

AMMCS 2019

INTERNATIONAL CONFERENCE



CONFERENCE PROGRAM

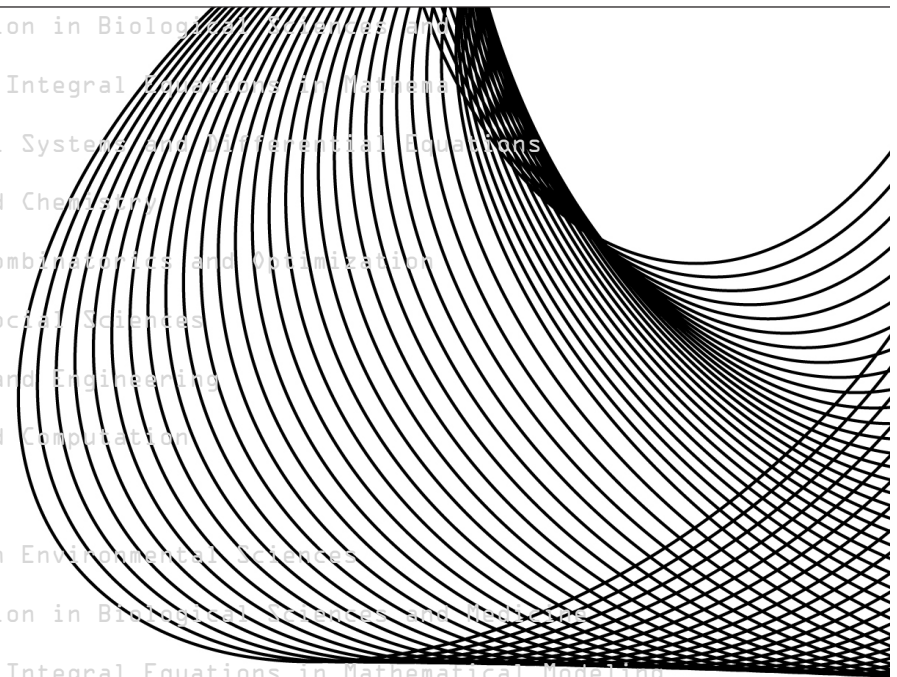
Program Chair
Herb Kunze



AUGUST 18-23

WATERLOO, ONTARIO, CANADA

Mathematics and Computation in Biological Sciences and
Partial Differential and Integral Equations in Medicine
Applications of Dynamical Systems and Differential Equations
Computational Physics and Chemistry
Computational Algebra, Combinatorics and Optimization
Mathematical Models in Social Sciences
Computational Mechanics and Engineering
Financial Mathematics and Computation
Statistical Modelling
Mathematical Modelling in Environmental Sciences
Mathematics and Computation in Biological Sciences and Medicine
Partial Differential and Integral Equations in Mathematical Modeling
Applications of Dynamical Systems and Differential Equations



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1. Acknowledgments

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2. Welcome

Welcome to the Vth AMMCS International Conference

On behalf of the Organizing, Scientific, and Technical Committees of the 2019 AMMCS International Conference, it is our pleasure to welcome you to this exciting event to be held from August 18 through 23, 2019 on the Waterloo Campus of Wilfrid Laurier University.

AMMCS-2019 is an international and interdisciplinary conference, the fifth in the series of AMMCS meetings held in Waterloo, Ontario, Canada. Since the first AMMCS meeting in 2011, the AMMCS Conference Series has aimed to promote interdisciplinary research and collaboration involving mathematical, statistical, and computational sciences within the larger international community, and to highlight recent advances in Applied Mathematics, Modeling and Computational Science.

This year the AMMCS Conference has an ambitious scientific program featuring

- 10 one-hour plenary presentations by distinguished mathematicians and scientists,
- about 40 special and contributed sessions in up to 7 parallel tracks,
- 5 semi-plenary and award speakers.

At the end of the Conference, student prizes and young researcher awards, including the AMMCS Kolmogorov-Wiener Prize for Young Researchers, will be presented. Starting on Monday 19 August, the morning and afternoon scientific programs will open with a plenary given by one of our distinguished plenary speakers.

The AMMCS-2019 scientific program has been designed to provide a unique opportunity for in-depth technical discussions and exchange of ideas in applied mathematics, statistical science, computational science, and mathematical modeling, including their applications in natural and social sciences, engineering and technology, industry, finance, economics, and management. We are proud that our Conference follows the AMMCS tradition of promoting interdisciplinary research.

The Conference venue is the Waterloo campus of Wilfrid Laurier University, the oldest university in the Cambridge-Kitchener-Waterloo-Guelph area. This beautiful part of Southwestern Ontario is a comfortable drive from some of North America's major tourist destinations, including the Niagara Escarpment (a UNESCO World Biosphere Reserve), Toronto and Niagara Falls.

On behalf of the Organizing, Scientific, and Technical Committees, we would like to thank everyone involved in the organization and of our event. In particular, we would like to express our sincere thanks to the special session organizers, to all the authors who submitted the valuable results that form the basis of the Conference, and to our sponsors. Thank you for helping to make AMMCS-2019 a dynamic, enjoyable, and professionally fulfilling event.

We hope that every attendee will have an opportunity to enjoy this beautiful part of the world. And we hope that AMMCS-2019 will be an intellectually inspiring and socially satisfying experience that you will take home with you.

Marc Kilgour, Roderick Melnik, and Sunny Wang
The Vth AMMCS International Conference General Chairs

3. Registration

The AMMCS Conference registration desk is located in Lazaridis Hall, Sunday through Friday. It will be staffed at the following times:

Day	Time	Location
Sunday, August 18	16:00-18:00 19:00-21:00	Lazaridis Hall Atrium
Monday, August 19	7:30-11:30 13:30-15:30	Lazaridis Hall Atrium
Tuesday, August 20	8:00-11:00 13:30-15:30	Lazaridis Hall Atrium
Wednesday, August 21	8:00-11:00 13:30-15:30	Lazaridis Hall Atrium
Thursday, August 22	8:00-11:00 13:30-15:30	Lazaridis Hall Atrium
Friday, August 23	8:00-11:00	Lazaridis Hall Atrium



4. Information

Hyperlinks	Other than in this remark, <ul style="list-style-type: none">• blue text signifies hyperlinks within this document• magenta text signifies external hyperlinks	
Wireless Network	Conference delegates have free wireless internet service on the Wilfrid Laurier University campus.	For connection information and to obtain a password <ul style="list-style-type: none">• please go to the registration desk.
Computers	Room LH3034 contain four computers that are available for use by Conference delegates.	For login information <ul style="list-style-type: none">• please go to the registration desk.
Parking	Conference delegates have the following parking options. Pay & Display parking is available, seven days a week, in Lots 4, 10, 20, & 33. Please refer to a campus map for these locations. Metered parking is available in Lot 3A. There is street parking available as per signage indicated.	Pay & Display can be accessed for \$3/hour (with a seven (7) minute time minimum) or a \$10/day flat rate (from 7:00-23:00). The machine accepts quarters, one and two dollar coins, Visa, and Mastercard. Meters in lot 3A accept credit card payments. Please be advised that this parking is monitored by the City of Waterloo and there is a three-hour maximum.
Public Transit	Wilfrid Laurier University is serviced by routes 7, 8, 12, 29, 200, and 201 on University Ave. West and King St. North. The ION light train (Route 301) stops at the nearby Laurier–Waterloo Park Station.	Route maps are available at <ul style="list-style-type: none">• the registration desk• www.grt.ca. If you interested in trying the train or exploring Kitchener-Waterloo, see the ION light train system map.

For more details on Visitor Parking Options, please visit the [WLU Website](#).

5. Events

([Campus Maps](#))

Day	Time	Event	Location	Details
Sunday August 18	19:00-21:00	Welcoming Reception	Lazaridis Hall Atrium	An informal social get-together, with food and drinks served. A conference registration table will be open.
Tuesday August 20	13:00-13:30	Maplesoft Session	LH1001	See next page (to come)
Wednesday August 21	9:30-10:00 14:30-15:00	Conference Poster Session	Lazaridis Hall atrium	Poster sessions over Wednesday's coffee breaks
Thursday August 22	12:00-12:30	Conference Photo Shoot	Lazaridis Hall Atrium	Meet in Lazaridis Hall atrium the Conference photo shoot
Thursday August 22	18:30-22:00	Conference Banquet Dinner	The Delta Hotel 110 Erb Street West (Directions)	Banquet tickets will be part of your registration package if you purchased them in advance. Tickets will also be available for purchase at the registration desk until 15:30 on Wednesday, August 21, at a cost of \$60 plus HST. Parking at the hotel is complimentary. Reception starts at 18:30, and banquet itself starts at 19:00.
Friday August 23	16:30-17:00	Conference Prizes, Closing	LH1009	Announcement and awarding of the Conference Prizes, and the closing of the Conference.

Join us for a Maple Presentation at AMMCS 2019!

Maple™ is math software that combines the world's most powerful math engine with an interface that makes it extremely easy to analyze, explore, visualize, and solve mathematical problems. Mathematicians and scientists around the world use Maple in their research to advance knowledge and better understand the world around us.



AMMCS Presentation: Applications of Maple

Speaker: Daniel Skoog, Maple Product Manager, Maplesoft

Tuesday August 20, 2019

1:00 pm - 1:30 pm

Lazaridis Hall, LH1001

In the past three decades, Maple has evolved from a symbolic computation engine to a fully featured mathematics software package that includes natural math notation for input and output, easy-to-use tools for creating interactive documents, and a vast library of commands for mathematical, scientific and engineering computations. In this talk, Maplesoft staff will provide a brief overview of Maple and demonstrate several applied examples.

Maple: A Powerful Research Tool

- **Over 5000 functions covering virtually every area of mathematics**, including algebra, differential equations, statistics, calculus, linear algebra, graph theory, differential geometry, number theory, and much more
- **Symbolic, numeric, and hybrid** computation algorithms
- **World-leading algorithms** for solving problems that are beyond the reach of any other software system
- **Sophisticated 2-D and 3-D plotting** and animations
- Efficient algorithms and tools for **high performance computing** and large-scale problem solving
- **Sophisticated programming language** designed for mathematics
- **Rich authoring environment** for creating technical documents and applications

6. Conference Student Prizes and Young Researcher Award

The Conference Prizes will be announced and awarded at the closing of the Conference on Friday, August 23, 16:30-17:00, in LH1009.

There are four student prizes, open to undergraduate and graduate students, described in the following table.

AMMCS 2019 Prize	Description: To be eligible,
Best Poster	the student must be a co-author of the work presented and a designer of the poster. This competition will include a 10-minute discussion related to the content of the poster with a judging panel.
Best Student Paper in a Special Session (SS)	the student must be a co-author of the work and present it during a special session or minisymposium.
Best Student Paper in a Contributed Session (CS)	the student must be a co-author of the work and present it during a contributed session.

One additional award is open to young researchers, meaning recent Ph.D. graduates and postdoctoral fellows under the age of 35.

AMMCS 2019 Award	Description: To be eligible,
Kolmogorov-Wiener Prize for Young Researchers	the young researchers must <ol style="list-style-type: none">have earned their PhD degrees within 5 years of January 1 of the year of the award;have at least two peer refereed publications, minimum one of which has appeared in an internationally recognized journal;have presented their talks at an AMMCS event in the year of the award.

7. Conference Plenary Lectures

Monday, August 19, 9:00-10:00, in Room LH1001

Ariel Procaccia, Carnegie Mellon University

About the speaker: Ariel Procaccia is an Associate Professor in the Computer Science Department at Carnegie Mellon University. He works on a broad and dynamic set of problems related to AI, algorithms, economics, and society. His distinctions include the Social Choice and Welfare Prize (2020), a Guggenheim Fellowship (2018), the IJCAI Computers and Thought Award (2015), and a Sloan Research Fellowship (2015). To make his research accessible to the public, he has founded the not-for-profit websites Spliddit.org and RoboVote.org, and has written op-eds for the Washington Post, Wired, and Bloomberg (where he is a regular contributor).



Putting Ethical AI to the Vote

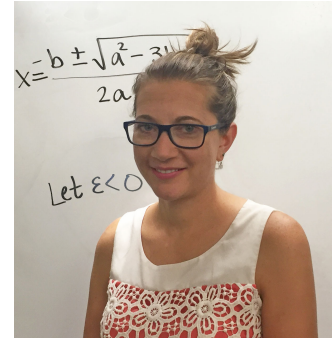
I will present the “virtual democracy” framework for the design of ethical AI. In a nutshell, the framework consists of three steps: first, collect preferences from voters on example dilemmas; second, learn models of their preferences, which generalize to any (previously unseen) dilemma; and third, at runtime, predict the voters’ preferences on the current dilemma, and aggregate these virtual “votes” using a voting rule to reach a decision. I will focus on two instantiations of this approach: a proof-of concept system that decides ethical dilemmas potentially faced by autonomous vehicles, and a decision support tool designed to help a Pittsburgh-based nonprofit allocate food donations to recipient organizations. These projects bridge AI, social choice theory, statistics, and human-computer interaction; I will discuss challenges in all of these areas.

Conference Plenary Lectures

Monday, August 19, 14:00-15:00, in Room LH1001

Deanna Needell, University of California Los Angeles

About the speaker: Deanna Needell earned her PhD from UC Davis before working as a postdoctoral fellow at Stanford University. She is currently a full professor of mathematics at UCLA. She has earned many awards including the IEEE Best Young Author award, the Hottest paper in Applied and Computational Harmonic Analysis award, the Alfred P. Sloan fellowship, an NSF CAREER and NSF BIGDATA award, and the IMA prize in Applied Mathematics. She was a research professor fellow at MSRI last Fall and is now a (semi-) long term visitor at Simons this Fall. She also serves as associate editor for IEEE Signal Processing Letters, Linear Algebra and its Applications, the SIAM Journal on Imaging Sciences, and Transactions in Mathematics and its Applications as well as on the organizing committee for SIAM sessions and the Association for Women in Mathematics.



Simple Approaches to Complex Data with Lyme Application

Recent advances in technology have led to a monumental increase in large-scale data across many platforms. One mathematical model that has gained a lot of recent attention is the use of sparsity. Sparsity captures the idea that high dimensional signals often contain a very small amount of intrinsic information. Using this notion, one may design efficient low-dimensional representations of large-scale data as well as robust reconstruction methods for those representations. Binary, or one-bit, representations of data for example, arise naturally in many applications, and are appealing in both hardware implementations and algorithm design. In this talk, we provide a brief background to sparsity and 1-bit measurements, and present new results on the problem of data classification with low computation and resource costs. We illustrate the utility of the proposed approach on recently acquired data about Lyme disease.

Conference Plenary Lectures

Tuesday, August 20, 8:30-9:30, in Room LH1001

Fioralba Calkoni, Rutgers University

About the speaker: Fioralba Calkoni is a professor in the Department of Mathematics at Rutgers University, New Brunswick. Prior to coming to Rutgers, she was an Alexander von Humboldt scholar at the University of Stuttgart (1998-2000), and held faculty positions at the University of Delaware (2000-2015). Her research focuses on inverse problems for partial differential equations and inverse scattering theory. She is on the editorial boards of SIAM J. Applied Math, SIAM J. Math Analysis, Inverse Problems, Inverse Problems and Imaging, and J. of Integral Equations and Applications. She is a co-author of four research monographs on topics in inverse scattering theory, two published by Springer and two in the CBMS-NSF Regional Conference Series in Applied Mathematics. She was an invited lecturer at College de France (2011) and a plenary speaker in the 9th Applied Inverse Problems International Conference (2016). She is Simons Fellow in Mathematics and Fellow of American Mathematical Society.



A New Approach to Inverse Scattering for Anisotropic Media

In the past thirty years the field of inverse scattering theory has become a major theme of applied mathematics with applications to such diverse areas as medical imaging, geophysical exploration and nondestructive testing. The growth of this field has been characterized by the realization that the inverse scattering problem is both nonlinear and ill-posed, thus presenting particular problems in the development of efficient inversion algorithms. Although linearized models continue to play an important role in many applications, the increased need to focus on problems in which multiple scattering effects can no longer be ignored has led to the nonlinearity of the inverse scattering problem playing a central role. In addition, the possibility of collecting large amounts of data over limited regions of space has led to the situation where the ill-posed nature of the inverse scattering problem becomes a problem of central importance. Initial efforts to deal with the nonlinear and ill-posed nature of the inverse scattering problem focused on the use of nonlinear optimization methods. Although efficient in many situations, their use suffers from the need for strong a priori information in order to implement such an approach. In addition, recent advances in material science and nanostructure fabrications have introduced new exotic materials for which full reconstruction of the constitutive parameters from scattering data is challenging or even impossible. In order to circumvent these difficulties, a recent trend in inverse scattering theory has focused on the development of a new approach, in which the amount of a priori information needed is drastically reduced but at the expense of obtaining only limited information of the scatterers.

