitrary Lagrangian-Eulerian Approach to Acoustic Streaming **Francesco Costanzo***, Nitesh Nama, Tony Huang	
Room: 520F	**MS 506**	**Free and Moving Boundary Problems: Methods and Applications** **Chari(s): TBD**		
Keynote Presentation: **Alexandre Caboussat***	A Splitting Algorithm for the Numerical Simulation of Sediment Transport in Free Surface Flows	A Lattice-Boltzmann Based Multiscale Approach for Simulating Nanoparticle Transport in Cellular Blood Flow **Zixiang Liu***, Yuanzheng Zhu, Rekha Rao, Jonathan Clausen, Cyrus Aidun	Progress Towards the Development of a 2D Immersed Boundary Solver for the Simulation of Particles at Fluid-Fluid Interfaces **Adam O'Brien***, Markus Bussmann	
Room: 520E	**MS 507**	**Phase-field Modeling and Simulation in Fluids, Solids and Biomechanics** **Chair(s): Tymofiy Gerasimov**		
A Parallel Adaptive Multigrid Approach to Simulating Phase-Field Problems **Matthew Hubbard***, Feng Wei Yang, Peter Jimack	Development of Phase-Field Models of Tumor Growth with Radiation Effects **Ernesto A.B.F. Lima***, Amir Shamoradi, David A. Hormuth II, J. Tinsley Oden, Thomas Horger, Barbara Wohlmuth, Thomas E. Yankeelov	Using Hyper-Dual Numbers to Integrate an Equation of State into a Phase Field Model for Droplets **Felix Diewald***, Charlotte Kuhn, Michaela Heier, Martin Horsch, Kai Langenbach, Hans Hasse, Ralf Müller	A Novel Numerical Algorithm For Modeling Solidification Of Water **Hasan Shetabivash***, Ali Dolatabadi, Marius Paraschivoiu	A CFD Study of Supercooled Cloud Size Droplet Impact on a Superhydrophobic Surface **Reza Attarzadeh***, Firoozeh Yeganehdoust, Ali Dolatabadi

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 518C	**MS 508**	**Stabilized and Multiscale Methods for Interface Mechanics Chair(s): Timothy Truster and Arif Masud**		
Embedded Boundary Conditions for Plate Bending Problems **Isaac Harari***	Stabilized Finite Element Method for Compressible Phase Change Phenomena **Ehsan Shams***, Fan Yang, Yu Zhang, Chao Liu, Mark Shephard, Onkar Sahni, Assad Oberai	Adaptive Variational Multiscale Method for Non-Newtonian Multiphase Flows **Elie Hachem***, Stéphanie Riber, Youssef Mesri, Rudy Valette	Recent Advances in Spline-Based Embedded Finite Element Methods **John Dolbow***, Yingjie Liu, Wen Jiang	CutFEM: Discretizing Geometry and Partial Differential Equations in Multidimensional Multiphysics Problems **André Massing***, Erik Burman, Peter Hansbo, Mats G. Larson
Room: 524C	**MS 602**	**Advances in Topology Optimization for Manufacturing Chair(s): Xu Guo**		
Average-Worst-Case Topology Optimization using Stochastic Programming and Conditional Value-at-Risk **Geoffrey Oxberry***, Cosmin Petra, Mark Stowell, Andrew Barker, Daniel White, Daniel Tortorelli	Stochastic Sensitivity Analysis for Reliability-Based Topology Optimization **Xuchun Ren***, Xiaodong Zhang			
Room: 525B	**MS 603**	**Bayesian Statistical Inversion in Engineering Mechanics Chair(s): TBD**		
Model Discrepancy Calibration Across Experiments **Kathryn Farrell-Maupin***, Laura Swiler	Bayesian Model Calibration with an Embedded Statistical Characterization of Model Error **Xun Huan***, Khachik Sargsyan, Habib Najm	Bayesian Selection of Optimal Physics-Based Model and Modeling Error **Philippe Bisaillon***, Rimple Sandhu, Mohammad Khalil, Chris Pettit, Dominique Poirel, Abhijit Sarkar	Bayesian Model Selection in Continuous Model Domain using Automatic Relevance Determination with Applications to Nonlinear Aeroelasticity **Rimple Sandhu***, Chris Pettit, Mohammad Khalil, Dominique Poirel, Abhijit Sarkar	

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 519B	**MS 605**	**New Trends in Topology Optimization** **Chair(s): Philip Buskohl**		
A Feasible Minimum Energy State Method for Constrained, Multi-Disciplinary Topology Optimization Problems **Willem Roux***	Robust Topology Optimization under Loading Uncertainty using a Density Matching Approach **Bingxiao Du***, Timoleon Kipouros, Geoff Parks, Yong Zhao, Wen Yao, Xiaoqian Chen	Stress-Constrained Level Set Topology Optimization for Compliant Mechanisms **Hélio Emmendoerfer Junior***, Eduardo Alberto Fancello, Emílio Carlos Nelli Silva	A Maximum Filter for Material Nonlinear Topology Optimization using the Ground Structure Method **Sylvia Almeida***, Glaucio Paulino	
Room: 523A	**MS 705**	**Instabilities in Solids Across the Scales** **Chair(s): Christian Linder**		
Keynote Presentation: **Julian Rimoli***	A Physics-Based Reduced-Order Model for the Dynamic and Post-Buckling Behavior of Tensegrity Structures and Metamaterials	A Numerical Study of Branching and Stability of Solutions to Three-Dimensional Martensitic Phase Transformations using Gradient-Regularized, Non-Convex, Finite Strain Elasticity **Koki Sagiyama***, Shiva Rudraraju, Krishna Garikipati	A Systematic Study of Swelling-Induced Instabilities of Hydrogels **Berkin Dortdivanlioglu***, Andreas Krischok, Ali Javili, Christian Linder	Computational Framework for Homogenization at Finite Deformation with Stability Considerations using Isogeometric Analysis **Ryan Alberdi***, Kapil Khandelwal
Room: 518A	**MS 706**	**Modeling and Simulation for Solidification Processes in Manufacturing** **Chair(s): Greg Wagner**		
Dendrite Fragmentation and the Columnar-to-Equiaxed Transition During Solidification **P.W. Voorhees***, T. Cool, E.B. Gulsoy	Finite Element Modeling of Ceramic Deposition by LBM (SLM) Additive Manufacturing **Qiang Chen***, Gildas Guillemot, Charles-André Gandin, Michel Bellet	A Space-Time Computational Vademecum Based Approach for Multi-Parametric Simulations of Welding Processes **Ye Lu***, Nawfal Blal, Anthony Gravouil	Multi-Scale Solidification Simulations of Additive Manufacturing Process in Metals **Gregory Wagner***, Stephen Lin, Wing Kam Liu	