In this talk we present an overview of the aforementioned new ideas in the context of solving the inverse scattering problem for anisotropic inhomogeneous media. Our approach exploits properties of the linear scattering operator to decode non-linear information about the scattering medium, yielding mathematically justified and computationally simple reconstruction algorithms. We first show that the support of the scattering media can be rigorously characterized from the range of the scattering operator. The mathematical study of this operator is based on the analysis of a non-selfadjoint eigenvalue problem known as the transmission eigenvalue problem. Transmission eigenvalues relate to interrogating frequencies for which there is an incident field that does not scatter. We show that the transmission eigenvalues can be determined from the scattering data and provide information on the constitutive properties of the scattering media. Numerical examples will be presented to confirm the viability of our reconstruction algorithms.

Conference Plenary Lectures

Tuesday, August 20, 13:30-14:30, in Room LH1001

William Thomson, University of Rochester

About the speaker: William Thomson is the Elmer B. Milliman professor of Economics at the University of Rochester. He has also taught at the University of Minnesota, Harvard University, the University of Caen, and the Paris School of Economics. He is the author of over one hundred articles and several books including, *Axiomatic Theory of Bargaining with a Variable Number of Agents* (Cambridge University Press, 1989), co-authored with T. Lensberg, *A guide for the Young Economist* (M.I.T. Press, 2001; 2nd edition, 2011; translated into four languages), *How to Divide when There isn't enough: from Aristotle, the Talmud, and Maimonides to the Axiomatics of Resource Allocation* (Cambridge University Press, 2019), *Consistent Allocation Rules* (Cambridge University Press, 2019). He has been the Ph.D advisor of over 50 students. He has served on the board of editors of numerous journals, and was editor-in-chief of the *International Journal of Game Theory*. He is a Fellow of the Econometric Society, a Fellow of the Society for Economic Theory, and a Fellow of the Game Theory Society. He was President of the Society for Social Choice and Welfare in 2004-2006. His research deals with cooperative game theory, in particular bargaining theory, and the normative and strategic analysis of resource allocation problems, with a focus on fairness and incentive compatibility.



Claims Problems, a Progress Report

When a firm goes bankrupt, how should its liquidation value be divided among its creditors? More generally, when a group of people have claims on a resource but there isn't enough of it to fully honor all of these claims, what should be done? The literature on the "adjudication of conflicting claims," which builds upon fascinating examples from antiquity and medieval times, has experienced a considerable development in the last few years. I will provide a short introduction to it and give a progress report on the recent research on the subject. The approach I will follow is mainly axiomatic. It starts with the formulation of elementary properties of allocation rules and seeks to understand the implications of these properties, when imposed in various combinations.

Conference Plenary Lectures

Wednesday, August 21, 8:30-9:30, in Room LH1001

Eric Cancès, École des Ponts ParisTech

About the speaker: Eric Cancès is a professor at École des Ponts ParisTech and the head of the Applied Mathematics department. He is also affiliated to Inria Paris. He graduated from École Polytechnique (engineering degree, 1992), École des Ponts ParisTech (PhD, 1998) and University Paris Dauphine (habilitation, 2003). His research focuses on quantum and classical molecular simulation, in particular on Density Functional Theory, implicit solvent models for quantum chemistry and molecular biology, and electronic structure models for materials science. He is a member of the editorial boards of ESAIM: Mathematical Modeling and Numerical Analysis, SIAM Journal of Scientific Computing, Multiscale Modeling and Simulation (SIAM MMS), and Journal of Computational Mathematics. He was awarded the Blaise Pascal Prize in 2009, and the Dargelos Prize in 2017. He was an invited lecturer at the International Congress of Mathematicians in 2014. He is one of the four PIs of the European Research Council (ERC) Synergy grant EMC2 (Extreme-scale Mathematically-based Computational Chemistry).



Molecular-scale modeling and simulation of materials

Molecular-scale modeling and simulation is one of the most dynamics area of scientific computing. It has a very broad field of applications, ranging from chemistry and drug design to solid-state physics, materials science and nanotechnology.

It is also a inexhaustible source of exciting mathematical and numerical problems of various nature: linear and nonlinear partial differential equations, optimization and control, stochastic processes and Monte Carlo methods, spectral theory, group theory, non-commutative algebra and geometry, statistical methods and machine learning...

In this talk, I will give an overview of some mathematical models and numerical methods used to predict macroscopic properties of a material from its atomic structure. I will first present the case of perfect crystals, where e.g. band structure diagrams constructed from Bloch-Floquet theory allow us to understand the difference in behavior between conductors, semiconductors, and insulators, as well as some of the properties of emerging topological materials. I will then discuss recent advances in the challenging field of modeling and simulating disordered systems such as crystals with defects, doped semiconductors, glasses, quasicrystals, or multilayer 2D materials.

Conference Plenary Lectures

Thursday, August 22, 8:30-9:30, in Room LH1001

Peter Kloeden, University of Tuebingen

About the speaker: Peter Kloeden completed his Ph.D. and D.Sc. at the University of Queensland, Australia in 1975 and 1995. He was until recently a professor of mathematics at the Goethe University in Frankfurt am Main and then research professor of mathematics at the Huazhong University of Science & Technology in China. He now lives in Tuebingen. He has wide interests in the applications of mathematical analysis, numerical analysis, stochastic analysis and dynamical systems. Professor Kloeden is the coauthor of several influential books on nonautonomous dynamical systems, metric spaces of fuzzy sets, and in particular “Numerical Solutions of Stochastic Differential equations” (with E. Platen) and “Random Ordinary Differential Equations and Their Numerical Solution” (with Xiaoying Han) published by Springer in 1992 and 2017. He is a Fellow of the Society of Industrial and Applied Mathematics and was awarded the W.T. & Idalia Reid Prize in 2006. His current interests focus on nonautonomous and random dynamical systems and their applications in the biological sciences.



Random ordinary differential equations and their numerical approximation

Random ordinary differential equations (RODEs) are pathwise ordinary differential equations that contain a stochastic process in their vector field functions. They have been used for many years in a wide range of applications, but have been very much overshadowed by stochastic ordinary differential equations (SODEs). The stochastic process could be a fractional Brownian motion, but when it is a diffusion process there is a close connection between RODEs and SODEs through the Doss-Sussmann transformation and its generalisations, which relate a RODE and an SODE with the same (transformed) solutions. RODEs play an important role in the theory of random dynamical systems and random attractors. They are also useful in biology.

Classical numerical schemes such as Runge-Kutta schemes can be used for RODEs but do not achieve their usual high order since the vector field does not inherit enough smoothness in time from the driving process. It will be shown how, nevertheless, Taylor expansions of the solutions of RODEs can be obtained when the stochastic process has Hölder continuous sample paths and then used to derive pathwise convergent numerical schemes of arbitrarily high order. RODEs with Ito noise will also be considered as well as RODEs with affine structure and Poisson noise. Applications to biology will be given.

Xiaoying Han and P. E. Kloeden, Random Ordinary Differential Equations and their Numerical Solution, Springer Nature Singapore, 2017.

Conference Plenary Lectures

Thursday, August 22, 13:30-14:30, in Room LH1001

Matt Davison, Western University

About the speaker: Matt Davison earned his PhD in Applied Mathematics from Western University in 1995, and worked at the University of Bern and at Deutsche Bank before returning to Western as a faculty member in 1999. Matt has written numerous papers in the area of financial mathematics, industrial mathematics, and energy real options. Matt is exceptionally proud of the more than 20 PhD students and more than 50 Master's students he has mentored who now hold roles in Banking, Industry, and Academia. Matt held the Canada Research Chair in Quantitative Finance between 2006 and 2016 and is a Fellow of the Fields Institute for Research in the Mathematical Sciences. After holding a number of leadership roles at Western, Matt has been Dean of Science at Western since July 2018.



Real Options and Differential Games in Commodity Finance

Process Industries such as Mining, Energy, and Commodity Processing are the historical foundation of the Canadian economy. These industries typically utilize long-lived, expensive and large pieces of infrastructure. The profitability of projects in these industries depends on prices set on world commodity markets, but project operators often have considerable optionality in deciding when to open, close, run, or idle facilities. The question is, how to optimally utilize this operational flexibility and how to value projects in the face of it. The resulting problems are mathematically quite similar to American Options problems from traditional Quantitative Finance, but often involve more complicated modelling around cost structures to idle a run plant or to restart an idled plant. In addition, particularly in rather local energy markets, the impact of idling a plant can significantly impact market prices, leading to interesting multi-player dynamic, or differential, games.

This talk will focus on the mathematical, economic, and financial insights my co-workers and I have found over nearly 20 years of working in this area, in areas including hydroelectric power, to natural gas storage, to corn ethanol production, to shipping of oil and liquefied natural gas.

Conference Plenary Lectures

Friday, August 23, 8:30-9:30, in Room LH1001

Lisa Lix, University of Manitoba

About the speaker: Dr. Lisa Lix is Professor and Tier I Canada Research Chair in Methods for Electronic Health Data Quality in the Department of Community Health Sciences, Max Rady College of Medicine, University of Manitoba. She is also Director of the Data Science Platform in the George & Fay Yee Centre for Healthcare Innovation (CHI), a collaboration between the Winnipeg Regional Health Authority and the University of Manitoba. Her team of 30+ faculty, staff and trainees have expertise in biostatistics, bioinformatics, and clinical database development; they focus on providing methodological research, training, and consulting services to strengthen patient-oriented research in Manitoba. Dr. Lix's areas of research expertise include methods to address bias and error in electronic health databases, statistical methods for patient-reported outcomes, and longitudinal data analysis. She is a prolific researcher who has published more than 325 scholarly papers and mentored more than 40 trainees. Dr. Lix is a member of the Board of Directors of the Statistical Society of Canada, Program Chair for the Society's 2019 meeting in Calgary, Co-Chair of the Data Quality Working Group for the Canadian Chronic Disease Surveillance System, and Program Chair-Elect for the 2020 Joint Statistical Meetings Health Policy Statistics Section. Foundation.



Quality of Electronic Health Databases for Real-World Evidence Studies

Canada is a world leader in the creation, linkage, and use of population-based electronic health databases to support healthcare decision making. However, there are challenges in using electronic health databases to improve our understanding of health. These databases were developed to monitor patient care and manage the healthcare system; they were not intended to be used for research. Accordingly, the information contained in electronic health databases is often of poor quality for real-world studies; it lacks standardization and documentation, and frequently contains inaccurate and inconsistent information. In this talk, methods to combine electronic health data from multiple sources or time periods to improve the accuracy of health measures will be discussed, including imputation models, latent variable models, and various approaches to data validation. Activities to automate data quality evaluations will be described. Examples from provincial and national chronic disease research and surveillance projects will be used to illustrate the challenges and opportunities.

Conference Plenary Lectures

Friday, August 23, 13:30-14:30, in Room LH1001

Edward Boyden, Massachusetts Institute of Technology

About the speaker: Ed Boyden is Y. Eva Tan Professor in Neurotechnology at MIT, associate professor of Biological Engineering and Brain and Cognitive Sciences at MIT's Media Lab and McGovern Institute for Brain Research, and was recently selected to be an Investigator of the Howard Hughes Medical Institute (2018). He leads the Synthetic Neurobiology Group, which develops tools for analyzing and repairing complex biological systems such as the brain, and applies them systematically to reveal ground truth principles of biological function as well as to repair these systems. These technologies include expansion microscopy, which enables complex biological systems to be imaged with nanoscale precision; optogenetic tools, which enable the activation and silencing of neural activity with light; robotic methods for directed evolution that are yielding new synthetic biology reagents for dynamic imaging of physiological signals; novel methods of noninvasive focal brain stimulation; and new methods of nanofabrication using shrinking of patterned materials to create nanostructures with ordinary lab equipment. He co-directs the MIT Center for Neurobiological Engineering, which aims to develop new tools to accelerate neuroscience progress.



Tools for Mapping and Controlling the Brain

To enable the understanding and repair of complex biological systems such as the brain, we are creating novel optical tools that enable molecular-resolution maps of large scale systems, as well as technologies for observing and controlling high-speed physiological dynamics in such systems. These tools may enable datasets for precision modeling and control of the brain, at a computational level. First, we have developed a method for imaging large 3-D specimens with nanoscale precision, by embedding them in a swellable polymer, homogenizing their mechanical properties, and exposing them to water – which causes them to expand isotropically manyfold. This method, which we call expansion microscopy (ExM), enables scalable, inexpensive diffraction-limited microscopes to do large-volume nanoscopy, in a multiplexed fashion – important, for example, for brain mapping. Second, we have developed a set of genetically-encoded reagents, known as optogenetic tools, that when expressed in specific neurons, enable their electrical activities to be precisely driven or silenced in response to millisecond timescale pulses of light. We have also begun to develop noninvasive ways to electrically stimulate deep targets in the human brain. Finally, we are developing novel reagents, such as fluorescent voltage indicators, and systems, such as novel microscope architectures, to enable the imaging of fast physiological processes in 3-D with millisecond precision. In this way we aim to enable the systematic mapping, control, and dynamical observation of complex biological systems like the brain, with the ultimate goal of enabling detailed computational models of brain circuits and computational principles of neural control.

8. Conference Semi-Plenary Lectures

Tuesday, August 20, 10:00-11:00, in Room LH2066

Jon Sorenson, Butler University

About the speaker: Jonathan Sorenson graduated from the University of Wisconsin-Madison in 1991 with a Ph.D. in Computer Science and an M.S. in Mathematics. He has taught at Butler University in Indianapolis, Indiana since then. He was promoted to Professor in 2004 and became chair of Computer Science and Software Engineering in 2005. Jon won college-level awards as Natural Science Faculty Member of the Year in 2007, and Outstanding Teacher in 2014. Jon's research focuses on the design and analysis of sequential and parallel algorithms for problems in number theory, including computing integer greatest common divisors, counting smooth numbers, and sieving for primes, pseudoprimes, pseudosquares, and perfect powers. He recently served as co-chair of the program committee and co-editor of the proceedings volume for ANTS XIII.



New Results on the Erdős-Selfridge Function $g(k)$

Let $g(k)$ be the smallest integer larger than $k + 1$ such that the binomial coefficient $C(g(k), k)$ has no prime divisors $\leq k$. So for example, we have $g(2) = 5$, since $C(5, 2) = 15$, and 15's smallest prime divisor is 3. Also we have $g(3) = g(4) = 7$, since $C(7, 3) = C(7, 4) = 35$, and 35's smallest prime divisor is 5. The problem of estimating $g(k)$ has interested number theorists since Paul Erdős introduced the problem back in 1969. For example, Richard Guy mentions the problem in his well-known book *Unsolved Problems in Number Theory*. Ecklund, Erdős, and Selfridge published the first paper on this problem back in 1974, where they proved upper and lower bounds on $g(k)$, stated several conjectures on its behavior, and tabulated $g(k)$ for k up to 40, plus $g(42)$, $g(46)$, and $g(52)$. The best current upper bound, $g(k) < \exp[k(1 + o(1))]$, is from this same 1974 paper. The best current lower bound, $g(k) > \exp[c(\log k)^2]$ for an absolute constant $c > 0$, is due to Konyagin (1999). Others who published lower bounds for $g(k)$, all in the 1990s, include Lacampagne, Granville, and Ramaré. Scheidler and Williams (1992) described how to use Kummer's theorem to construct a sieving algorithm to compute $g(k)$, and computed $g(k)$ for all $k \leq 140$. Finally, Lukes, Scheidler, and Williams (1997) improved their sieve and computed $g(k)$ for all $k \leq 200$. A complete table of known values of $g(k)$ is available from the Online Encyclopedia of Integer Sequences (A003458) at <https://oeis.org/A003458/>.