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 516D	**MS 802**	**Advances in Atomistic-to-Continuum Coupling Techniques** **Chair(s): Ron Miller**		
Keynote Presentation: **Mitchell Luskin*** Andrew Binder, Christoph Ortner	A New Predictor-Corrector Method for Efficient Modeling of Surface Effects	Atomistic-to-Continuum Influenced Consistent Coupling of Nonlocal Diffusion Problems **Xingjie Li***, Jianfeng Lu, Xiaochuan Tian, Qiang Du	Blended Force-Based Quasicontinuum Method for Multilattice Materials **Derek Olson***, Xingjie Li	
Room: 515B	**MS 805**	**Computational Modeling of Multi-Functional Materials** **Chair(s): Jae Hyun Park**		
Ab Initio Study of Interfacial Magnetoelectric Effect in Oxide Superlattices **Jaekwang Lee***	Molecular Dynamics Analysis of DNA-Micelle Complex and its Electrophoretic Transport for Drug Delivery System **Jae Hyun Park***, Narayana Aluru			
Room: 515C	**MS 808**	**Modeling at the Intersection of First Principles Methods, Mechanics and Mathematics** **Chair(s): Michael Falk**		
Energy Renormalization Approach to Coarse-Graining of Polymer Dynamics **Sinan Keten***, Jake Song, Wenjie Xia, Cheol Jeong, David Hsu, Fred Phelan, Jack Douglas	Potential Energy Landscape and Dynamics of Inherent Structure Evolution in Metallic Glasses **Yue Fan***	Mesodynamics - A Hybrid Deterministic-Statistical Framework for Molecular Dynamics **Amuthan Ramabathiran***, Pilar Ariza, Michael Ortiz	The Properties of Dislocation Cores in Refractory Body-Centered Cubic Metals Affected by Ideal Strength Behaviors **Liang Qi***, Chaoming Yang, Yongjie Hu	

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 516E	**MS 812**	**Multiphysics Computation and Coupled Effects** **Chair(s): Shaoqiang Tang**		
Matching Boundary Conditions for a Heterogeneous Atomic Chain **Shaoqiang Tang***, Xingru Chen, Shuyu Liu	From Forging to End of Lifecycle: A Multiphysics Simulation Workflow for Hydrogen Embrittlement **Gabriel de Frías***, James Foulk III, Michael Veilleux, Kevin Manktelow, Lauren Beghini, Alexander Hanson, Andrew Stershic, Jakob Ostien, Dorian Balch	The Thermal Transport in Branched Carbon Nanotube **I-Ling Chang***, Yu-Wei Lo	A Computational Study on Multi-Physics Coupling Effects in Ultrashort-Pulse Laser Material Processing **Dong Qian***, Mohammad Rezaul Karim, Zhenpeng Qian	Coupled Moisture Diffusion and Mechanical Analysis to Evaluate the Differential Drying of Concrete: Application to Failure Prediction of Concrete Material **Razakamandimby Ranjanoro Diamondra Fenosoa Tiana***
Room: 523B	**MS 904**	**BIE/BEM and Their Fast Solution Methods** **Chair(s): Martin Schanz**		
A Double-Layer Interpolation Method for BIE Implementation **Jianming Zhang***, Weicheng Lin, Yunqiao Dong, Chuanming Ju	On the Construction and Use of High-Order Boundary Element **Hang Ma***, Donghong He	Space-Time Boundary Element Methods for Dynamic Trusses **Dominik Pölz***, Michael Helmut Gfrerer, Martin Schanz	The Moving Porous Green's Function Associated with Dopplers Effect in BEM and Analysis for Vehicle Jumping on Highways **B.Y. Ding***, Y.Z. Song	
Room: 524A	**MS 908**	**Finite Element Methods for Wave Propagation** **Chair(s): Leszek Demkowicz**		
Advancing Hyperbolic Solutions through Unstructured Meshes by Mapped Tent Pitching **Jay Gopalakrishnan***	Analysis of a Mixed Discontinuous Galerkin Method for Incompressible Magnetohydrodynamics **Weifeng Qiu***	Symplectic HDG Methods for Wave Propagation Phenomena **Manuel Sanchez***, Bernardo Cockburn, Ngoc Nguyen, Jaime Peraire		

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 522BC	**MS 915**	**Polygonal and Polyhedral Discretizations in Computational Mechanics** **Chair(s): Gianmarco Manzini**		
Discontinuous Galerkin Approximation of Flows in Fractured Porous Media on Polytopic Grids **Chiara Facciolà***, Paola Francesca Antonietti, Alessandro Russo, Marco Verani	A Minus One Norm Stabilized DG Method on Polygonal Meshes **Silvia Bertoluzza***, Daniele Prada	Arbitrary Polygonal Elements using Discontinuous Petrov-Galerkin (DPG) Method **Jaime Mora Paz***, Ali Vaziri Astaneh, Federico Fuentes, Leszek Demkowicz	Preconditioners for the Virtual Element Method: FETI-DP and BDDC **Micol Pennacchio***, Silvia Bertoluzza, Daniele Prada	Polyhedral Discretizations using Tetrahedral Subdivisions for Applications in Nonlinear Solid Mechanics **Joseph Bishop***, N. Sukumar
Room: 514A	**MS 1003**	**Enabling Technologies and Simulation Practices for Advanced Scientific and Engineering Computation** **Chair(s): William Barth**		
Prototyping the Next Generation of Aria **Jonathan Clausen***, Chris Forster, David Noble, Christian Trott, Si Hammond, Mark Hoemenn, Paul Lin	Mesh Generation for Large-Scale Multi-Physics Simulations using HPC Architectures **Andreas Lintermann***	Coupling of Molecular Dynamics and Lattice-Boltzmann on Spatially-Adaptive Grids **Michael Lahnert***, Takayuki Aoki, Carsten Burstedde, Miriam Mehl	A Practical Method for Automatic Camera Paths Generation in Scientific Visualization Storytelling **Benoît Ozell***, Anis Benyoub	Immersive Simulation of the Reduction of Femoral Diaphyseal Fracture **Mohamed Mediouni***, Djemel Ziou, François Cabana
Room: 516A	**MS 1102**	**Advances in Error Analysis and Computational Aspects of Deterministic and Stochastic PDE Eigenvalue Problems** **Chair(s): Jeffrey Ovall**		
Convergence of Adaptive FEM for the Approximation of Eigenvalues of PDEs in Mixed Form **Lucia Gastaldi***	Efficient Solution of Eigenvalue Problems Related to Coupled Acoustical Systems **Antti Ojalammi***, Antti Hannukainen	Eigenlocking in Shells of Revolution **Harri Hakula***		

TS9: WEDNESDAY EVENING

04:40 PM	05:00 PM	05:20 PM	05:40 PM	06:00 PM
Room: 514B	**MS 1104**	**A Posteriori Error Estimation and Adaptivity** **Chair(s): Marc Laforest**		
A Posteriori Error Estimation for Reduced Basis Approximation by the Method of Random Duals **Kathrin Smetana***, Anthony T. Patera	A Posteriori Mesh Quality Control in Probabilistic Bayesian Inversion **Pierre Kerfriden***, Abhishek Kundu, Susanne Claus	Goal-Oriented Proper Generalized Decomposition with Error Estimation and Adaptivity **Kenan Kergrene***, Serge Prudhomme, Ludovic Chamoin, Marc Laforest	A Posteriori Error Estimation for Several Classes of Finite Difference Schemes **Simon Tavener***, Jehanzeb Chaudhry, Jeb Collins, John Shadid	
Room: 524B	**MS 1105**	**Data Driven Paradigms and Uncertainty Quantification in Computational Mechanics** **Chair(s): Karthik Duraisamy**		
Multilevel-Multifidelity Expansions with Application to Emulator-Based Bayesian Inference **Michael Eldred***, Gianluca Geraci, Alex Gorodetsky, John Jakeman	Optimal Multi-Level Monte Carlo Methods for the Stochastic Drift-Diffusion-Poisson System and for Stochastic Homogenization **Clemens Heitzinger***, Leila Taghizadeh, Amirreza Khodadadian, Stefan Rigger	Modeling Model-Form Uncertainties in Eigenvalue Computations using a Data-Driven Stochastic Reduced-Order Model **Adrien Bos***, Charbel Farhat, Phil Avery, Christian Soize	Data-Driven Modeling of Turbulent Boundary Layer Noise **Gregory Bartram***	

Thursday Plenary Speaker

9:00-9:45 am

Anthony Patera

Massachusetts Institute of Technology

Parametrized Model Order Reduction for Component-to-System Synthesis and Analysis

Room: 517BC

Abstract: In this talk we describe and demonstrate a model order reduction methodology for efficient solution of partial differential equations characterized by many (spatially distributed) parameters. The approach is relevant in many-query and real-time contexts such as design, shape and topology optimization, parameter estimation and classification, and reconditioning. The numerical approach comprises four principal ingredients: component-to-system synthesis, formulated as a static-condensation procedure; model order reduction, informed by evanescence arguments at component interfaces (port reduction) and low-dimensional parametric manifolds in component interiors (reduced basis techniques); offline-online computational decomposition strategies; and parallel calculation, implemented in a cloud environment. We provide examples in acoustics, linear elasticity, and nonlinear solid mechanics, with applications from musical instruments to shiploaders.

Bio: Anthony T. Patera is Ford Professor of Engineering and Professor of Mechanical Engineering at the Massachusetts Institute of Technology (MIT), and Co-Director of the MIT Center for Computational Engineering. In 2013-2014 Professor Patera also held a Research Chair from the Paris Foundation for Mathematical Sciences hosted at the University Pierre and Marie Curie. His research interests include partial differential equations, variational techniques, computational methods, numerical analysis, model order reduction, a posteriori error estimation, real-time simulation, data assimilation and classification, fluid dynamics, heat transfer, and acoustics and continuum mechanics. Professor Patera has undergraduate and graduate degrees in Mechanical Engineering from MIT and a doctoral degree in Applied Mathematics also from MIT.

TS10: THURSDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 516A	**MS 001**	**Reliable Automated Simulation Technologies: A Symposium Celebrating the 65th Birthday of Professor Mark S. Shephard** **Chair(s): Kenneth Jansen**		
Simulations of Gas-Liquid-Solid Interactions using the Immersed Approach **Lucy Zhang***	Reliable Modelling of Neural Network at Extreme Scale: Status, Opportunities and Challenges **Fabien Delalondre***	Modeling and Simulation of the Mechanical Behavior of Fiber Networks with Cohesion **Vineet Negi***, Catalin Picu		
Room: 514C	**MS 105**	**Direct and Inverse Methods for Cardiovascular and Pulmonary Mechanics** **Chair(s): Alberto Figueroa**		
Characterization of Airway Wall Mechanics **Mona Eskandari***, Alberto Arvayo, Marc Levenston, Ellen Kuhl	Pressure Induced Damage of Pulmonary Artery: Mechanical Parameters Estimation **Sara Roccabianca***, Marissa Grobbel, Hailu Getachew, Yuheng Wang, Laura Nye, Seungik Baek	Constitutive and Computational Modelling with Fluid-Structure Interactions of Venous Tissues **Nayyan Kaul***, Hsiao-Ying Shadow Huang	Parametric Simulations of Trileaflet Valve Function **Rana Zakerzadeh***, Ming-Chen Hsu, Michael Sacks	Simulating the Effect of Permanent Set on Bioprosthetic Heart Valves under Cyclic Loading **Will Zhang***, Michael Sacks
Room: 515A	**MS 107**	**Mechanobiology of Cells, Vesicles and Biomembranes** **Chair(s): Roger Sauer**		
A Coarse-Grained Model for Cell Nuclear Pore Complex and Nanoparticles Interaction **Xianqiao Wang***, Liuyang Zhang	Effect of Lipid Type and Surface Charges on the Bending Modulus of Lipid Bilayer Membranes **Adarsh Chaurasia***, Andrew Rukangu, Eric Freeman, Michael Philen, Gary Seidel	Application of Atomic Force Microscopy for Investigation of Anisotropic Mechanical Properties of Living Cells **Chien-Kai Wang***, Ping-Liang Ko, Yi-Chung Tung		