In this talk, we present some new results and work-in-progress on $g(k)$. We have a new sieve algorithm to compute $g(k)$, based on a wheel datastructure that was used previously to find pseudosquares, pseudoprimes, and primes in patterns. This algorithm runs in time sublinear in $g(k)$, and we used it to find $g(k)$ for all k up to 272 so far. In particular we have $g(272) = 57\ 61284\ 34192\ 78614\ 55093\ 37498$.

Let $M = M(k)$ be the product of the primes $p \leq k$, raised to the power $\lfloor \log_p k \rfloor + 1$, and let $R = R(k)$ be the number of acceptable residues modulo M under Kummer's theorem. Our unproven Uniform Distribution Heuristic states that the smallest acceptable residue modulo M is roughly M/R , which implies that $\log g(k) = \log(M/R) + O(\log k)$ with high "probability". We then show unconditionally that $\log(M/R)$ is roughly $k/\log k$, or more specifically, that the ratio of $\log(M/R)$ over $k/\log k$ is, in the limit, at least $(1 - \log 2)/2$, and at most 2. The data from our computations supports this so far, and in fact, our data implies that $g(k) \approx \exp[1.19k/\log k]$.

This is joint work with Brianna Sorenson (undergraduate student) and Jonathan Webster, both of Butler University.

Tuesday, August 20, 15:00-16:00, in Room LH1011

Edward R. Vrscay, University of Waterloo

About the speaker: Edward R. Vrscay has been Professor of Applied Mathematics at the University of Waterloo since 1994 and is the founder of the “Waterloo Fractal Analysis and Coding Project.” Having “grown up” in the area of mathematical physics/quantum mechanics, Ed’s research activities have included: (1) dynamical systems theory and applications, (2) mathematical imaging (e.g., nonlocal image processing, fractal-based image coding methods and their applications, models of local self-similarity of images), mathematical study of image quality measures (e.g., “structural similarity”), novel spaces of image functions, e.g., measure- and function-valued image mappings, and their applications (hyperspectral imaging, dMRI), “diagnostically lossless” medical image compression, (3) fractal-based methods of analysis and approximation (e.g., iterated function systems, “generalized fractal transforms” and associated inverse problems). He is a co-author of “Fractal-Based Methods in Analysis” (Springer 2012). More recently, Ed and colleagues/students developed a general algorithm to construct conformable tubular networks which occupy arbitrary regions in R^3 , as part of an NSERC Collaborative Research and Development Grant with Fiat Chrysler Automotive Canada as the industrial sponsor.



The “Waterloo Fractal Analysis and Coding Project”: Generalized fractal transforms, contraction maps and associated inverse problems

Originally inspired by the work of B. Mandelbrot, who showed that classic “fractal sets” could be viewed as unions of contracted copies of themselves, as well as the idea of generating fractal sets using systems of contraction mappings, our “Waterloo Fractal Analysis and Coding Project” has, over the past 30 years, been interested in “generalized fractal transforms” (GFTs) over various spaces. A GFT, T , defined on a complete metric space (X, d) acts on an element $x \in X$ in the following “fractal-like” way: It first makes N modified copies of x (e.g., spatially-contracted, range-transformed and translated), then combines these “fractal components,” x_i , in a manner appropriate to the space X , to produce a new element $y = Tx$.

Under certain conditions, the operator T is contractive on X which, from Banach’s Fixed Point Theorem, implies the existence of a unique fixed point $p = Tp$. From the action of T , p is “self-similar” in the sense that it is an appropriate combination of modified copies of itself.

In the 1990’s, fractal image coding naturally led to the formulation of GFTs on various function spaces. This naturally leads to associated GFTs on Fourier and wavelet transforms. More recently, we have looked at GFTs on multifunctions, as well as function- and measure-valued mappings, both of which have applications in image processing, as will be briefly discussed.

We also have been concerned with the following inverse problems associated with contraction mappings: Let $Con(X)$ be a class of contraction maps on a complete metric space (X, d) (e.g. GFT’s). Then given an $x \in X$, can one find a map $T \in Con(X)$ with fixed point p sufficiently close to x ? This is the essence of fractal image coding and compression: We approximate an image x with p and then store the parameters that define T – the so-called “fractal code” of x . The approximation p can then be generated by iteration. Fractal image coding seems to work, in other words, images do possess a kind of self-similarity, which will be discussed briefly.

However, finding a map T by trying to make the approximation error $d(x, p)$ small is generally intractable. Thanks to a very simple consequence of Banach’s Theorem – known in the fractal coding literature as the “Collage Theorem” – one looks for a contractive map T that minimizes the so-called “collage distance” $d(x, Tx)$.

Such collage-based methods are also applicable in “nonfractal” situations, for example, inverse problems in ODEs, PDEs and inclusions. In fact, it didn’t take long for the “nonfractal” applications to outnumber the “fractal” ones!

Wednesday, August 21, 15:00-17:00, in Room LH1010

Colleagues, Friends, & Family of F. Diacu



A tribute to our colleague and friend Florin Diacu

In February 2018 Florin Diacu passed away. He was an energetic member of the celestial mechanics community, a gifted writer, a father and a husband. His work was awarded the 2015 SIAM Crawford Prize for his “novel approach to the n -body problem in curved space, blending dynamical systems, differential geometry, and geometric and celestial mechanics in a lucid, inspirational manner”. This presentation is dedicated to Florin’s journey in life. We will recall some of his prominent accomplishments and events that marked his presence among us.

Thursday, August 22, 10:00-11:00, in Room LH1011

Daniel Onofrei, University of Houston

About the speaker: Dr. Daniel Onofrei, obtained his BS in 2001 in Pure Mathematics at the University Alexandru Ioan Cuza, in Romania, followed with his Master in Industrial Mathematics in 2003 and PhD in Applied Mathematics in 2007 at the Worcester Polytechnic Institute, MA, then held postdoctoral positions in the Mathematics Departments at Rutgers University and University of Utah. Since 2011 he joined University of Houston as an assistant professor and since 2016 became associate professor in the Mathematics Department with a joint appointment in Electrical and Computer Engineering department. Dr. Onofrei research interests are in inverse problems in acoustics and electromagnetism, optimization, control of wave phenomena and multi-scale analysis of metamaterials, and he has held several honorary invited position, published over 30 peer reviewed journal papers, delivered 10 keynote presentations and over 50 conference presentations.



Field control in exterior regions through surface sources

In this talk we will present our results concerning the problem of exterior field control through surface currents with applications to pattern synthesis, scattering cancellation and design of essentially non-radiating sources. We will first offer a brief review of our existent results concerning the control of scalar fields and then discuss how these controls can be used for Maxwell fields. We will then present current results for the control of the electromagnetic fields together with numerical simulations for various applied scenarios.

9. AMMCS Prize-Winning Lecture

Kolmogorov-Wiener Prize for Young Researchers

Wednesday, August 21, 13:30-14:30, in Room LH1001

David Emerson, Street Contxt & Tufts University

About the speaker: David Emerson is a Computational Scientist at Street Contxt in Toronto and a Visiting Research Scholar at Tufts University. Originally from Vermont, he studied mathematics and computer science at Boston College, receiving his BS in 2009. Continuing at Boston College, he earned an MA in Mathematics and an MBA in 2012. In 2015, he obtained his PhD in Applied Mathematics from Tufts University and was awarded the 5th BGCE Student Paper Prize for outstanding student work in the field of Computational Science and Engineering. His research interests lie in the areas of computational mathematics and physics, specifically in the domains of finite-element methods and linear solvers.



Some Mathematical Advances in Computational Techniques for Liquid Crystal Modeling

As materials possessing mesophases with characteristics of both liquids and organized solids, liquid crystals exhibit an array of interesting physical properties, including dielectric and flexoelectric coupling, inspiring a wide range of applications. In addition to prevalent use in modern display technologies, liquid crystals are applied, for example, to nanoparticle organization, the manufacture of nanoporous solids, and the design of effective actuators, such as light driven motors and artificial muscles. Accurate and efficient numerical simulation of liquid crystal behavior is used to optimize device design, analyze experiments, and suggest the presence of new physical phenomena. Mathematical models of liquid crystals present a number of interesting challenges for the design of theoretically supported computational techniques. Such challenges include highly nonlinear systems, point-wise unit-length constraints, strong coupling with electric and hydrodynamic effects, and stable configurations incorporating discontinuities, among others. In this talk, we focus on the Frank-Oseen model of liquid crystals, introducing the elastic model for equilibrium configurations, its extension incorporating electric fields, and briefly discuss the addition of hydrodynamic effects. We consider the construction of theoretically supported approaches for such systems and examine a number of methods aimed at addressing different aspects of efficient simulation ranging from well-posed finite-element discretizations to reliable a posteriori error estimators. These methods expand the existing set of computational tools available for effective simulation of liquid crystal behavior. Finally, we highlight some of the interesting open questions and ongoing work in this area. This is joint work with a number of collaborators including James Adler and Tim Atherton (Tufts), Scott MacLachlan (Memorial), Patrick Farrell (Oxford), and Tom Manteuffel (Colorado Boulder).

10. Special Sessions & Organizers

Session ID	Session Name	Session Organizers	Session Blocks
SS-AAIP	Applied Analysis & Inverse Problems	Herb Kunze (University of Guelph) Davide La Torre (University of Milan) Franklin Mendivil (Acadia University) Manuel Ruiz-Galán (University of Granada)	SS-AAIP #1 Monday A.M. SS-AAIP #2 Monday P.M. SS-AAIP #3 Tuesday A.M. SS-AAIP #4 Tuesday P.M.
SS-ANMPDEA	Advanced Numerical Methods for PDEs and Applications	Dong Liang (York University) Paul Muir (Saint Mary's University)	SS-ANMPDEA #1 Tuesday A.M. SS-ANMPDEA #2 Tuesday P.M. SS-ANMPDEA #3 Wednesday A.M. SS-ANMPDEA #4 Wednesday P.M.
SS-ASDEDS	Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	Chrystopher L. Nehaniv (University of Waterloo) Attila Egri-Nagy (Akita International University)	SS-ASDEDS #1 Friday A.M. SS-ASDEDS #2 Friday P.M.
SS-CMSM	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu	Manuele Santoprete (Wilfrid Laurier University) Cristina Stoica (Wilfrid Laurier University)	SS-CMSM #1 Tuesday A.M. SS-CMSM #2 Tuesday P.M. SS-CMSM #3 Wednesday A.M. SS-CMSM #4 Wednesday P.M.
SS-CNT	Computational Number Theory	Michael Jacobson (University of Calgary) Chester Weatherby (Wilfrid Laurier University)	SS-CNT #1 Monday A.M. SS-CNT #2 Monday P.M. SS-CNT #3 Tuesday A.M. SS-CNT #4 Tuesday P.M.
SS-COA	Continuous Optimization and Applications	Monica Cojocaru (University of Guelph) Tangi Migot (University of Guelph)	SS-COA Wednesday P.M.
SS-CSCCN	Computational Studies of Clusters, Complexes, and Nanostructures	Ian Hamilton (Wilfrid Laurier University) Marek Wartak (Wilfrid Laurier University)	SS-CSCCN Monday A.M.
SS-DASO	Data Analytics for System Optimization	Wenying Feng (Trent University) Jimmy Huang (York University) Jianhong Wu (York University)	SS-DASO #1 Tuesday A.M. SS-DASO #2 Tuesday P.M.
SS-DF	Decisions and Fairness	Marc Kilgour (Wilfrid Laurier University) Bill Zwicker (Union College)	SS-DF #1 Monday A.M. SS-DF #2 Monday P.M. SS-DF #3 Tuesday A.M. SS-DF #4 Tuesday P.M.

Session ID	Session Name	Session Organizers	Session Blocks
SS-DMI	Disease Modelling and Interventions	Elena Aruffo (York University) Safia Athar (York University) Jane Heffernan (York University)	SS-DMI #1 Thursday A.M. SS-DMI #2 Thursday P.M. SS-DMI #3 Friday A.M.
SS-EMA	Environmental Modelling and Analysis	Steven Roberts (Wilfrid Laurier University) Colin Robertson (Wilfrid Laurier University)	SS-EMA Friday P.M.
SS-FCQAMIM	Fields-CQAM Special Session on Industrial Mathematics	Sean Bohun (Ontario Tech University) Huaxiong Huang (York University) Michael McCulloch (CQAM-Fields)	SS-FCQAMIM1 Thursday P.M. SS-FCQAMIM2 Friday A.M.
SS-FIDDM	Functional, Integral, and Delay Dynamical Models of Real World Phenomena	Elena Braverman (University of Calgary) Anatoli Ivanov (Pennsylvania State University) Erik Verriest (Georgia Institute of Technology)	SS-FIDDM #1 Thursday A.M. SS-FIDDM #2 Thursday P.M.
SS-GTMDS	Geometric and Topological Methods in Data Science	Maia Fraser (University of Ottawa) Tanya Schmah (University of Ottawa)	SS-GTMDS Tuesday A.M.
SS-HCLNWE	Hyperbolic Conservation Laws and Nonlinear Wave Equations	Alberto Bressan (Pennsylvania State University) Geng Chen (University of Kansas, Lawrence)	SS-HCLNWE #1 Thursday A.M. SS-HCLNWE #2 Thursday P.M.
SS-IDAHDMD	Interdisciplinary Data Analysis of High-Dimensional Multimodal Data	Sunny Wang (Wilfrid Laurier University) Yan Yuan (University of Alberta)	SS-IDAHDMD Monday P.M.
SS-MF	Mathematical Finance	Joe Campolieti (Wilfrid Laurier University) Adam Metzler (Wilfrid Laurier University) Mark Reesor (Wilfrid Laurier University)	SS-MF Thursday A.M.
SS-MMLSM	Mathematical Modelling in Life Sciences and Medicine	Corina Drapaca (Pennsylvania State University) Siv Sivaloganathan (University of Waterloo)	SS-MMLSM #1 Wednesday A.M. SS-MMLSM #2 Wednesday P.M.
SS-MMNN	Mathematical Models for Nanoscience and Nanotechnology	Zoran Miskovic (University of Waterloo) Russell Thompson (University of Waterloo)	SS-MMNN #1 Monday A.M. SS-MMNN #2 Monday P.M.
SS-MSWID	The Mathematics and Statistics of Wealth and Income Distributions	Taisei Kaizoji (International Christian University) Enrico Scalas (University of Sussex)	SS-MSWID Thursday A.M.

Session ID	Session Name	Session Organizers	Session Blocks
SS-NATAWP	Numerical and Analytical Techniques with Applications in Wave Propagation	Eduard Kirr (University of Illinois at Urbana-Champaign) Daniel Onofrei (University of Houston) Nicolae Tarfulea (Purdue University Northwest)	SS-NATAWP #1 Thursday A.M. SS-NATAWP #2 Thursday P.M. SS-NATAWP #3 Friday A.M. SS-NATAWP #4 Friday P.M.
SS-OCGA	Optimal Control, Games, and Applications	Alberto Bressan (Pennsylvania State University) Khai Nguyen (North Carolina State University)	SS-OCGA #1 Monday A.M. SS-OCGA #2 Monday P.M.
SS-PSN	Probability and Statistics in Neuroscience	Paul Marriott (University of Waterloo) Billy Marshall (University of Waterloo) Reza Ramezan (University of Waterloo) Peijun Sang (University of Waterloo) Yi Shen (University of Waterloo)	SS-PSN Wednesday A.M.
SS-QEHA	Quantum Engineering meets Harmonic Analysis	Bing-Zhao Li (Beijing Institute of Technology) Artur Sowa (University of Saskatchewan) Alexandre Zagoskin (Loughborough University)	SS-QEHA #1 Wednesday A.M. SS-QEHA #2 Wednesday P.M.
SS-QIQC	Quantum Information and Quantum Computation	Hussein Abulkasim (The New Valley University) Ahmed Farouk (Wilfrid Laurier University) Shohini Ghose (Wilfrid Laurier University)	SS-QIQC Wednesday A.M.
SS-QSQC	Quantum Control: Toward Quantum Simulation and Quantum Computation	Lian-Ao Wu (University of the Basque Country and Ikerbasque)	SS-QSQC Monday A.M.
SS-RPHCS	Recent Progress in Hybrid and Complex Systems	Xinzhi Liu (University of Waterloo) Mohamad Alwan (University of Saskatchewan) Peter Stechlinski (University of Maine)	SS-RPHCS #1 Friday A.M. SS-RPHCS #2 Friday P.M.