TS10: THURSDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 519A	**MS 202**	**Advances in Meshfree Particle Methods for Fluid Mechanics** **Chair(s): Ahmad Shakibaeinia and Tewfik Mahdi**		
Developing SPH Based Modeling of Volcanic Plumes using Modified SPH Schemes **Zhixuan Cao***, Abani Patra	Numerical Simulation of Natural Convection Heat Transfer in a Heat Exchanger using an Incompressible Smoothed Particle Hydrodynamics (SPH) **Faroogh Garoosi***, Ahmad Shakibaeinia	Towards a Meshfree Finite Difference Model for Reactive Mixing Problems **Timo Wächtler***, Jörg Kuhnert		
Room: 520B	**MS 204**	**Computational Methods in Environmental Fluid Mechanics** **Chair(s): Kazuo Kashiyama**		
A RB-VMS Modeling Framework for Sediment Transport: The Coupling of Turbulence and Rheological Behavior **Gabriel M. Guerra***, Souleymane Zio, Paulo Paraizo, Renato Elias, Fernando A. Rochinha, Alvaro L.G.A. Coutinho	Interfacing Geotechnical and Hydrodynamic Models to Resolve Failure Mechanisms of Flood Control Systems under Storm Surge **Dylan Wood***, Ethan Kubatko, Abdollah Shafieezadeh, Mehrzad Rahimi	Using a Sponge Layer as a Boundary Treatment for Open-Ocean Boundaries in a Finite-Element-Based Coastal Ocean Model **Damrongsak Wirasaet***, Juan Gonzalez, William J. Pringle, Andika Suhardjo, Joannes J. Westerink	Towards an Adaptive Discontinuous Galerkin Storm Surge Model **Ethan J. Kubatko***	
Room: 520A	**MS 206**	**Model Reduction in Computational Fluid Dynamics** **Chair(s): Jeff Borggaard**		
Data-Driven Reduced-Order Modeling of Fluids Systems **Scott Dawson***, Clarence Rowley	High-Dimensional Separable Compression and Basic Operations: A PGD Arithmetic Toolbox **Pedro Díez***, Sergio Zlotnik, Antonio Huerta	Computational Vademecum Efficient Simulation of Stokes Flow **Antonio Huerta***		

TS10: THURSDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 520C	**MS 301**	**Advancements in Hydraulic Fracture Simulation** **Chair(s): Robert Gracie**		
Keynote Presentation: **Andrei Osiptsov***	A Review of Fundamental Issues in Fluid Mechanics of Hydraulic Fracturing	Modeling of Proppant Transport in a Fracture with Effects of Jamming and Unyielding **Sergei Boronin***, Andrei Osiptsov, Jean Desroches, Brice Lecampion	On Modeling of Particles Settling in Hele-Shaw Flows of Non-Newtonian Fluids **Maxim Ivanov***, Vadim Isaev, Denis Bannikov, Rostislav Romanovskii	Benchmark Solutions for Models of Solids Transport in Hele-Shaw Cell **Vadim Isaev***, Ivan Velikanov, Dmitry Kuznetsov, Denis Bannikov, Alexey Tikhonov
Room: 518B	**MS 401**	**Computational Fracture Mechanics** **Chair(s): Adrian Lew**		
A Class of Examination of Simulation for Ductile Fracture **Hirofumi Sugiyama***, Kazumi Matsui, Takahiro Yamada	A Local Crack-Tracking Strategy to Model Three-Dimensional Crack Propagation with Embedded Methods **Chandrasekhar Annavarapu***, Randolph Settgast, Efrem Vitali, Joseph Morris	A Modified Non-Local GTN Damage Model for High Strain Rate Loading **Nisha Mohan***, Gary Dilts	Crack Detection by Scaled Boundary Finite Element Method and Global Optimization Algorithms **Adrian W. Egger***, Savvas P. Triantafyllou, Eleni N. Chatzi	
Room: 525A	**MS 402**	**Modeling and Simulation for Complex Material Behavior** **Chair(s): Patrick Diehl**		
Keynote Presentation: **Boris Burgarella***, Aurélien Maurel-Pantel, Noël Lahellec, Jean-Luc Bouvard, Hervé Moulinec, Frédéric Lebon, Noëlle Billion	Short Fiber Reinforced Thermoplastic Composite Modelling using Full Field Computing, Application to Glass Fiber Reinforced PEEK	Plastic Deformation and Non-linear Damage Evolution Modeling for Pipeline Steel **Hari Simha***	Towards the Identification of Damage Parameters from Full-Field Measurements within the Finite Strain Framework **Francesco Bettonte***, Sylvia Feld-Payet, David Lévêque, Jacques Besson	

TS10: THURSDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 521BC	**MS 403**	**Modeling and Simulation of Damage and Fracture in Brittle and Quasi-Brittle Materials** **Chair(s): Robert B. Haber**		
Combining Continuum Damage with a Cohesive Zone Model: Modeling Damage in Quasi-Brittle Materials with Application to Masonry Structures **Shenghan Zhang***, Nicolas Richart, Katrin Beyer	Modeling and Simulation of Patched Structure under Low Velocity Impact Loading **Stephanie TerMaath***	Dislocation Dynamics Modeling of Fracture Toughness and Plasticity at Crack Tip **Hayato Suga***, Akiyuki Takahashi	ERR Associated with Crack Growth in Quasi-Brittle Materials **Mohamed Chabaat***, Hillal Ayas, Mokhtar Touati	
Room: 520F	**MS 506**	**Free and Moving Boundary Problems: Methods and Applications** **Chair(s): TBD**		
Finite-Element Simulation and Optimal Control of Free-Surface Problems **Nicola Parolini***, Ivan Fumagalli, Mattia Tamellini, Marco Verani	Magnetophoretic Interaction of a Pair of Ferrofluid Droplets in a Rotating Magnetic Field **Mingfeng Qiu***, Shahriar Afkhami, Ching-Yao Chen, James Feng	A 3D Immersed Boundary Method for Viscoelastic-Fluid-Structure Interaction **Luoding Zhu***		
Room: 523A	**MS 705**	**Instabilities in Solids Across the Scales** **Chair(s): Emma Lejeune**		
Fractures with Constricted Opening **Junxian He***, Elena Pasternak, Arcady Dyskin	Transitional Negative Stiffness as a New Form of Instability **Yuan Xu*,** Arcady Dyskin, Elena Pasternak	Kink Band Instabilities in Layered Media **Henrik M. Jensen***, Jens L. Wind, Simon P.H. Skovsgaard		