11. Contributed Sessions


Session ID	Session Name	Session Blocks
CS-APMRE	Applied Problems and Methods in Research & Education	CS-APMRE Monday P.M.
CS-BSM	Mathematics and Computation in Biological Sciences and Medicine	CS-BSM #1 Thursday A.M. CS-BSM #2 Thursday P.M.
CS-CPC	Computational Physics and Chemistry	CS-CPC Friday P.M.
CS-DSDE	Applications of Dynamical Systems and Differential Equations	CS-DSDE #1 Wednesday A.M. CS-DSDE #2 Wednesday P.M.
CS-ENV	Mathematical Modelling in Environmental Sciences and Models for Complex Media	CS-ENV Tuesday P.M.
CS-FINANCE	Financial Mathematics and Computation	CS-FINANCE Friday A.M.
CS-MECHE	Computational Mechanics and Engineering	CS-MECHE #1 Thursday P.M. CS-MECHE #2 Friday A.M. CS-MECHE #3 Friday P.M.
CS-MODELING	Partial Differential and Integral Equations in Mathematical Modeling	CS-MODELING Friday P.M.
CS-POST	Poster Session	CS-POST #1-#2 Wednesday

12. High-Level Conference Schedule

Mon: A.M.=10:30-12:30; P.M.=3:30-5:30
 Tues-Fri: A.M.=10:00-12:00; P.M.=3:00-5:00

Room	LH1001	LH1009	LH1010	LH1011	LH2066	LH3094	LH3098	LH3101
August 19	PLENARY A. Procaccia	SS-DF Decisions and Fairness	SS-OCGA Optimal Control, Games, and Applications	SS-AAIP Applied Analysis & Inverse Problems	SS-CNT Computational Number Theory	SS-MMNN Mathematical Models for Nanoscience and Nanotechnology	SS-CSCCN Computational Studies of Clusters, Complexes and Nanostructures	SS-QSQC Quantum Control: Toward Quantum Simulation and Quantum Computation
August 20	D. Needell	F. Cakoni	SS-CMSM Celestial Mechanics: a Symposium in Memoriam of Florin Diacu	SS-MMLSM Mathematical Modelling in Life Sciences and Medicine	SS-QIQC Quantum Information and Quantum Computation	SS-ANMPDEA Advanced Numerical Methods for PDEs and Applications	SS-IDAHDMD Interdisciplinary Data Analysis of High-Dimensional Multimodal Data	SS-APMRE Applied Problems and Methods in Research & Education
August 21	W. Thomson	SS-QEHA Quantum Engineering meets Harmonic Analysis	E. Cancès	SS-NATAWP Numerical and Analytical Techniques with Applications in Wave Propagation	SS-MF Mathematical Finance	SS-HCLNWE Hyperbolic Conservation Laws and Nonlinear Wave Equations	SS-DASO Data Analytics for System Optimization	SS-GTMDS Geometric and Topological Methods in Data Science
August 22	D. Emerson (Prize Lecture)	SS-FIDDM Functional, Integral, and Delay Dynamical Models of Real World Phenomena	SS-DMI Disease Modelling and Interventions	SS-FCQAMIM Fields-CQAM Special Session on Industrial Mathematics	SS-MSWID The Mathematics and Statistics of Wealth and Income Distributions	SS-PSN Probability and Statistics in Neuroscience	SS-COA Continuous Optimization and Applications	CS-ENV Mathematical Modelling in Environmental Sciences and Models for Complex Media
August 23	P. Kloeden	SS-RPHCS Recent Progress in Hybrid and Complex Systems	SS-EMA Mathematical Modelling in Environmental Sciences and Models for Complex Media	CS-MODELING Partial Differential and Integral Equations in Mathematical Modeling	CS-FINANCE Financial Mathematics and Computation	CS-ENGINEERING Computational Mechanics and Engineering	CS-DSDE Applications of Dynamical Systems and Differential Equations	CS-BSM Mathematics and Computation in Biological Sciences and Medicine
August 23	M. Davison	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	L. Lix	CS-CPC Computational Physics and Chemistry	CS-MECHE Computational Mechanics and Engineering	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications
August 23	E. Boyden	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications	SS-ASDEDS Algebraic Structure of Discrete-Event Dynamical Systems, and Applications

Time	Room				
8:30-9:00	LH1001	AMMCS Conference Opening			
		<p>Marc Kilgour, Department of Math, Wilfrid Laurier University Deborah MacLatchy, President, Wilfrid Laurier University Jen Vasic, Acting Mayor, City of Waterloo</p>			
9:00-10:00	LH1001	Conference Plenary Lecture			
		<p style="text-align: center;"><i>Putting Ethical AI to the Vote</i></p> <p>Ariel Procaccia, Carnegie Mellon University, Abstract & Biography on p. 10 (Chair: M. Kilgour, Wilfrid Laurier University)</p>			
10:00-10:30	LH Halls	Coffee Break			
10:30-12:30	LH1009	LH1010	LH1011	LH2066	
	SS-DF #1	SS-OCGA #1	SS-AAIP #1	SS-CNT #1	
	Decisions and Fairness	Optimal Control, Games, and Applications	Applied Analysis & Inverse Problems	Computational Number Theory	
		LH3094	LH3098	LH3101	
		SS-MMNN #1	SS-CSCCN	SS-QSQC	
		Mathematical Models for Nanoscience and Nanotechnology	Computational Studies of Clusters, Complexes and Nanostructures	Quantum Control: Toward Quantum Simulation and Quantum Computation	
12:30-14:00		Lunch			
14:00-15:00	LH1001	Conference Plenary Lecture			
		<p style="text-align: center;"><i>Simple Approaches to Complex Data with Lyme Application</i></p> <p>Deanna Needell, University of California Los Angeles, Abstract & Biography on p. 11 (Chair: R. Melnik, Wilfrid Laurier University)</p>			
15:00-15:30	LH Halls	Coffee Break			
15:30-17:30	LH1009	LH1010	LH1011	LH2066	
	SS-DF #2	SS-OCGA #2	SS-AAIP #2	SS-CNT #2	
	Decisions and Fairness	Optimal Control, Games, and Applications	Applied Analysis & Inverse Problems	Computational Number Theory	
		LH3094	LH3098	LH3101	
		SS-MMNN #2	SS-IDAHDMD	CS-APMRE	
		Mathematical Models for Nanoscience and Nanotechnology	Interdisciplinary Data Analysis of High-Dimensional Multimodel Data	Applied Problems and Methods in Research & Education	

Time	Room				
8:30-9:30	LH1001	Conference Plenary Lecture			
		<i>A New Approach to Inverse Scattering for Anisotropic Media</i> Fioralba Calkoni , Rutgers University, Abstract & Biography on p. 12 (Chair: H. Kunze, University of Guelph)			
9:30-10:00	LH Halls	Coffee Break			
10:00-12:00	LH1009	LH1010	LH1011	LH2066	
	SS-DF #3	SS-CMSM #1	SS-AAIP #3	SS-CNT #3	
	Decisions and Fairness	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu	Applied Analysis & Inverse Problems	Computational Number Theory	
					Semi-plenary: J. Sorenson Abstract & Biography on p. 19
		LH3094	LH3098	LH3101	
		SS-ANMPDEA #1	SS-DASO #1	SS-GTMS	
		Advanced Numerical Methods for PDEs and Applications of Wave Propagation	Data Analysis for System Optimization	Geometric and Topological Methods in Data Science	
12:00-13:00		Lunch			
13:00-13:30	LH1001	Maplesoft Session			
		Applications of Maple			
13:30-14:30	LH1001	Conference Plenary Lecture			
		<i>Claims Problems, a Progress Report</i> William Thomson , University of Rochester, Abstract & Biography on p. 13 (Chair: M. Kilgour, Wilfrid Laurier University)			
14:30-15:00	LH Halls	Coffee Break			
15:00-17:00	LH1009	LH1010	LH1011	LH2066	
	SS-DF #4	SS-CMSM #2	SS-AAIP #4	SS-CNT #4	
	Decisions and Fairness	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu	Applied Analysis & Inverse Problems	Computational Number Theory	
					Semi-plenary: E.R. Vrscay Abstract & Biography on p. 20
		LH3094	LH3098	LH3101	
		SS-ANMPDEA #2	SS-DASO #2	CS-ENV	
		Advanced Numerical Methods for PDEs and Applications of Wave Propagation	Data Analysis for System Optimization	Mathematical Modelling in Environmental Sciences and Models for Complex Media	

Time	Room				
8:30-9:30	LH1001	Conference Plenary Lecture			
		<i>Molecular-scale modeling and simulation of materials</i> Eric Cancès , École des Ponts ParisTech, Abstract & Biography on p. 14 (Chair: R. Melnik, Wilfrid Laurier University)			
9:30-10:00	LH Halls	Coffee Break & Poster Session			
10:00-12:00	LH1009	LH1010	LH1011	LH2066	
	SS-QEHA #1	SS-CMSM #3	SS-MMLSM #1	SS-QIQC	
	Quantum Engineering meets Harmonic Analysis	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu	Mathematical Modelling in Life Sciences and Medicine	Quantum Information and Quantum Computation	
		LH3094	LH3098	LH3101	
		SS-ANMPDEA #3	SS-PSN	CS-DSDE #1	
	Advanced Numerical Methods for PDEs and Applications of Wave Propagation	Probability and Statistics in Neuroscience	Applications of Dynamical Systems and Differential Equations		
12:00-13:30		Lunch			
13:30-14:30	LH1001	AMMCS Prize-Winning Lecture			
		<i>Some Mathematical Advances in Computational Techniques for Liquid Crystal Modeling</i> David Emerson , Street Contxt & Tufts University, Abstract & Biography on p. 23 (Chair: R. Melnik, Wilfrid Laurier University)			
14:30-15:00	LH Halls	Coffee Break & Poster Session			
15:00-17:00	LH1009	LH1010	LH1011	LH2066	
	SS-QEHA #2	SS-CMSM #4	SS-MMLSM #2		
	Quantum Engineering meets Harmonic Analysis	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu	Mathematical Modelling in Life Sciences and Medicine		
		Semi-plenary: F. Diacu Tribute Biography on p. 21			
		LH3094	LH3098	LH3101	
	SS-ANMPDEA #4	SS-COA	CS-DSDE #2		
	Advanced Numerical Methods for PDEs and Applications of Wave Propagation	Continuous Optimization and Applications	Applications of Dynamical Systems and Differential Equations		

Time	Room				
8:30-9:30	LH1001	Conference Plenary Lecture			
		<i>Random ordinary differential equations and their numerical approximation</i> Peter Kloeden , University of Tuebingen, Abstract & Biography on p. 15 (Chair: H. Kunze, University of Guelph)			
9:30-10:00	LH Halls	Coffee Break			
10:00-12:00	LH1009	LH1010	LH1011	LH2066	
	SS-FIDDM #1	SS-DMI #1	SS-NATAWP #1	SS-MF	
	Functional, Integral, and Delay Dynamical Models of Real World Phenomena	Disease Modelling and Interventions	Numerical and Analytical Techniques with Applications in Wave Propagation	Mathematical Finance	
			Semi-plenary: D. Onofrei Abstract & Biography on p. 22		
	LH3094	LH3098	LH3101		
	SS-HCLNWE #1	SS-MSWID #1	CS BSM #1		
	Hyperbolic Conservation Laws and Nonlinear Wave Equations	The Mathematics and Statistics of Wealth and Income Distribution	Mathematics and Computation in Biological Sciences and Medicine		
12:00-13:30	Conference Photo Shoot at 12:00 & Lunch				
13:30-14:30	LH1001	Conference Plenary Lecture			
		<i>Real Options and Differential Games in Commodity Finance</i> Matt Davison , Western University, Abstract & Biography on p. 16 (Chair: J. Campolieti, Wilfrid Laurier University)			
14:30-15:00	LH Halls	Coffee Break			
15:00-17:00	LH1009	LH1010	LH1011	LH2066	
	SS-FIDDM #2	SS-DMI #2	SS-NATAWP #2	SS-FCQAMIM #1	
	Functional, Integral, and Delay Dynamical Models of Real World Phenomena	Disease Modelling and Interventions	Numerical and Analytical Techniques with Applications in Wave Propagation	Fields-CQAM Special Session on Industrial Mathematics	
	LH3094	LH3098	LH3101		
	SS-HCLNWE #2	CS-MECHE #1	CS-BSM #2		
	Hyperbolic Conservation Laws and Nonlinear Wave Equations	Computational Mechanics and Engineering	Mathematics and Computation in Biological Sciences and Medicine		
18:30-22:00	Waterloo Delta Hotel	Conference Banquet Dinner			

Time	Room				
8:30-9:30	LH1001	Conference Plenary Lecture			
		<i>Quality of Electronic Health Databases for Real-World Evidence Studies</i> Lisa Lix , University of Manitoba, Abstract & Biography on p. 17 (Chair: X. Wang, Wilfrid Laurier University)			
9:30-10:00	LH Halls	Coffee Break			
10:00-12:00	LH1009	LH1010	LH1011	LH2066	
	SS-RPHCS #1	SS-DMI #3	SS-NATAWP #3	SS-FCQAMIM #2	
	Recent Progress in Hybrid and Complex Systems	Disease Modelling and Interventions	Numerical and Analytical Techniques with Applications in Wave Propagation	Fields-CQAM Special Session on Industrial Mathematics	
		LH3094	LH3098	LH3101	
	CS-FINANCE	CS-MECHE #2	SS-ASDEDS #1		
	Financial Mathematics and Computation	Computational Mechanics and Engineering	Algebraic Structure of Discrete-Event Dynamical Systems, and Applications		
12:00-13:30		Lunch			
13:30-14:30	LH1001	Conference Plenary Lecture			
		<i>Tools for Mapping and Controlling the Brain</i> Edward Boyden , Massachusetts Institute of Technology, Abstract & Biography on p. 18 (Chair: R. Makarov, Wilfrid Laurier University)			
14:30-15:00	LH Halls	Coffee Break			
15:00-16:20	LH1009	LH1010	LH1011	LH2066	
	SS-RPHCS #2	SS-EMA	SS-NATAWP #4	CS-MODELING	
	Recent Progress in Hybrid and Complex Systems	Mathematical Modelling in Environmental Sciences and Model for Complex Media	Numerical and Analytical Techniques with Applications in Wave Propagation	Partial Differential and Integral Equations in Mathematical Modeling	
		LH3094	LH3098	LH3101	
	CS-CPC	CS-MECHE #3	SS-ASDEDS #2		
	Computational Physics and Chemistry	Computational Mechanics and Engineering	Algebraic Structure of Discrete-Event Dynamical Systems, and Applications		
16:30-17:00	LH1009	Conference Prize Announcements & Closing			

13. Parallel Sessions Schedule

The following pages give the detailed speaker list for the morning and afternoon parallel session each day of the Conference.

Monday, August 19

Monday, August 19: Morning

Time	Room	LH1010	LH1011	LH2066
	LH1009	LH1010	LH1011	LH2066
	SS-DF #1	SS-OCGA #1	SS-AAIP #1	SS-CNT #1
	Decisions and Fairness: Fairness Chair: M. Kilgour Wilfrid Laurier University	Optimal Control, Games, and Applications Chair: A. Bressan Pennsylvania State University	Applied Analysis & Inverse Problems Chair: D. La Torre University of Milan	Computational Number Theory Chair: C. Weatherby Wilfrid Laurier University
10:30-10:50	<i>Fair Division of Graphs and Tangles</i> W. Zwicker Union College	<i>Optimal Control in Fluid-Elasticity Interactions</i> L. Bociu North Carolina State University	<i>Solving Inverse Problems for Elliptic Equations Using the Generalized Collage Theorem and Shannon Entropy</i> H. Kunze University of Guelph	<i>On the Lang-Trotter Conjecture for Two Elliptic Curves</i> A. Akbary University of Lethbridge
10:50-11:10	<i>Group Fairness for the Allocation of Indivisible Goods</i> N. Shah University of Toronto	<i>Proximal Point Approach for Moving Horizon Estimation: Real-Time Application to the Stabilization of a Double Inverted Pendulum</i> H. Tran North Carolina State University	<i>In Search of a New Economic Model Determined by Logistic Growth</i> R. Smirnov Dalhousie University	<i>Elliptic Curves of Prime Conductor</i> A. Deines Center for Communications Research
11:10-11:30	<i>Domination of Stable Allocations as a Fairness Criterion</i> V. Manjunath University of Ottawa	<i>A Debt Management Problem with Bankruptcy Risk and Currency Devaluation</i> S. Gilmore North Carolina State University	<i>New Classes of Potentials with Exact Eigenvalues and Eigenfunctions</i> J. Benbourenane Abu Dhabi University	<i>Categorizing Elliptic Curves with Rational 2 Torsion in Terms of the Existence of Integer Points</i> P.G. Walsh University of Ottawa
11:30-11:50	<i>Fairness Comparisons of Strategyproof and Efficient Matching Rules</i> S. Papai Concordia University	<i>Sensitivity Relationships for Optimal Control Problems with Endpoint Constraints. Applications to Trajectory Optimization of Space Launchers.</i> A. Desilles ENSTA ParisTech	<i>A Numerical Algorithm for Computing the Limit Inferior and its Probabilistic Analysis</i> F. Mendivil Acadia University	<i>Divisor Class Group Arithmetic on $C_{3,4}$ Curves</i> E. MacNeil University of Calgary
11:50-12:10		<i>On the Optimal Shape of Tree Roots and Branches</i> Q. Sun Pennsylvania State University	<i>Computer Science Techniques for Species Classification</i> D. St. Jean University of Guelph	<i>Integral Points on Continued Fraction Varieties</i> A. Logan Tutte Institute of Mathematics & Computation
12:10-12:30			<i>Error Estimation for Fan Beam Algorithm</i> N. Yadav University of Delhi	

Monday, August 19: Morning

Time	Room	LH3098	LH3101
	LH3094	LH3098	LH3101
	SS-MMNN #1	SS-CSCCN	SS-QSQC
	Mathematical Models for Nanoscience and Nanotechnology Chair: Z. Miskovic University of Waterloo	Computational Studies of Clusters, Complexes and Nanostructures Chair: I. Hamilton Wilfrid Laurier University	Quantum Control: Toward Quantum Simulation and Quantum Computation Chair: L. Wu University of the Basque Country and Ikerbasque
10:30-10:50	<i>An Implementation of LCAO Time-Dependent DFT in the Optical Limit</i> K. Lyon University of Waterloo	<i>Iron Doped Gold Cluster Nanomagnets: ab initio Determination of Barriers for Demagnetization</i> C. Ehlert Institute of Applied Physics and Computational Mathematics	<i>Topological Models of Superconducting Quantum Circuits</i> Y.-X. Liu Tsinghua University
10:50-11:10	<i>Machine Learned Exchange-Correlation Functionals in the GPAW Environment</i> A. Baier-Reinio University of Waterloo	<i>A DFT Study of Small Gold Superatoms</i> H.M. Gaebler Wilfrid Laurier University	<i>Effects of Charge Noise on a Spin Qubit in Silicon</i> X. Hu University at Buffalo
11:10-11:30	<i>The Effects of Dielectric Decrement and Finite Ion Size on Differential Capacitance of Electrolytically Gated Graphene</i> L. Daniels University of Waterloo	<i>Computer Modeling of Assembly of Non-convex Nanoparticles</i> V. Kwan Western University	<i>Deterministic Production of More Than 10000 Atom Entangled Dicke State</i> L. You Tsinghua University
11:30-11:50	<i>Differential Capacitance of Ionic Liquid Interface with Graphene: The Effects of Correlation and Finite Size Of Ions</i> A. Shalabi University of Waterloo	<i>Triskelion Structured Small Colloidal Semiconductor Quantum Dots</i> R. Edwards Wilfrid Laurier University	<i>Modeling Open Quantum Systems</i> M. Byrd Southern Illinois University
11:50-12:10	<i>First Principle Calculations of Cobalt doped Cadmium Sulphide for Spintronics Applications</i> M. Yaseen University of Agriculture, Pakistan	<i>Lowest Energy Collective Modes in the Adsorption and Absolute Value Circular Dichroism Spectra of Helical Gold Nanorods</i> H. Hodgins Wilfrid Laurier University	<i>Shortcuts to Adiabaticity in Driven Open Quantum Systems</i> A. del Campo DIPC & Ikerbasque
12:10-12:30			<i>Optimal Control of Quantum Spin Chains</i> E. Sherman University of the Basque Country and Ikerbasque
12:30-12:50			<i>Demultiplexing of Photonic Temporal Modes by a Linear System</i> X. Yi Northeast Normal University
12:50-13:10			<i>Adiabatic approximation in open quantum systems: applications in quantum computation and quantum thermodynamics</i> M. Sarandy Fluminense Federal University

Monday, August 19: Afternoon

Time	Room	LH1010	LH1011	LH2066
	LH1009	LH1010	LH1011	LH2066
	SS-DF #2	SS-OCGA #2	SS-AAIP #2	SS-CNT #2
	Decisions and Fairness: Strategies and Games Chair: M. Jones Mathematical Reviews	Optimal Control, Games, and Applications Chair: K.T. Nguyen North Carolina State University	Applied Analysis & Inverse Problems Chair: H. Kunze University of Guelph	Computational Number Theory Chair: C. Weatherby Wilfrid Laurier University
15:30-15:50	<i>From Fairness and Decisions to a New Game Theoretic Approach</i> D. Saari University of California Irvine	<i>Game Theoretical Learning: Performance Guarantees for Fictitious Play</i> R. Murray Pennsylvania State University	<i>Optimal Control of a Spatial Economic Growth Model with Physical Capital Accumulation and Pollution Diffusion</i> D. La Torre University of Milan	<i>The Least Prime in the Chebotarev Theorem</i> A. Fiori University of Lethbridge
15:50-16:10	<i>Rationality and Stability in Bargaining Games Played by Finite Automata</i> J. Bell Wilfrid Laurier University	<i>Gap Avoidance Conditions in Optimal Control</i> M. Palladino Gran Sasso Science Institute	<i>A Computational Comparison of Inverse Problem Techniques, Young and Old</i> K. Levere University of Guelph	<i>Exploring the Fractional Derivatives of the Riemann Zeta Function</i> S. Pauli University of North Carolina Greensboro
16:10-16:30	<i>Strategy-proofness and Perfect Mechanisms</i> A. Mackenzie Maastricht University	<i>Mean Field Games with State Constraints</i> R. Capuani North Carolina State University	<i>Using Shooting Approaches to Generate Initial Guesses for ODE Parameter Estimation</i> J. Calver University of Toronto	<i>Continued Fractions in Imaginary Quadratic Fields</i> D.E. Martin University of Colorado
16:30-16:50	<i>Endowment Manipulations in Probabilistic Assignment Problem</i> Y. Tamura University of Rochester	<i>First Integrals and Exact Solutions of Dynamical Systems and Dynamic Optimization Models</i> I. Naeem Lahore University of Management Sciences	<i>Neural Network Approaches to An Inverse Fractal Problem</i> L. Graham University of Guelph	<i>How to Compute Ideal Class Groups Using Subfields</i> J.-F. Biasse University of South Florida
16:50-17:10	<i>Strategic Voting and Black's Condorcet-or-Borda Voting System</i> W. Stromquist Bryn Mawr College	<i>Generic Structure and Stability of Solutions to Stackelberg Games</i> A. Bressan Pennsylvania State University	<i>Inverse Problems for a two-dimensional Fractional Parabolic equation</i> S. Kerbal Sultan Qaboos University	<i>Computing the Regulator of a Real Quadratic Order Using p-Adic Methods</i> W. Youmans University of South Florida
17:10-17:30				

Monday, August 19: Afternoon

Time	Room		
	LH3094	LH3098	LH3101
	SS-MMNN #2	SS-IDAHDMD	CS-APMRE
	Mathematical Models for Nanoscience and Nanotechnology Chair: R. Thompson University of Waterloo	Interdisciplinary Data Analysis of High-Dimensional Multimodal Data Chair: X. Wang & Y. Yuan Wilfrid Laurier University & University of Alberta	Applied Problems and Methods in Research & Education Chair: H. Shodiev Wilfrid Laurier University
15:30-15:50	<i>Tunable Directional Plasmon Excitation and Transition Radiation in Phosphorene by a Swift Electron</i> K. Akbari University of Waterloo	<i>Combined Effect of Industrial Airborne Pollutants on Birth Outcomes in Alberta</i> K. Vu University of Alberta	<i>Using Cognitive Fit Theory to Evaluate the Effectiveness of Financial Information Visualization: An Example Using Data to Detect Fraudulent Transactions</i> A. Czegledi Conestoga College
15:50-16:10	<i>Gauge Theory and Boundary Conditions in Spin Ice Thin Films</i> K. Chung University of Waterloo	<i>Inference with Sparse Covariance and Precision Matrices</i> A. Kashlak University of Alberta	<i>Model Predictive Control Implementation for a Quadruple-Tank System Using Arduino</i> C.A. Machuca-Mejia Metropolitan Autonomous University - Azcapotzalco
16:10-16:30	<i>Ultrahigh Frequency Mass Detection Using Nonlinear Nanowire Resonators</i> R. Fallahpourghadikolaei Wilfrid Laurier University	<i>Convolutional Neural Network Modelling for Polysomnography Data of Obstructive Sleep Apnea Diagnosis</i> L. Feng Wilfrid Laurier University	<i>How to Write Down the Uncertainty of Measurements, if the First Significant Figure is the Unity</i> V. Samedov National Research Nuclear University & MPhI
16:30-16:50	<i>A Mathematical Model for Equation of State Effects Relevant to Nano-Cellular Polymeric Foams</i> H. Alam University of Waterloo	<i>Machine Learning Techniques for Insurance Applications</i> L. Diao University of Waterloo	<i>Covering Large Complex Networks by Cliques - A Sparse Matrix Approach</i> W. Abdullah University of Lethbridge
16:50-17:10	<i>Integral Equation Solution for Two-Dimensional Simulations in Nanoplasmonics; Single Layer vs Multi-Layer Configurations</i> H. Kurkcu Gulf University of Science and Technology	<i>Ensemble-based Ultrahigh-dimensional Variable Screening</i> W. Tu University of Alberta	<i>A Frequency-Dependent Meteorological Impulse Response Model for Accurate Water Level Prediction</i> M. El-Diasty King Abdulaziz University
17:10-17:30		<i>SuperNet: Using Supermodeling in Developing More Efficient Data Models</i> W. Dzwinel AGH University of Science and Technology	

Tuesday, August 20

Tuesday, August 20: Morning

Time	Room	LH1010	LH1011	LH2066
	LH1009 SS-DF #3	LH1010 SS-CMSM #1	LH1011 SS-AAIP #3	LH2066 SS-CNT #3
	Decisions and Fairness: Representation Chair: W. Zwicker Union College	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu Chair: M. Santoprete Wilfrid Laurier University	Applied Analysis & Inverse Problems Chair: F. Mendivil Acadia University	Computational Number Theory Chair: M. Jacobson University of Calgary
10:00-10:20	<i>Weighted Representative Democracy</i> M. Pivato Université de Cergy-Pontoise	<i>From Celestial Mechanics to the Dark Matter Mystery</i> D.Saari Institute of Applied Mathematics and Automation of Kabardin-Balkar Scientific Center of RAS	<i>Derivatives on Fractals Generated by Iterated Function Systems and Their Application</i> D. La Torre University of Milan	Semi-plenary Lecture <i>New Results on the Erdos-Selfridge Function $g(k)$</i> J. Sorenson Butler University Abstract & Biography on p.19
10:20-10:40	<i>New Quota-based Apportionment Methods: The Allocation of Delegates in the Republican Presidential Primary</i> M. Jones Mathematical Reviews	<i>A Model for the Binary Asteroid 2017 YE5</i> L. Bakker Brigham Young University	<i>"Range-based Function Approximation" Using Measures in Range Space and Generalized Weber's Model of Perception</i> E.R. Vrscay University of Waterloo	
10:40-11:00	<i>The Cutoff Paradox in the Kansas Presidential Caucuses</i> D. McCune William Jewell College	<i>Central Configurations in Planar 6-Body Problem Forming Two Equilateral Triangles</i> Z. Xie The University of Southern Mississippi	<i>Comparing Regularization Techniques Applied to a Perceptron</i> B. Boreland University of Guelph	
11:00-11:20	<i>Agendas in Legislative Decision-Making</i> S. Horan Université de Montréal	<i>Formal Stability of L_4 in the Spatial Restricted Circular Three-Body Problem</i> P. Yanguas Universidad Pública de Navarra	<i>Dynamic Recursion (DR): A Multivariate Non/linear Autoregressive Model for Quasi-Periodic Signals</i> J. Vass Independent Scholar	
11:20-11:40		<i>On Co-orbital Quasi-Periodic Motion of Two Small Moons Around a Large Planet</i> J. Palacià Universidad Pública de Navarra	<i>Investigating Model Improvement Using Fractional Differential Equations: An Inverse Approach</i> J. Lawson University of Guelph	
11:40-12:00		<i>Planar Central Configurations of the N-Body Problem with a Homogeneous Potential</i> M. Hampton University of Minnesota Duluth	<i>Existence and Approximation of Attractive Points</i> S. Khan Qatar University	

Tuesday, August 20: Morning

Time	Room		
	LH3094	LH3098	LH3101
	SS-ANMPDEA #1	SS-DASO #1	SS-GTMDS
	Advanced Numerical Methods for PDEs and Applications of Wave Propagation Chair: D. Liang York University	Data Analysis for System Optimization Chair: J. Zhao Wilfrid Laurier University	Geometric and Topological Methods in Data Science Chair: M. Fraser & T. Schmah University of Ottawa
10:00-10:20	<i>High-Order Error Control B-spline Gaussian Collocation Software for the Numerical Solution of PDEs</i> P. Muir Saint Mary's University	<i>About the Algorithms of Strategic Management</i> M. Chumburidze Ak.Tsereteli State University	<i>Fiber Bundles in Probabilistic Models</i> S. Mukherjee Duke University
10:20-10:40	<i>eBACOLI: Software for solving one-dimensional multi-scale parabolic-elliptic PDE systems with adaptive error control</i> R. Spiteri University of Saskatchewan	<i>A Framework for Data-Driven and Compute-Intensive Applications on High Performance Computers</i> K. Wong University of Tennessee, Knoxville	<i>Variable Bandwidth Kernels and the UMAP Graph Construction</i> T. Schmah University of Ottawa
10:40-11:00	<i>Fast Multipole Boundary Element Method for Thermal Radiation Problems</i> Y. Nie Northwestern Polytechnical University	<i>A Comparison of Machine Learning Algorithms for Energy Forecasting</i> M. Selim Trent University	<i>Metric Learning for Persistence-Based Summaries and Application to Graph Classification</i> Y. Wang Ohio State University
11:00-11:20	<i>A 3D IB Method for Non-Newtonian-Fluid Flexible-Structure Interaction</i> L. Zhu Indiana University	<i>Confidence Intervals for Regression Analysis of Taxi Trip Length</i> E. Morgan Trent University	<i>Towards Hierarchical TDA Learning</i> M. Fraser University of Ottawa
11:20-11:40	<i>Mass-preserving Solution-Flux Scheme for Parabolic Multi-Interface Problems</i> H.N. Kandel York University	<i>Utilizing Bidirectional Encoder Representations From Transformers for Answer Selection Task</i> Md T.R. Laskar York University	<i>Using Supermodeling in Computer Simulation of Complex Systems</i> W. Dzwinel AGH University of Science and Technology
11:40-12:00	<i>Discontinuous Galerkin Method for a Two-Dimensional Fractional Reaction-Diffusion Equation From Combustion Process</i> Q. Xu Nanjing University	<i>An Analytics and Visualization System for Exploring Online Public Consultation</i> C.D. Zheng York University	