TS10: THURSDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 516D	**MS 802**	**Advances in Atomistic-to-Continuum Coupling Techniques** **Chair(s): Ellad Tadmor**		
Grain Boundary Structural Phase Transition under Mechanical Loading in Cu **Mohammad Aramfard***, Chuang Deng	Atomistic Investigation and Continuum Model Prediction of Hydrogen Diffusion along Grain Boundaries **Jun Song***, Xiao Zhou	Atomic Interaction Mechanisms of Coherent Twin Boundary and Stacking Fault Tetrahedron under Shear **Lianping Wu***, Wenshan Yu, Shuling Hu, Shengping Shen	Amorphous Silica: From Molecular Dynamics to the Continuum **William Schill***, Stefanie Heyden, Michael Ortiz	The Predicted Dielectric Constant of an Amorphous PVDF Changing with Temperature by Molecular Dynamics Simulations **Taotao Hu***, Qian Deng, Shengping Shen
Room: 515C	**MS 808**	**Modeling at the Intersection of First Principles Methods, Mechanics and Mathematics** **Chair(s): Vikram Gavini**		
Keynote Presentation: **Michael Falk***, Tonghu Jiang, Shiva Rudraraju, Krishna Garikipati, Anton van der Ven	The Materials Science of Chemically Driven Elastic Incompatibility: A Multi-Physics Study of Lithium Ion Battery Electrode Li_(1+x) Ti_2 O_4	Spectrum Slicing using Chebyshev Polynomials **Xin Wang***, Michael Lee, Jaroslaw Knap	Molecular Dynamics Based Predictive Modeling of High Strain Rate Fragmentation in Metals **Doyl Dickel***, Bradley Huddleston, Mark Horstemeyer	Large and Fast Density Functional Theory Calculations **Phanish Suryanarayana***
Room: 523B	**MS 904**	**BIE/BEM and Their Fast Solution Methods** **Chair(s): Jianming Zhang**		
Harmonic Balance-Boundary Element Method for 2-D Wave Scattering by a Crack with Contact Boundary Conditions **Taizo Maruyama***, Terumi Touhei	A New Simple Multidomain Fast Multipole BEM **Yijun Liu***, Shuo Huang	Boundary Integral Representation for Solenoïdal Fields **Mykola Yasko***		

TS10: THURSDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 524A	**MS 908**	**Finite Element Methods for Wave Propagation** **Chair(s): Jay Gopalakrishnan**		
DG Methods, Wave Propagation, and Geostrophic Adjustment in Geophysical Fluid Flows **Robert Higdon***	Mixed Finite Elements for Nonlinearly Damped Global Tide Models **Robert Kirby***, Jameson Graber	A Finite Element Method for the Jones Eigenmodes of an Elastic Scatterer **Nilima Nigam***	An Explicit Scheme with Local Time Stepping for One-Dimensional Discontinuous Wave Propagation in Heterogeneous Solids **Radek Kolman***, Sang Soon Cho, Jose G. Gonzalez, K.C. Park, Arkadi Berezovski	Spectral Seismic Analysis of Underground Long Tunnels by 2.5D Finite/Infinite Element Approach **Yeong-Bin Yang***, Hsiao-Hui Hung
Room: 522BC	**MS 915**	**Polygonal and Polyhedral Discretizations in Computational Mechanics** **Chair(s): Joseph Bishop**		
Implementation of Discontinuous Skeletal Methods on Arbitrary-Dimensional, Polytopal Meshes using Generic Programming **Matteo Cicuttin***, Daniele Di Pietro, Alexandre Ern	Polyhedral Smoothed Finite Element Method for Thermoelastic and Thermal Contact Analysis **Hobeom Kim***, Seyoung Im	Polyhedral Elements using an Edge-Based Smoothed Finite Element Method for Nearly Incompressible Material **Chan Lee***, Hobeom Kim, Jungdo Kim, Seyoung Im	Improved Partitioned Element Method for Constructing Higher Order Shape Functions on Arbitrary Polyhedra **Brian Giffin***, Mark Rashid	High-Order Polygonal Elements for Elastodynamic Problems **Hauke Gravenkamp***
Room: 515B	**MS 1001**	**Building Advanced Capabilities in Scientific Software** **Chair(s): Vikram Garg**		
Continuous Integration for Large-Scale Scientific Software Development **Andrew Slaughter***	Source Transformation Algorithmic Differentiation of Memory Allocation and Pointer Manipulation **Sri Hari Krishna Narayanna***, Laurent Hascoet, Jean Utke	MIT Uncertainty Quantification (MUQ): Flexible Software for Connecting Uncertainty Quantification Algorithms and Applications **Andrew Davis***, Matt Parno, Youssef Marzouk	Development and Applications of the Discrete Adjoint Solver in PETSc **Hong Zhang***, Emil Constantinescu	Implementing Generalized Adjoint Capabilities in libMesh **Roy Stogner***, Vikram Garg