Tuesday, August 20: Afternoon

Time	Room			
	LH1009	LH1010	LH1011	LH2066
	SS-DF #4	SS-CMSM #2	SS-AAIP #4	SS-CNT #4
	Decisions and Fairness: Voting and Elections Chair: M. Pivato Université de Cergy-Pontoise	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu Chair: C. Stoica Wilfrid Laurier University	Applied Analysis & Inverse Problems Chair: D. La Torre University of Milan	Computational Number Theory Chair: M. Jacobson University of Calgary
15:00-15:20	<i>The Excess Method: A Multiwinner Approval Voting Procedure to Allocate Wasted Votes</i> S. Brams New York University	<i>Invariant Manifolds in the Hamiltonian-Hopf Bifurcation</i> K. Meyer University of Cincinnati	Semi-plenary Lecture <i>The “Waterloo Fractal Analysis and Coding Project”: Generalized Fractal Transforms, Contraction Maps and Associated Inverse Problems</i> E.R. Vrscay University of Waterloo Abstract & Biography on p.20	<i>Algorithms for the Multiplication Table Problem</i> J. Webster Butler University
15:20-15:40	<i>Inferring Rankings From First Order Marginals</i> S. Wolff Denison University	<i>A Symplectic Sightseeing Tour On Singular Hamiltonian Systems</i> A. Portaluri University of Turin		<i>Detecting Square Numbers in Binary Arithmetic</i> P. Brown Texas A&M University at Galveston
15:40-16:00	<i>The Prevalence and Consequences of Ballot Truncation in Ranked-Choice Elections</i> M. Kilgour Wilfrid Laurier University	<i>Conley-Zehnder Index Theory and its Applications to Stability for Periodic Orbits</i> D. Offin Queen's University		<i>The Least Primitive Root and Grosswald's Conjecture</i> K. McGown California State University, Chico
16:00-16:20	<i>Choosing Between Non-Mutually Exclusive Social Groups</i> C. Trudeau University of Windsor	<i>Loose Ends in the Strong Force N-Body Problem</i> C. Jackman CIMAT		<i>Solving Norm Equations Over Function Fields Using Compact Representations</i> S. Leem University of Calgary
16:20-16:40	<i>Modelling the influence of campaign contributions and advertising on US Presidential elections</i> M. Gallego Wilfrid Laurier University	<i>Invariant Tori for a Class of Singly Thermostated Hamiltonians</i> L. Butler University of Manitoba		<i>Absolute Bounds for the Number of Solutions of Certain Thue and Thue-Mahler Equations</i> A. Mosunov University of Waterloo
16:40-17:00				

Tuesday, August 20: Afternoon

Time	Room		
	LH3094	LH3098	LH3101
	SS-ANMPDEA #2	SS-DASO #2	CS-ENV
	Advanced Numerical Methods for PDEs and Applications of Wave Propagation Chair: P. Muir Saint Mary's University	Data Analysis for System Optimization Chair: W. Feng & J. Huang Trent University & York University	Mathematical Modelling in Environmental Sciences and Models for Complex Media Chair: A. Mahmood Pennsylvania State University
15:00-15:20	<i>Artificial Viscosity Joint Spacetime Multigrid Method for HJB-KFP System Arising from Mean Field Games</i> Y. Chen University of Waterloo	<i>Creation of a Model for Efficient Management of a Sustainable Development of a Region as an Organizational System</i> T. Zhvania Guram Tavartkiladze Tbilisi Teaching University	<i>Efficiency of Contaminant Removal in Ceramic Water Filters using Bacterial Biofilms</i> H.J. Gaebler University of Guelph
15:20-15:40	<i>Highly Accurate Numerical Simulation of Acoustic Wave Equation with Perfectly Matched Layer Boundary Condition</i> W. Liao University of Calgary	<i>Key Performance Indicators and Individual Prediction Models on Kicks From the Penalty Spot</i> J. Fialho British University of Vietnam & University of Evora	<i>Statistical and Computer Models for Geophysical Mass Flows</i> A. Mahmood Pennsylvania State University
15:40-16:00	<i>Adaptive Radial Basis Functions for Embedded Surfaces</i> C. Macdonald University of British Columbia	<i>Modelling Bike Sharing Activities with Dynamical Systems</i> J. Bogaard Trent University	<i>Fire Mediates Bark Beetle Outbreaks in Serotinous Forests</i> P. Jentsch University Of Waterloo
16:00-16:20	<i>A Penalty-like Method for CVA Pricing by a PDE Model</i> Y. Chen University of Toronto	<i>Convolutional Neural Network with Attention-based Layer for Text Classification</i> X. Zhao York University	<i>Spatially Explicit Models for Forest-grassland Mosaics: Exploring Climate Change Scenarios</i> K.R. Fair University of Waterloo & University of Guelph
16:20-16:40	<i>Time-parallelization of Hyperbolic Equations with MGRIT</i> F. Danieli University of Oxford	<i>Uncertainty in Machine Learning for energy forecasting</i> R. Zhou Trent University	<i>Modelling for An Intelligent Aerospace Tracking System</i> M. El-Arabaty Misr International University
16:40-17:00	<i>On the Numerical Solution of Advection-diffusion Equations with Singular Source Terms</i> I. Turk Egitim Bilimleri-Fomara	<i>A Hierarchical Neural Model for Sequential Data Classification</i> J. Zhao Wilfrid Laurier University	<i>An Efficient Model for Integrating Public Participation in the Solid Waste Collection Vehicle Routing Problem</i> O.J. Adeleke Covenant University, Nigeria
17:00-17:20			<i>Sensitivity of Shale Gas Transport Model to Changes in the Pressure Dependent Parameters</i> N. Malik Texas Tech University

Wednesday, August 21

Wednesday, August 21: Posters

Time	Room		
	LH Atrium CS-POST #1-2 Poster Session		
9:30-10:00 & 14:30-15:00	<p><i>Computational Study of Secondary Neutrons Produced by Protontherapy</i></p> <p>A. Al Qaaod International Centre for Theoretical Physics</p>	<p><i>The Generalized Wavelet Convolution Associated with the Linear Canonical Transform</i></p> <p>Q. Feng Yanan University</p>	<p><i>BOLD.R: A software package to interface directly with BOLD through R</i></p> <p>N. Mudalige University of Guelph</p>
	<p><i>Convergence of the Regularized Sinc Collocation Method Applied to Fredholm Integral Equation</i></p> <p>N. Bilel Badji Mokhtar University</p>	<p><i>Simulation of Wind Patterns on Sub-Antartic Marion Island Using Computational Fluid Dynamics and Measured Wind Data</i></p> <p>K.A. Goddard University of South Africa</p>	<p><i>Analysis of CMLR Trees for European And Asian Option Pricing Under Regime-switching Jump-diffusion Models</i></p> <p>Y. Sui Wilfrid Laurier University</p>
	<p><i>Simulating Coherent Electron Shuttling in Quantum Dots</i></p> <p>B. Buonacorsi University of Waterloo</p>	<p><i>Two-phase Case-control Cohort Study On Rare Event</i></p> <p>T. Jin Wilfrid Laurier University</p>	<p><i>Quantum Light and Topological Surface States</i></p> <p>W. Wang Northeast Normal University</p>
	<p><i>Quantum Correlations in the Mollow Triplet and its Higher-Harmonic Side-bands</i></p> <p>E. Darsheshdar Univsersidade Federal de São Carlos</p>	<p><i>Predicting Cardiac Arrest Using Convolution Neural Networks</i></p> <p>S. Kharche University of Western Ontario</p>	<p><i>Ebola: Impact of Hospital'S Admission Policy in an Overwhelmed Scenario</i></p> <p>M.H. Zahid University of Texas at Arlington</p>

Wednesday, August 21: Morning

Time	Room			
	LH1009	LH1010	LH1011	LH2066
	SS-QEHA #1	SS-CMSM #3	SS-MMLSM #1	SS-QIQC
	Quantum Engineering meets Harmonic Analysis Chair: A. Zagoskin Loughborough University	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu Chair: L. Bakker Brigham Young University	Mathematical Modelling in Life Sciences and Medicine Chair: C. Drapaca Pennsylvania State University	Quantum Information and Quantum Computation Chair: A. Farouk Wilfrid Laurier University
10:00-10:20	<i>How to Make Spin and Lattice Dynamical Together</i> J. Fransson Uppsala University	<i>Equilibria of the Curved N-body Problem in S^n</i> S. Zhu University of Science and Technology of China	<i>Mathematical Model of a Brain-on-a-Chip for Studying the Role of the Nitric Oxide Dynamics in Cerebral Microaneurysms</i> C. Drapaca Pennsylvania State University	<i>Experimental Detection of Qubit-Quart Pseudo-Bound Entanglement using Three Nuclear Spins</i> A. Singh Indian Institute of Science Education and Research Mohali
10:20-10:40	<i>Defining the Planck Constant: The Link Between Microscopic Quantum Measurements and Macroscopic Masses</i> M. Bradley University of Saskatchewan	<i>New Families of Relative Equilibria in the Curved N-body Problem</i> E. Perez-Chavela ITAM Mexico	<i>Mathematical Modeling of Electro-thermal Response on Nerve Tissue Subjected to Radiofrequency Field</i> S. Singh Wilfrid Laurier University	<i>Direct quantification of non-Gaussian entanglement using the Wigner function</i> M. Ziane Mohammed V University
10:40-11:00	<i>Entangling Continuous Variables with a Qubit Array</i> P. Navez Helmholtz-Zentrum Dresden-Rossendorf	<i>Separation of Variables for the Hamilton-Jacobi Equation for the Charged Particle Orbits for the Liénard-Wiechert</i> R. McLenaghan University of Waterloo	<i>Multiscale Stochastic Modelling of Cortical Spreading Depression Dynamics in Brain</i> H. Shaheen Wilfrid Laurier University	<i>Synthesis, DFT Calculations and Electrical Properties of Cr(III), Fe(III) and Zn(II) Complexes of a New Bidentate Schiff Base Ligand and Their Corresponding Metal Oxides</i> L.H.A. Rahman University of Sohag
11:00-11:20	<i>Martingale Strategy for Modeling Quantum Adiabatic Evolution</i> E. Darsheshdar Univrsidade Federal de São Carlos		<i>Stochastic Self-assembly of HIV-1 Capsids using an Extended Becker-Doring Model</i> P. Kunwar Ryerson University	<i>Decaying Aspects of Quantum States Under Noise</i> N. LaRacuenté University of Illinois at Urbana-Champaign
11:20-11:40	<i>Engineering Quantum Defects in Polycrystalline Diamonds for Magnetic Field Sensing Application</i> H. Ejalonibu University of Saskatchewan		<i>Stochastic Simulations for Reactive and Diffusive Systems</i> K. Rohlf Ryerson University	<i>Quantum Algorithms for a Min-Max Optimization Problem</i> B. Sepehry 1QBit, Vancouver
11:40-12:00			<i>A Parallel Implementation of the Delay Stochastic Simulation Algorithm</i> K. Cook University of Alabama	<i>Robust General N User Quantum Secure Direct Communication via GHZ-Like State</i> A. Farouk Wilfrid Laurier University
12:00-12:20			<i>Multiscale/multiphysics Modeling of Ocular Physiology: The Eye as a Window on the Body</i> G. Guidoboni University of Missouri	

Wednesday, August 21: Morning

Time	Room	LH3098	LH3101
	LH3094 SS-ANMPDEA #3	LH3098 SS-PSN	LH3101 CS-DSDE #1
	Advanced Numerical Methods for PDEs and Applications of Wave Propagation Chair: R. Spiteri University of Saskatchewan	Probability and Statistics in Neuroscience Chair: R. Ramezan University of Waterloo	Applications of Dynamical Systems and Differential Equations Chair: H. Kunze University of Guelph
10:00-10:20	<i>Fourth-order and Temporal Second-order Conservative Characteristic Method for Environmental Modelling</i> D. Liang York University	<i>Sparse Estimation for Functional Semiparametric Additive Models</i> P. Sang University of Waterloo	<i>Sustainable Finance: A Model of Real-financial Sector Interaction, Behavioural Cycles, and the Role of Proactive Supervision and Risk Management</i> M. Yodzis University of Guelph
10:20-10:40	<i>Fourth-Order Orthogonal Spline Collocation Methods for Two-Dimensional Helmholtz Problems with Interfaces</i> G. Fairweather American Mathematical Society	<i>Computational Topology in Neuroscience</i> W. Qi University of Waterloo	<i>A Hamiltonian Framework for the Problems of Economic Growth Theory</i> R. Smirnov Dalhousie University
10:40-11:00	<i>A First-order System Finite-Element Method for Boundary Layer Problems</i> S. MacLachlan Memorial University of Newfoundland	<i>From Neural Integration to a Statistical Model</i> R. Ramezan University of Waterloo	<i>On infinite Beams Simply Supported</i> F. Minhòs University of Évora
11:00-11:20	<i>Analysis of Methods for the Maxwell-Random Lorentz Model</i> N. Gibson Oregon State University	<i>Data Visualization Techniques for Single and Multiple Spike Trains</i> W. Li University of Waterloo	<i>The Inverse Problem and Applications</i> M. Farre Puiggali University of Michigan
11:20-11:40	<i>T-ψ Formulation of an Induction Hardening Model With a Nonlinear Constitutional Relation for the Magnetic Induction Field</i> T. Kang Communication University of China	<i>Information Geometric and Probability Models for Multiple Neurons</i> P. Marriott University of Waterloo	<i>Structural Invertibility and Optimal Sensor Node Placement for Error and Input Reconstruction in Dynamic Systems</i> D. Kahl University of Applied Sciences Koblenz
11:40-12:00	<i>Coarse-graining Langevin Dynamics</i> L. Ma Trinity College	<i>Integrated Information Theory - A Mathematical Model of Consciousness</i> W. Marshall Brock University	<i>Estimation of Parameters of a Constrained Predator Prey Dynamical Model with Incomplete Data</i> A. Adeniji Tshwane University of Technology
12:00-12:20			<i>Scatterer Location Via Time Reversal Methods in Acousto-elastodynamics</i> F. Assous Ariel University

Wednesday, August 21: Afternoon

Time	Room	LH1010	LH1011	LH2066
	LH1009	LH1010	LH1011	LH2066
	SS-QEHA #2	SS-CMSM #4	SS-MMLSM #2	
	Quantum Engineering meets Harmonic Analysis Chair: B.-Z. Li & A. Sowa Beijing Institute of Technology & University of Saskatchewan	Celestial Mechanics: a Symposium in Memoriam of Florin Diacu Chair: C. Stoica Wilfrid Laurier University	Mathematical Modelling in Life Sciences and Medicine Chair: C. Drapaca Pennsylvania State University	
15:00-15:20	<i>Quaternion Windowed Linear Canonical Transform of Two-Dimensional Signals</i> B.-Z. Li Beijing Institute of Technology	Semi-plenary Tribute <i>A Tribute to Our Colleague and Friend Florin Diacu</i> Colleagues, Friends, and Family of Florin Diacu Biography on p. 21	<i>A 2D Simulation of Aqueous Humor Hydrodynamics in the Anterior Chamber by FreeFEM++</i> G. Guidoboni University of Missouri	
15:20-15:40	<i>Characterizing Pulse Waves for Disease Diagnosis</i> H. Zhu York University		<i>Towards High-Order Meshes of Cardiac Anatomy</i> S. Shontz University of Kansas	
15:40-16:00	<i>Reversible Image Reconstruction for Reversible Data Hiding in Encrypted Images</i> C.-M. Pun University of Macau		<i>First Order System of ODE's: The Role of Functional Boundary Conditions on Applications in Medicine</i> J. Fialho University of Évora	
16:00-16:20	<i>Application of Fractional Calculus to Image Denoising</i> Y.S. Zhang Zhengzhou University of Aeronautics		<i>Models of Swimming Bacteria with Two Flagellar Bundles</i> H. Shum University of Waterloo	
16:20-16:40	<i>Perturbing Hamiltonians Via Automorphisms of the Torus</i> A. Sowa University of Saskatchewan		<i>An in Silico Analysis of Hypoxia-Activated Prodrugs in Combination with Anti-Angiogenic Therapy Through Nanocell Delivery</i> C. Meaney University of Waterloo	
16:40-17:00			<i>Numerical Modelling of Drug Delivery in an Isolated Solid Tumor</i> M. Mohammadi University of Waterloo	
17:00-17:20			<i>A Mathematical Model to Explore the Consequences of Inflammation in Cancer</i> K. Wilkie Ryerson University	
17:20-17:40			<i>Modeling the Recruitment of Tumor-Infiltrating T Lymphocytes</i> Y. Derbal Ryerson University	

Wednesday, August 21: Afternoon

Time	Room	LH3098	LH3101
	LH3094	LH3098	LH3101
	SS-ANMPDEA #4	SS-COA	CS-DSDE #2
	Advanced Numerical Methods for PDEs and Applications of Wave Propagation Chair: W. Liao University of Calgary	Continuous Optimization and Applications Chairs: M. Cojocaru & T. Migot University of Guelph	Applications of Dynamical Systems and Differential Equations Chair: K. Herder University of Guelph
15:00-15:20	<i>High-Order Numerical Methods for Good Boussinesq Equations</i> C-T. Lin Providence University	<i>Globalized High-order Methods for Unconstrained Optimization</i> S. Goyette Université de Sherbrooke	<i>Traffic Dynamics Subject to Random Misperception</i> M. Kleiber Leibniz Universität Hannover
15:20-15:40	<i>Energy and Enstrophy Study of the Time Relaxation Model</i> F. Pahlevani Pennsylvania State University	<i>Advances in Subgradient Computation for Nonsmooth Optimization</i> K. Khan McMaster University	<i>Group Classification of One Dimensional Non-linear Poisson Equation</i> M. Shabeer Qatar University
15:40-16:00	<i>Numerical PDE Methods for a Discontinuous Diffusion Problem with Application to Brain Cancer Growth</i> J. Yao University of Toronto	<i>Coupling Decomposition with Dynamic Programming : An Overview Applied to an Energy Management Model</i> L. Marchand Université de Sherbrooke	<i>Travelling Wave Solutions, Bifurcation Analysis and Conservation Laws of Resonance Nonlinear Shrodinger'S Equation With Kerr Law Nonlinearity</i> A. Jhangeer Namal Institute
16:00-16:20	<i>New Mixed Finite-element Methods for the Biharmonic Problem</i> A. Hamdan Memorial University of Newfoundland	<i>Positron Emission Tomography Image Resolution Limit when using the Likelihood Model with Excellent Time-of-Flight Resolution</i> M. Toussaint Université de Sherbrooke	<i>Differential Games and Singular Surfaces</i> M. El-Arabaty Misr International University
16:20-16:40	<i>Error Estimates for a Finite Volume Method for the Laplacian on Spherical Icosahedral Grids</i> L.A. Poveda University of Sao Paulo	<i>Controlling Infection Spread in a Predator-prey System</i> A. Jaber University of Guelph	<i>Spontaneous Symmetry-breaking in Deterministic Queueing Models with Delayed Information</i> J. Collera University of the Philippines Baguio
16:40-17:00	<i>Liquid Surface Deformation due to Impinging Gas and Gas-Plasma Jets: Modelling and Experiments</i> C.J. Ojiako Loughborough University	<i>Explicit-Implicit SDP Relaxation Scheme in Combinatorial Optimization</i> M. Ataei York University	<i>Multidimensional Time-fractional Diffusion-wave and Parabolic Dirac Operators and Their Fundamental Solutions</i> N. Vieira CIDMA - University of Aveiro
17:00-17:20			<i>Fundamental Solutions of a Fractional Equation with Laplace Operator</i> M.M. Rodrigues CIDMA - University of Aveiro

Thursday, August 22

Thursday, August 22: Morning

Time	Room		
	LH3094	LH3098	LH3101
	SS-HCLNWE #1	SS-MSWID	CS-BSM #1
	Hyperbolic Conservation Laws and Nonlinear Wave Equations Chair: G. Chen University of Kansas	The Mathematics and Statistics of Wealth and Income Distributions Chair: T. Kaizoji & E. Scalas International Christian University & University of Sussex	Mathematics and Computation in Biological Sciences and Medicine Chair: K. Herder University of Guelph
10:00-10:20	<i>Spatially Periodic Solutions of the Nonisentropic Compressible Euler Equations</i> J. Hunter University of California Davis	<i>Functional and Thermodynamic Limits of a Simple Stylized Model for the Distribution of Wealth</i> E. Scalas University of Sussex	<i>Model of a Cortical Circuit Associated with Childhood Absence Epilepsy</i> M. Ahmed University of Waterloo
10:20-10:40	<i>Asymptotic Stability of the Novikov Peakons</i> M. Chen University of Pittsburgh	<i>Persistence in Firm Growth: an Inter-Distributional Analysis</i> G. Bottazzi Scuola Superiore Sant'Anna	<i>A Dynamic Model for Tuberculosis Transmission in Algeria</i> S. Selmane University of Sciences and Technology Houari Boumediene
10:40-11:00	<i>Global Riemann Solver For 3×3 System of Conservation Laws With Degeneracy</i> W. Shen Pennsylvania State University	<i>Power-law Distributions of High-incomers and Formation of Exclusive Residential Districts</i> T. Kaizoji International Christian University	<i>Mapping of Artificial Neural Networks and Brain Health Studies</i> A. Joghataie University of British Columbia
11:00-11:20	<i>Sharp Fronts for the SQG Equation</i> J. Shu University of California at Davis	<i>On One and Two Dimensional Cellular Automata Models and Statistical Wealth Condensation: Conditions to Generate a Wealth-like Distribution</i> A.R. Hernandez-Montoya University of Veracruz	<i>Control of Bacterial Communities Using Deep Reinforcement Learning</i> N. Treloar University College London
11:20-11:40	<i>Compensated Compactness, Isometric Immersions, and Physical Applications</i> S. Li Rice University & McGill University	<i>Approximate Bayesian Computation for the Distributions of Wealth and Income</i> T. Kaizoji International Christian University	<i>Applied Machine Learning to Define and Predict Pain Volatility in Users of the Manage My Pain App</i> Q. Rahman York University
11:40-12:00			<i>Differential Equation Model for the Treatment of Tumor Growth with the Effect of Immune Response with Radiotherapy</i> R. Sharma Dr. Bhimrao Ambedkar University

Thursday, August 22: Afternoon

Time	Room			
	LH1009	LH1010	LH1011	LH2066
	SS-FIDDM #2	SS-DMI #2	SS-NATAWP #2	SS-FCQAMIM #1
	Functional, Integral, and Delay Dynamical Models of Real World Phenomena Chair: E.I. Verriest Pennsylvania State University	Disease Modelling and Interventions Chair: E. Aruffo York University	Numerical and Analytical Techniques with Applications in Wave Propagation Chair: N. Tarfulea Purdue University Northwest	Fields-CQAM Special Session on Industrial Mathematics Chair: M. McCulloch CQAM-Fields
15:00-15:20	<i>On the Problem of Maximum Delay Margin in Linear Control</i> A. Lindquist, Shanghai Jiao Tong University	<i>Epidemic Dynamics and Adaptive Vaccination Strategy : Scalar-renewal Equation Approach</i> A. Nzokem York University	<i>Surface Water Waves Over a Variable Bottom</i> C. Sulem University of Toronto	<i>Image Reconstruction Using a Non-local Normalized Graph Laplacian</i> C. Falconer Ontario Tech University
15:20-15:40	<i>Global Asymptotic Stability and Periodic Solutions in Cyclic Differential Delay Systems</i> A.F. Ivanov Pennsylvania State University	<i>Stochastic Modelling for Population of Culex Mosquitoes With Temperature</i> B. (Bing) Hu York University	<i>Large Bound States in Schrödinger Equation with General Nonlinearities</i> E. Kirr University of Illinois at Urbana-Champaign	<i>Coulomb Explosion Imaging: Super-resolution by Optical Properties of Electrostatics Lens</i> D. Babalola Ontario Tech University
15:40-16:00	<i>Oscillations and Periodic Solutions in a Two-dimensional Differential Delay Model</i> Z.A. Dzalilov Federation University Australia	<i>Epidemic Dynamics of Vector-Transmitted Diseases: Analysis of the Vector-to-Host and Host-to-Vector Forces of Infection</i> M. Alavinejad York University	<i>Long-time Asymptotics for the Focusing Nonlinear Schrödinger Equation and the Nonlinear Stage of Modulational Instability</i> D. Mantzavinos University of Kansas	<i>Data-based optimization for learning and control</i> M. Guay Queen's University
16:00-16:20	<i>The Effect of Two Delays on Stability of the Mackey-Glass Equation</i> E. Braverman University of Calgary	<i>Disease Dynamics Inferred from Last Wills and Testaments</i> A. Bushby McMaster University	<i>A High-Order Solver for the Scattering of Elastic Waves from Periodically Rough Rigid Surfaces</i> M. Haslam York University	<i>Advances in the Forensic Estimation of Time of Death</i> L. Calla Ontario Tech University
16:20-16:40		<i>A Within-host Model of Influenza A (H9N2) Virus Infection Dynamics and Type-I Interferon Response in Chickens</i> W. Xie University of Guelph	<i>Lax-Wendroff Schemes for Quasi-exponential Moment-closure Approximations of Kinetic Models</i> J. Rossmannith Iowa State University	<i>A New Method of Modelling Tuneable Lasers With Functional Composition</i> B. Metherall Ontario Tech University
16:40-17:00		<i>Modelling the Daily Risk of Ebola Virus in the Presence and Absence of a Potential Vaccine</i> S. Abo University of Ottawa	<i>Higher Order Collocation Methods for Nonlocal Wave Equations with Inhomogeneous Boundary Conditions</i> F. Celiker Wayne State University	<i>Simulating Elastic-Like Polypeptides to Better Understand the Mechanical Properties of Materials</i> M.H. Khatami Ontario Tech University

Thursday, August 22: Afternoon

Time	Room		
	LH3094	LH3098	LH3101
	SS-HCLNWE #2	CS-MECHE #1	CS-BSM #2
	Hyperbolic Conservation Laws and Nonlinear Wave Equations Chair: A. Bressan Pennsylvania State University	Computational Mechanics and Engineering Chair: N. Nedialkov McMaster University	Mathematics and Computation in Biological Sciences and Medicine Chair: M. Demers University of Guelph
15:00-15:20	<i>Large Time Behavior of Logarithmic Keller-Segel-Fisher/KPP System</i> Y. Zeng University of Alabama at Birmingham	<i>Numerical Integration of Stiff High-Index DAEs</i> R. Zolfaghari McMaster University	<i>Mathematical Modeling of Integrated Pest Management with Stage Structuring and Impulsive Control</i> A. Sharma IKG PTU
15:20-15:40	<i>Global Solutions of the Compressible Navier-Stokes Equations</i> C. Yu University of Florida	<i>Finite Element Modelling and Simulation Tools for Investigation of the Process and Materials 3D-printed by Selective Laser Melting</i> H.J. Willy National University of Singapore	<i>Deterministic and Stochastic Models of Spontaneous Cell Polarization</i> Y. Liu City University of Hong Kong
15:40-16:00	<i>Scale-dependent Hyperbolic Models and Well-controlled Dissipation Schemes</i> A. Tesdall City University of New York	<i>Recent Developments in 3D Sparse Grid Turbulence</i> N. Malik King Fahd University of Petroleum and Minerals	<i>Investigation and Numerical Solution of the Discrete Analogue of Initial-Boundary Value Problem to One Nonlinear Parabolic Equation</i> M. Tutberidze Ilia State University
16:00-16:20	<i>Convergence of the Vanishing Physical Viscosity Limit for Gas Dynamics</i> M. Schrecker University of Wisconsin-Madison	<i>Numerical Investigation of VAWT Airfoil Shapes on Power Extraction and Self-starting Purposes</i> K. Gharali University of Tehran	<i>Investigation of the Evolution of the Microvascular Network of a Tumor Under the Inhibitory Effect of Endostatin: A Mathematical Study</i> M. Mohammadi K.N. Toosi University of Technology
16:20-16:40	<i>An Experimental and Numerical Study Verifying the Effects of Spectral Enrichment Due to Nonlinear Wave Propagation in Trumpets and Trombones</i> J. Resch University of Waterloo	<i>Numerical Simulation of Mixed Convection Stagnation-point Boundary Layer Flow and Heat Transfer of Hybrid Nanofluids Over a Vertical Plate</i> A. Rosca Babes-Bolyai University	<i>SIR Model with Time-Varying Contact Rate</i> N. Al-Salti Sultan Qaboos University
16:40-17:00			<i>On the Modeling of Drug Delivery to Solid Tumors; Computational Viewpoint</i> M. Soltani K.N. Toosi University of Technology

Friday, August 23

Friday, August 23: Morning

Time	Room	LH1010	LH1011	LH2066
	LH1009	LH1010	LH1011	LH2066
	SS-RPHCS #1	SS-DMI #3	SS-NATAWP #3	SS-FCQAMIM #2
	Recent Progress in Hybrid and Complex Systems Chair: M.S. Alwan University of Saskatchewan	Disease Modelling and Interventions Chair: K. Nah York University	Numerical and Analytical Techniques with Applications in Wave Propagation Chair: D. Onofrei University of Houston	Fields-CQAM Special Session on Industrial Mathematics Chairs: D. Babalola Ontario Tech University
10:00-10:20	<i>Stability Criteria of Hybrid Dynamical Systems in Terms of Two Measures</i> X.Z. Liu University of Waterloo	<i>A Mathematical Model for Studying the Impact of Education Campaigns on HIV/AIDS Transmission</i> P.N.T. Tandong Cheikh Anta Diop University	<i>Long-time Asymptotics for Some Nonlinear Wave Equations with Variable Propagation Speeds</i> S. Snelson Florida Institute of Technology	<i>Identification of communities in complex networks using hypergraph modularity</i> B. Pankratz SGH Warsaw School of Economics
10:20-10:40	<i>Theory of Optimization-constrained Differential Equations</i> P. Stechliniski University of Maine	<i>Predictive Temperature-driven Modeling and Risk Assessment of West Nile Virus in Southern Ontario, Canada</i> D. Yu York University	<i>On the Near-field Cloaking Problem for Maxwell's Equations with Passive Stratified Anisotropic Media</i> A. Welters Florida Institute of Technology	<i>Model Identification for Blood Sugar Levels</i> J. Morra Ontario Tech University
10:40-11:00	<i>A Weak iISS Notion for Impulsive Systems with Time-Delay</i> K. Zhang Queen's University	<i>Decoys and Dilution: the Impact of Incompetent Hosts on Prevalence Of Chagas Disease</i> M. Zahid University of Texas	<i>Domain Decomposition Based Preconditioning for the Integral Equation Formulations of the Forward and Inverse Scattering Problem</i> C. Borges University of Central Florida	<i>Identification of a Dynamic Metabolic Flux Model for a Mammalian Cell Culture</i> M. Carvalho University of Waterloo
11:00-11:20	<i>Stabilization for Delayed Stochastic Systems with Semi-Markovian Switching and Actuator Saturation</i> J. Yang Southwest Minzu University	<i>Population Motivated Discrete-time Disease Models</i> Y. Li Texas Tech University	<i>Adaptive GPU Accelerated Discontinuous Galerkin Method Applied to Solution of von Neumann Paradox</i> L. Krivodonova University of Waterloo	
11:20-11:40	<i>A Novel Observer based Control Scheme for Switched Impulsive Positive Systems</i> H. Chen University of Waterloo	<i>An Optimal Control Strategy for a Malaria Model</i> O. Abu The Federal Polytechnic, Idah, Nigeria	<i>A Convergent Numerical Method for a Multi-frequency Inverse Source Problem in Inhomogeneous Media</i> L. Nguyen University of North Carolina Charlotte	
11:40-12:00	<i>Exponential Stabilization for Markovian Neural Networks with Additive Time-varying Delays Via Sample-based Event-triggered Impulsive Control</i> H. Zhang Nanjing University of Science and Technology	<i>Linearization and Local Topological Conjugacies for Impulsive Systems</i> B. Phillips University of Waterloo	<i>A Kernel-independent Treecode Based on Barycentric Lagrange Interpolation</i> L. Wang University of Wisconsin-Milwaukee	
12:00-12:20	<i>Input-to-State Stability of Coupled Reaction-Diffusion Neural Networks: Delay-Dependent Pinning Impulsive Control</i> X. Xie Huazhong University of Science and Technology			