TS10: THURSDAY MORNING

10:15 AM	10:35 AM	10:55 AM	11:15 AM	11:35 AM
Room: 514A	**MS 1003**	**Enabling Technologies and Simulation Practices for Advanced Scientific and Engineering Computation** **Chair(s): Benoît Ozell**		
Transparent Performance Monitoring for Engineering Computation **William Barth***, Todd Evans	Profiling AMR/C Computations in MontBlanc Exascale Prototype **Fabio Canesin***, Jose Camata, Alvaro Coutinho	On Dynamic Load Balancing Schemes for Adaptive Finite Element Solvers **Youssef Mesri***, Elie Hachem	Balancing Domain Decomposition Method for Finite Element Analysis of Large-Scale Assembly Structure Modeled using Millions of Multi-Point Constraints **Tomoshi Miyamura***	
Room: 514B	**MS 1104**	**A Posteriori Error Estimation and Adaptivity** **Chair(s): Marc Laforest**		
Adaptivity of a B-Spline Based Finite-Element Method for Modelling Wind-Driven Ocean Circulation **Ibrahim Al Balushi***, Wen Jiang, Gantumur Tsogtgerel, Tae-yeon Kim	Anisotropic A Posteriori Error Estimation and Mesh Adaptation for the Monodomain Model in Cardiac Electrophysiology **Edward Boey***, Yves Bourgault, Thierry Giordano	Mapping Error Quantification and Adaptive Remeshing for Large-Deformation Solid Mechanics **Andrew Stershic***		
Room: 524B	**MS 1105**	**Data Driven Paradigms and Uncertainty Quantification in Computational Mechanics** **Chair(s): Krishna Garikipati**		
Data-Driven Probabilistic Calibration of Material Models from Small Datasets and its Influence on Structural Response **Jiaxin Zhang***, Aakash Bangalore Satish, Pawel Woelke, Michael Shields	A Deep Learning-Based Constitutive Model for Finite Element Method **Fariborz Ghavamian***, Angelo Simone	Tensor-Based Metamodels for the Calibration of Constitutive Laws in Material Science **Clément Olivier***, David Ryckelynck, Julien Cortial		

Index

TS6: POSTER SESSION – Tuesday, 4:30 – 6:00 pm, 517A

Poster Competition Participants:

Sai Vagbharathi Addagalla	
Pratyaksh Agrawal	University of Toronto
Kazem Alidoost	University of Illinois
Reza Avazmohammadi	The University Of Texas at Austin
Olalekan Babaniyi	
Alexey Baykin	Lavrentyev Institute of Hydrodynamics
Matthew Becton	University of Georgia
Eric Bryant	Columbia University
Hugo Casquero	Carnegie Mellon University
Robert Caulk	University of California, San Diego
Heng Chi	Georgia Institute of Technology
Youngsoo Choi	Lawrence Livermore National Lab.
XI Deng	Tokyo Institute of Technology
Kelsey DiPietro	University of Notre Dame
Yuchen Dong	Worcester Polytechnic Institute
Li Dong	Rensselaer Polytechnic Institute
Berkin Dortdivanlioglu	Stanford University
Kyle Dunn	Worcester Polytechnic Institute
Mahdad Eghbalian	University of Calgary
Luke Engvall	University of Colorado at Boulder
Mona Eskandari	Stanford University
Felipe Fernandez	University of Illinois at UC
Kek Boon Goh	Nanyang Technological University
Josep Maria Gras Ribot	UC, Colorado Springs
M. Gokhan Gunay	Trakya University
Ruize Hu	Vanderbilt University
Shiyan Jayanath	Clarkson University
Jiahua Jiang	University of Massachusetts Dartmouth
Kartik Josyula	Rensselaer Polytechnic Institute
Moon Soo Kang	Hongik University
Justin Kauffman	The Pennsylvania State University
Nayyan Kaul	North Carolina State University
Kenan Kergrene	École Polytechnique Montréal
Mehdi Khalloufi	Mines ParisTech
Elham Kheradmand Nezhad	École Polytechnique Montréal
Boyoung Kim	Hongik University, Republic of Korea
Mohammad Komijani	University of Waterloo
Andreas Krischok	Stanford University
Nikola Kuzmic	University of Toronto
Jae Lee	UNC Chapel Hill
Emma Lejeune	Stanford University
Tiange Li	University of California, Berkeley
Ji-Qin Li	University of Connecticut
Yingjie Liu	Duke University
Zixiang Liu	Georgia Institute of Technology
Jikai Liu	University of Pittsburgh
Dandan Lyu	University of California, Berkeley
Dominik Mattioli	The Ohio State University
Abdelkrim Merah	University of Boumerdes
Mostafa Mobasher	Columbia University
S. Muralikrishnan	The University of Texas at Austin
SeonHong Na	Columbia University
Hoang Nguyen	Northumbria University
Fabian Nick	Fraunhofer SCAI
Yannick A.D. Omar	RWTH Aachen University
Deniz Ozturk	Johns Hopkins University
Antonin Paquette-Rufiange	École Polytechnique Montréal
Aishwarya Pawar	Carnegie Mellon University

Poster Competition Participants:

Gregory Phlipot	California Institute of Technology
Naveen Prakash	Virginia Tech
Shivakanth Chary Puligilla	
Diamondra F.T. R. Ranjanoro	Yonsei University
William Schill	California Institute of Technology
Augustin Schmidt	École Polytechnique Montréal
Dingyi Sun	California Institute of Technology
Ilyass Tabiai	École Polytechnique Montréal
Krishna K. Talamadupula	Virginia Tech
Brandon Talamini	MIT
Gregory Teichert	University of Michigan
Ajith Ukwattage	Clarkson Univeristy
Ben Vadala-Roth	UNC Chapel Hill
Nicolas Venkovic	Johns Hopkins University
Javier Videla	University of Chile
Yongxiang Wang	Columbia University
Zhenlin Wang	University of Michigan
Haoran Wang	University of Illinois at UC
George Weber	Johns Hopkins University
Dylan Wood	The Ohio State University
Xuping Yang	
Qingcheng	U. of Pittsburgh & Penn State U.
Xiaoyu Zhang	Vanderbilt University
Xiang Zhang	Vanderbilt University
Rui Zhang	The University of Texas at Dallas
Xiaoxuan Zhang	Stanford University
Jiaxin Zhang	Johns Hopkins University
Yuqing Zhou	University of Michigan

Short Courses:

Pre-congress short courses are scheduled on Sunday, July 16, 2017 from 9:00 am to 4:00 pm at the Palais des Congrès de Montréal in 514B, 514C, 515B, and 515C. The following short courses are being offered for USNCCM14:

SC14-001: Peridynamics Theory of Solid Mechanics: Modeling, Computation, and Applications
Instructors: **Dr. John Foster, Dr. David Littlewood, and Dr. Pablo Seleson**

SC14-004: Discontinuous Petrov-Galerkin Method with Optimal Test Functions
Instructor: Dr. Leszek Demkowicz

SC14-005: 2D and 3D Modeling of River and Coastal Areas Hydrodynamics using TELEMAC
Instructors: **Drs. Riadh Ata and Dr. Sébastien Bourban**

SC14-008: Computational Phase-Field Modeling
Instructor: **Dr. Kris van der Zee**

Notes:

Notes:

Notes:

Notes:

Notes:

Notes:

Registration Package:

You will find in your registration package the following items:

1. **Foldable Backpack:** Compact, lightweight construction makes this an awesome bag for travel! Fold it into its own zippered pocket for easy storage or use it to pack for extras/souvenirs from your trip.