Friday, August 23: Morning

Time	Room		
	LH3094	LH3098	LH3101
	CS-FINANCE	CS-MECHE #2	SS-ASDEDS #1
	Financial Mathematics and Computation Chair: R. Makarov Wilfrid Laurier University	Computational Mechanics and Engineering Chair: M. Khammar Natural Resources Canada	Algebraic Structure of Discrete-Event Dynamical Systems, and Applications Chair: C.L. Nehaniv University of Waterloo
10:00-10:20	<i>On the Solution of the Optimal Control Problem of Inventory of a Discrete Product in Stochastic Model of Regeneration</i> N. Vakhtanov National Research University, Odintsovo	<i>Desaturation of Granular Materials in Conical Filtering Centrifuges</i> M. Khammar Natural Resources Canada	<i>A Bestiary of Transformation Semigroups for the Holonomy Decomposition</i> C.L. Nehaniv University of Waterloo
10:20-10:40	<i>State-dependent Model for Default Rate</i> B. (Bowen) Hu University of Waterloo	<i>Nonlinear Effects in Designing Environmentally-friendly Lead-free Piezocomposites</i> J.A. Krishnaswamy Wilfrid Laurier University	<i>Natural Subsystems in a Biochemical Reaction System with Multiple Steady States and Hysteresis</i> C. St-Pierre University of Waterloo
10:40-11:00	<i>Calibration and Analysis of Structural Credit Risk Models with Occupation Time</i> M. Mukhopadhyay Wilfrid Laurier University	<i>An Extended Pseudo Potential Multiphase Lattice Boltzmann Model with Variable Viscosity Ratio</i> M. Ashrafzaadeh Isfahan University of Technology	<i>Exploring Tetris as a Transformation Semigroup</i> P. Jentsch University of Waterloo
11:00-11:20	<i>High-Frequency Statistical Modelling for Jump-Diffusion Asset Price Processes</i> R. Xu Wilfrid Laurier University	<i>Vacuum Expanded - Laser Induced Therm-ionic Thrusters</i> P. Pal SRM Institute of Science and Technology	<i>Algebraic Structure and Complexity of Bootstrap Percolation with External Inputs</i> S. Pal University of Waterloo
11:20-11:40	<i>A Semi-definite Programming Formulation for Collective Mental Accounting: An Integrated Behavioral Portfolio Selection Model</i> A. Seifi Amirkabir University of Technology	<i>Development of a Lattice Boltzmann Model for the Solution of Partial Differential Equations</i> M. Ashrafzaadeh Isfahan University of Technology	<i>Spatial Iterated Prisoner's Dilemma as a Transformation Semigroup</i> I. Farahbakhsh University of Waterloo
11:40-12:00	<i>Fuzzy Logic Model to Identify the Authenticity of Claim of Insurance</i> S. Kumar Dr. Bhimrao Ambedkar University		

Friday, August 23: Afternoon

Time	Room	LH1010	LH1011	LH2066
	LH1009 SS-RPHCS #2	LH1010 SS-EMA	LH1011 SS-NATAWP #4	LH2066 CS-MODELING
	Recent Progress in Hybrid and Complex Systems Chair: P. Stechlinski University of Maine	Environmental Modelling and Analysis Chair: S. Roberts & C. Robertson Wilfrid Laurier University	Numerical and Analytical Techniques with Applications in Wave Propagation Chair: E. Kirr University of Illinois at Urbana-Champaign	Partial Differential and Integral Equations in Mathematical Modeling Chair: M. Narita National Institute of Technology, Okinawa College
15:00-15:20	<i>Input-to-State Stability for Delayed Hybrid Systems and Application to H_∞ Control</i> M.S. Alwan University of Saskatchewan	<i>Landscape Similarity Analysis: Comparing Hand-crafted and Learned Features</i> K. Malik Wilfrid Laurier University	<i>Solitary Waves of a Highly Nonlinear Fourth-order Wave Equation and Their Properties in Different Nonlinearity Regimes</i> S. Anco Brock University	<i>Mathematical Results on Hyper-Inflationary Cosmological Model</i> M. Narita National Institute of Technology, Okinawa College
15:20-15:40	<i>Pinning Impulsive Synchronization of Complex-valued Dynamical Networks</i> Y. Shen University of Waterloo	<i>Implementation, Risk-analytics, and Visualization of Large-scale Flood Modeling System on Big-data Framework</i> C. Chaudhuri Wilfrid Laurier University	<i>Poiseuille Flow of Nematic Liquid Crystals Via Ericksen-Leslie Model</i> G. Chen University of Kansas	<i>Local Fourier Analysis for Overlapping Additive Block Relaxation Schemes</i> Y. He Memorial University of Newfoundland
15:40-16:00	<i>Mean-square Stability of Stochastic System with Impulse and Unbounded Delay</i> M. Li South China University	<i>Integrating Discrete Spatial Simulation Models and Discrete Global Grid Systems: A Case Study Into Wildfire Modelling</i> M. Hojati Wilfrid Laurier University	<i>On the Energy Cascade of Wave Turbulence Systems</i> M.-B. Tran Southern Methodist University	<i>Fractional Calculus Approach for the Phase Dynamics of Josephson Junction Under the Influence of Magnetic Field</i> A. Rasheed Lahore University of Management Sciences
16:00-16:20	<i>Sampled-data H_∞ Filtering of a Class of Distributed Parameter Systems</i> H. Ji Jiang Nan University	<i>Distance Between Shapes for Closed Polygonal Curves</i> S.A. Roberts Wilfrid Laurier University	<i>Finite-dimensional Representation for Infinite-dimensional Dynamical System of Nonlinear Klein-Gordon Equations</i> Y. Iwata Kansai University	<i>Exact Solutions and Symmetry Classification of Heat Equation on Surfaces of Revolution</i> M. Mustafa Qatar University
16:20-16:40	<i>A Resource Allocation Approach to Studying the Rules and Resources</i> A. Joghataie University of British Columbia	<i>Impact of Agricultural Tariffs and Trade Wars on Global Land Use</i> S. Pal University of Waterloo	<i>Limiting on Adaptively Refined, Nonconforming Meshes</i> K. Dutt University of Waterloo	<i>Strip-saturation Model for Mode-III Semi-permeable Collinear Cracks Weakening a Piezoelectric Strip</i> P.R. Verma University of Delhi
16:40-17:00	<i>Stability and Stabilization of Chaotic Systems under Aperiodic Sampling and State Quantized Controller</i> J. Luo University of Electronic Science and Technology of China	<i>Peristaltic Transport of an Ellis Fluid in an Inclined Asymmetric Channel</i> A. Small The University of the West Indies	<i>Numerical Method in Riemann Invariant Form for Investigating The Effectiveness of A Submerged Bar Breakwater Model as A Coastal Protector</i> I. Magdalena Bandung Institute of Technology	
17:00-17:20	<i>Impulsive Distance-based Formation Tracking Control of Multi-agent Systems</i> Z. Wu Nanjing University of Science and Technology			

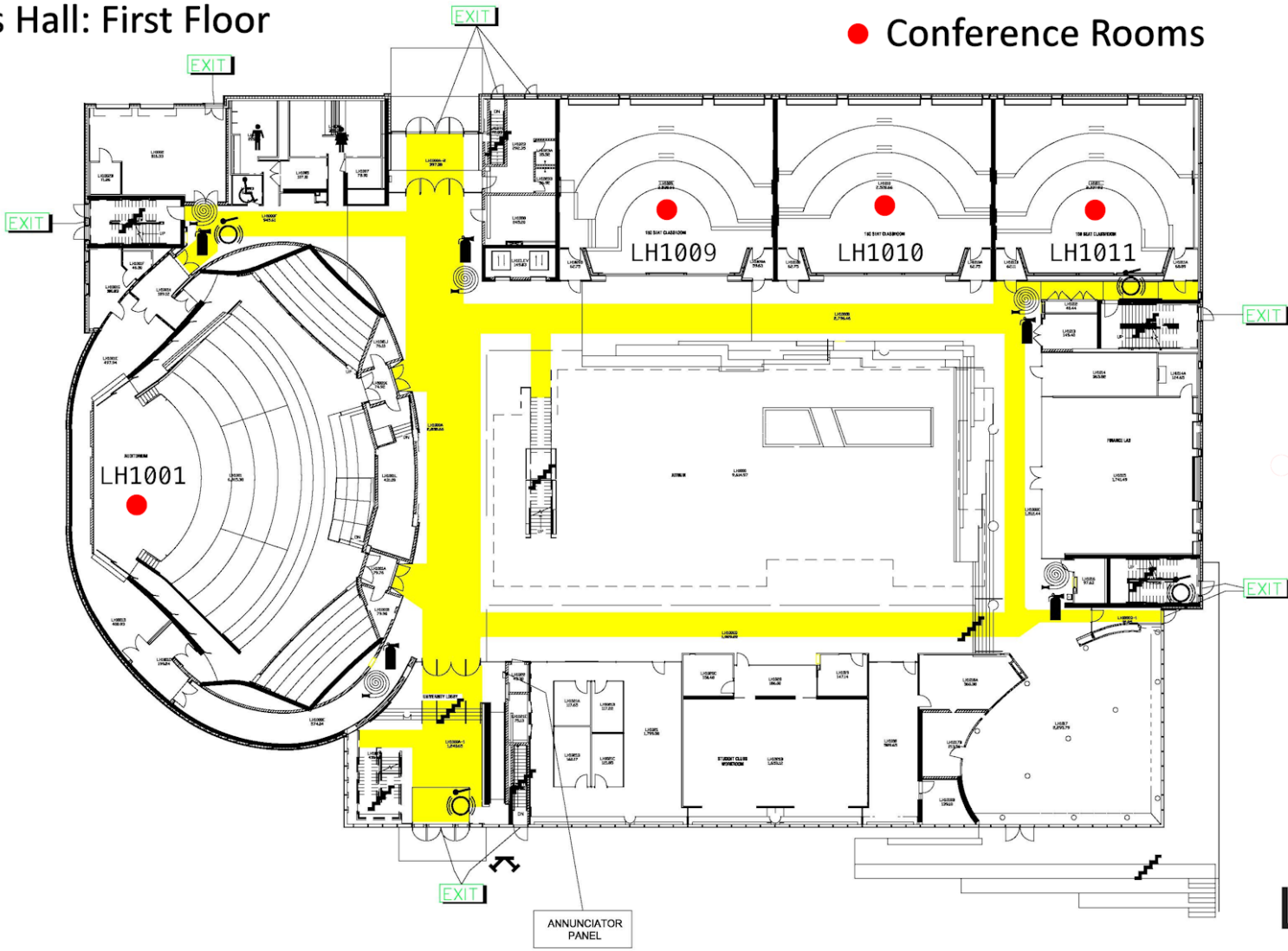
Friday, August 23: Afternoon

Time	Room		
	LH3094	LH3098	LH3101
	CS-CPC	CS-MECHE #3	SS-ASDEDS #2
	Computational Physics and Chemistry Chair: R. Meyer Laurentian University	Computational Mechanics and Engineering Chair: M. Soltani K.N. Toosi University of Technology	Algebraic Structure of Discrete-Event Dynamical Systems, and Applications Chair: C.L. Nehaniv University of Waterloo
15:00-15:20	<i>The Journey of a Single Polymer Chain to the Entrance of a Nanopore</i> N. Afrasiabian University of Western Ontario	<i>Thermal and Pollution Aspects of a Storage Water Heater Affected by Flue Baffles</i> G. Schneider University of Waterloo	<i>Algebraic Structure of the Varikon Box</i> J. d'Eon University of Waterloo
15:20-15:40	<i>Thermal Conductances of Silicon Phononic Crystals Determined by Reverse Non-Equilibrium Molecular Dynamics Simulations</i> R. Meyer Laurentian University	<i>Numerical Study of the Geometry of a Vertical U-tube Ground Heat Exchanger</i> K. Gharali University of Tehran	<i>Collatz Approximation Semigroups</i> S. Riasat University of Waterloo
15:40-16:00	<i>Symmetry and the Tradeoff Between Model Specificity and Effective Sample Size</i> N. LaRacunte University of Illinois at Urbana-Champaign	<i>Numerical Investigation of Evaporation of Multicomponent Droplet</i> A. Sadooghi Tarbiat Modares University	<i>Seeing Convolution Through the Eyes of Finite Transformation Semigroup Theory: An Abstract Algebraic Interpretation of Convolutional Neural Networks</i> A. Hryniewski University of Waterloo
16:00-16:20		<i>A Numerical Model for Predicting Desalinated Water Production from the Humid Atmosphere by Underground Condensation</i> M. Soltani K.N. Toosi University of Technology	
16:20-16:40			
16:40-17:00			

14. Maps

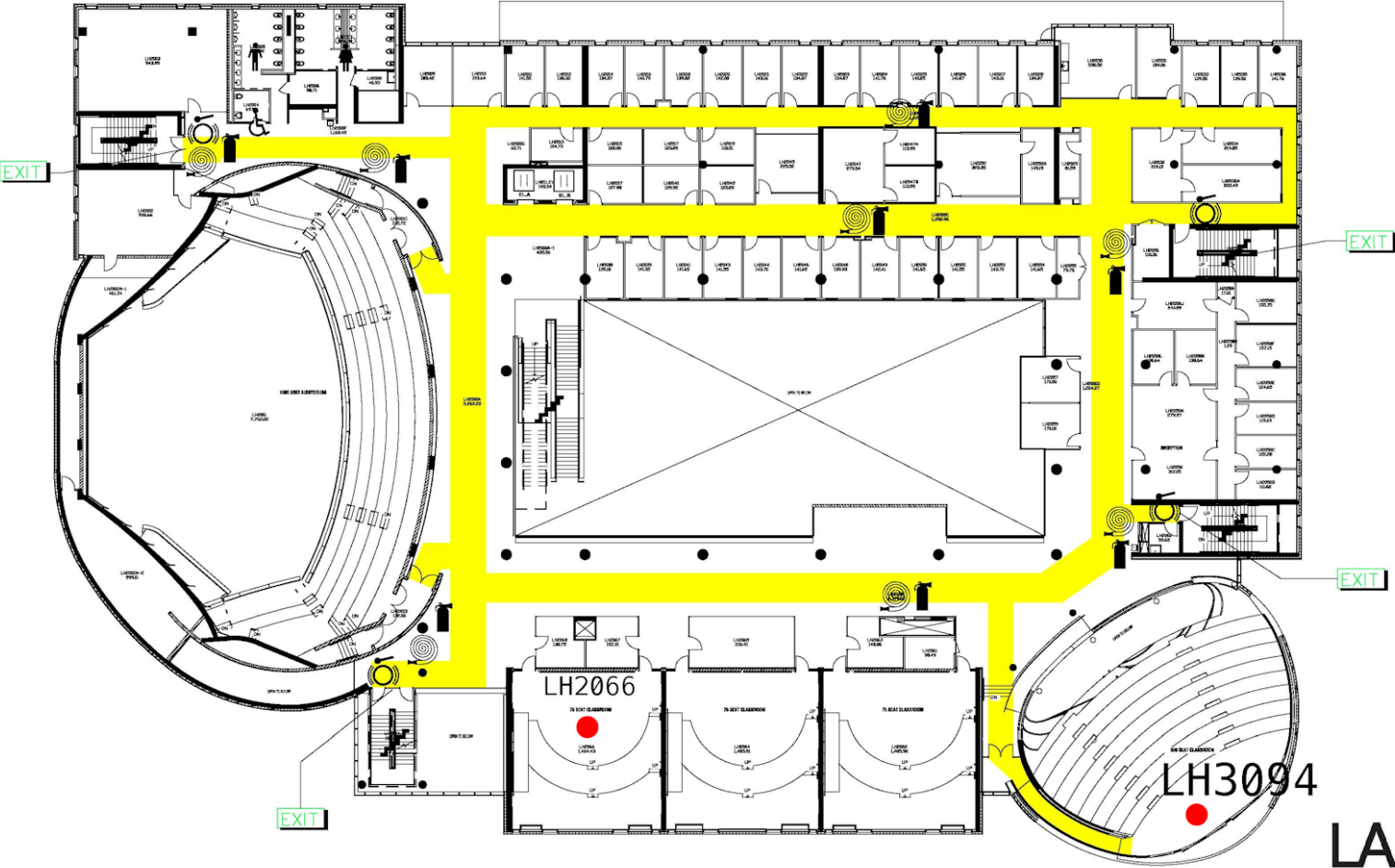
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● Conference Rooms



Lazaridis Hall: Second Floor

● Conference Rooms



Wilfrid Laurier University Campus & Parking



 Visitor Parking Lots

LH Lazaridis Hall

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