2. **Luggage Tag**: The luggage tag is attached to the backpack. You are encouraged to personalize it by writing your name on it. Markers are available at the registration desk.

3. **Stylus Pen:** Use it either as a stylus to scroll through the **Congress App** or as a "good ol' handwriting" pen to take notes.

4. **Plastic Envelop:** The envelop contains flyers, registration information, ...

5. **Bottle of Maple Syrup**: A special gift from Québec for your sweet tooth! The maple syrup has been especially prepared by the owners of the Cabane à Sucre Osias, which started in the early 1900's and is located in the region of Lanaudière, about one hour North of Montréal.

www.cabaneosias.com

Other Items:

Some USB flash drives and laser pointers will be available at the Registration Desk, if needed. Rooms will be provided with laser pointers. Finally, notebooks and notepads will be available on a self-serve basis at the Registration Desk.

Recycling:

We understand that some of the articles in your registration package will not be of any use for you or simply not to your taste.

No problem! However, for the sake of reducing waste, we would appreciate it if you could recycle the articles that you would like to discard rather than just throwing them in the basket of your hotel room…

You will find containers and baskets in 517A during the whole congress for recycling.

Thank you!

Food and Drinks:

There are many restaurants and cafés around the Palais des Congrès de Montréal. We have nevertheless compiled a few “Incontournables” for all taste for those who feel like exploring a bit further. **A more comprehensive list is also available on the congress website.**

Restaurants:

Mai Xiang Yuan, 1082 St Laurent Blvd, $$
Olive et Gourmando, 351 Saint-Paul St W, $
Niu Kee, 1163 Clark St, $$
Ikanos, 112 McGill St #1, $$
LOV Restaurant, 464 McGill St, $$
Stash Café, 200 Saint-Paul St W, $
Boustan, 2020 Crescent St, $
La Pizzaiolle, 600 Marguerite d'Youville St, $$
Ganadara, 1862 Maisonneuve Blvd W, $$
Lola Rosa Café, 545 Milton St, $$
Grenadine, 2004 Hôtel-de-Ville Ave, $$$$
Europea, 1227 de la Montagne St, $$$$
Burger Bar Crescent, 1465 Crescent St, $$
Schwartz’s Deli, 3895 St Laurent Blvd, $
Moishes, 3961 St Laurent Blvd, $$$$
O-Thym, 1112 de Maisonneuve Blvd E, $$$
Nil Blue, 3706 St Denis St, $$
Ma Poule Mouillée, 969 Rachel St E, $

Cafés and Bars:

Crew Collective & Café, 360 St Jacques St
Tommy, British Empire Building, 200 Notre-Dame St W
Café Olimpico, 419 St Vincent St
Café de Mercanti Old Montreal, 350 Notre-Dame St E #1
Café Osmo, 51 Sherbrooke St W
Café Santropol, 3990 St Urbain St

Terrasse Place D'Armes, 55 Saint-Jacques St, 8th floor, $$
Joverse, 52 St Jacques St, $$
Bistro-Brasserie Les Soeurs Grises, 32 McGill St, $$
Brasseur de Montréal, 1485 Ottawa St, $$
La Distillerie, 300 Ontario St E, $$
Réservoir, 9 Duluth Ave E, $$
N sur Mackay, 1244 Mackay St, $$
Dieu du Ciel!, 29 Laurier Ave W, $$

Cultural Activities in Montréal:

Montréal is internationally recognized for its many summer festivals, unique architecture, and hospitality. This year is also special because of **Montreal375** and **Canada150**. If you need any information about activities in Montréal and surroundings, feel free to ask one of the agents at the **Information Desk at the foot of the escalators** or at the **Desk specially set up for the congress by Tourisme Montréal nearby the Registration Desk.**

Below are some activities listed for each day of the week.
More information is also available on the congress website.

Saturday, July 15:
Comedy Festival Montréal Just For Laughs, Fantasia Film Festival, Festival International Nuits d’Afrique, Montréal Cirque Festival, Montreal International Fireworks Competition (Poland), Explosion 67–Terre des Jeunes

Sunday, July 16:
Comedy Festival Montréal Just For Laughs, Fantasia Film Festival, Festival International Nuits d’Afrique, Montréal Cirque Festival, Piknik Électronique, Tam Tams, Explosion 67–Terre des Jeunes, La Balade pour la Paix–Un Musée à Ciel Ouvert

Monday, July 17:
Comedy Festival Montréal Just For Laughs, Fantasia Film Festival, Festival International Nuits d’Afrique

Tuesday, July 18:
Comedy Festival Montréal Just For Laughs, Fantasia Film Festival, Festival International Nuits d’Afrique

Wednesday, July 19:
Comedy Festival Montréal Just For Laughs, Fantasia Film Festival, Festival International Nuits d’Afrique, Montréal International Fireworks Competition (Germany), Explosion 67–Terre des Jeunes, Montréal Avudo, McCord Museum

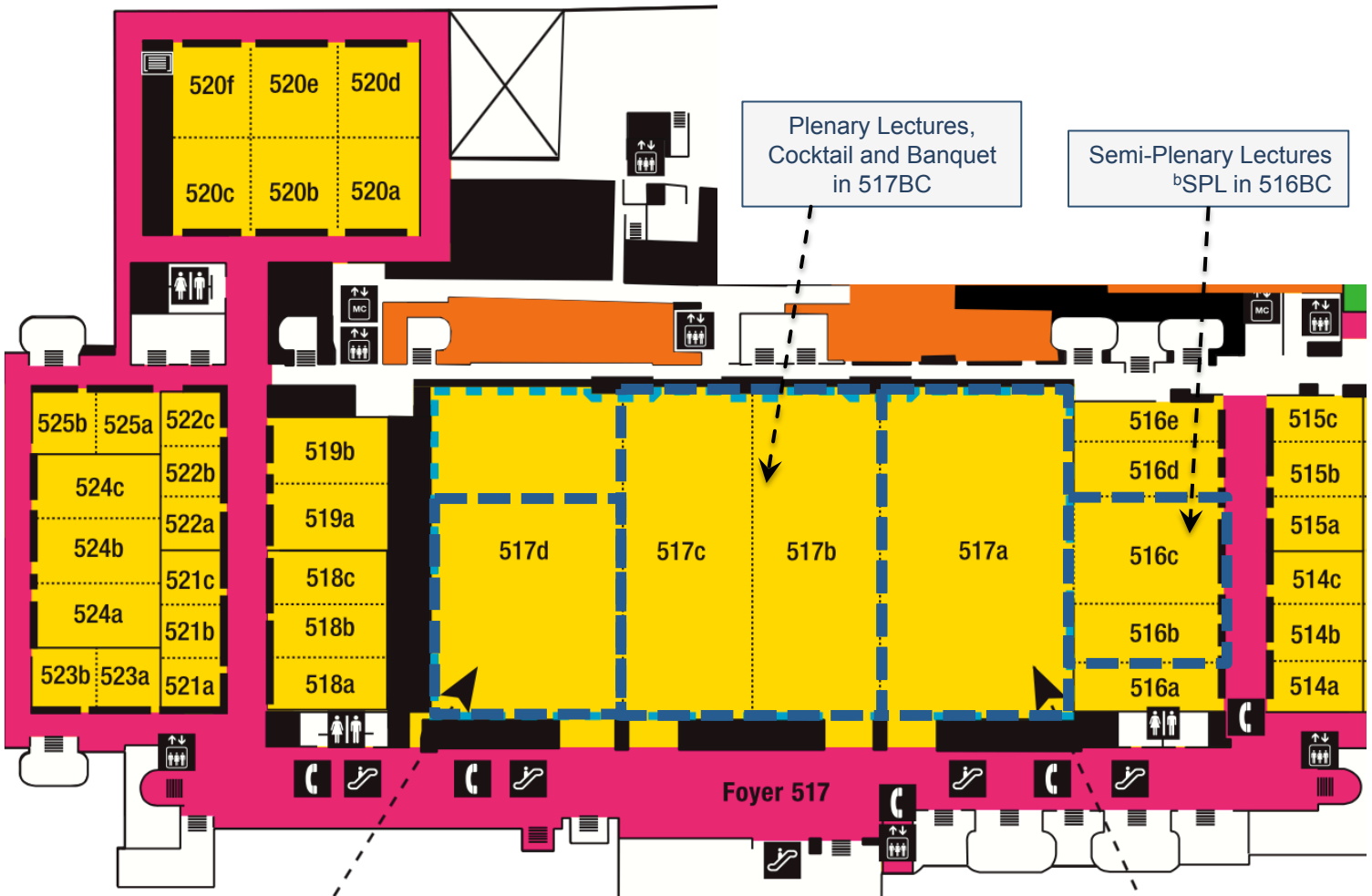
Thursday, July 20:
Comedy Festival Montréal Just For Laughs, Fantasia Film Festival, Festival International Nuits d’Afrique, Explosion 67–Terre des Jeunes, La Balade pour la Paix–Un Musée à Ciel Ouvert, Montréal Avudo

Friday, July 21:
Comedy Festival Montréal Just For Laughs, Fantasia Film Festival, Festival International Nuits d’Afrique, Explosion 67–Terre des Jeunes, Montréal Avudo, Soirées Country

Minisymposia at a Glance

Room	TS1	TS2	TS3	TS4	TS5	TS6	TS7	TS8	TS9	TS10
514A	1005	1005	1005	1101	1101		1101	1003	1003	1003
514B	108	108	108	108	106		1109	1104	1104	1104
514C	101	101	101	102	102			105	105	105
515A	104		103	103	103		103	107	107	107
515B	809	809		807	807		805	805	805	1001
515C	806	806	804	804	808		808	808	808	808
516A	001	001	001	001	001		001	1102	1102	001
516D	801	801	802	802	802		802	802	802	802
516E	813	813	813	813	813		803	812	812	
518A	708	708	708	707	707		707	707	706	
518B	406	406	406	401	401		401	401	401	401
518C	304	304	304	304	304		304	508	508	
519A	912	912	912	912	912		912	912	202	202
519B			605	605	605		605	605	605	
520A	201	201	201	201	201		206	206	206	206
520B			203	203	203		504	204	204	204
520C	205	205	301	301	301		301	301	301	301
520D	501	501	501	501	501		505	505	505	
520E	303	303	303	303	303		507	507	507	
520F	503	503		506	506		506	506	506	506
521BC	405	405	405	404	404		404	404	403	403
522A	902	902	902	913	913		905	1002		
522BC	901	901		901	302		915	915	915	915
523A	701	701	701		914		914	914	705	705
523B	702	709	709	916	916		916	904	904	904
524A	910	910	910	911	911		911	908	908	908
524B	903	903	903		1105		1105	1105	1105	1105
524C	601	601	601	601	602		602	602	602	
525A	703	703		710	710		402	402	402	402
525B	1108	1108	1108	1107	1107			603	603	

Convention Center 5th Floor



Plenary Lectures, Cocktail and Banquet in 517BC

Semi-Plenary Lectures [b]SPL in 516BC

Semi-Plenary Lectures [a]SPL in 517D

Entrance to Convention Center Congress Registration in Foyer

Coffee Breaks, Exhibitors, and Poster Session (TS6) in 517A


USACM


AHPCRC
Army High Performance Computing Research Center


POLYTECHNIQUE
MONTRÉAL


TOURISME /
MONTRÉAL


ELSEVIER


MICHIGAN INSTITUTE FOR
COMPUTATIONAL DISCOVERY & ENGINEERING
UNIVERSITY OF MICHIGAN


WILEY


Fraunhofer


ÉTS
Le génie pour l'industrie


siam


McGill