



Newsletter

Winter 2017

AARMS Summer School 2017

Theme: **Financial Mathematics and Actuarial Sciences**.
Time and location: July 3 – 28, 2017, University of Prince Edward Island. School Directors: Dr. Alexander Alvarez, Dr. Gordon MacDonald, and Dr. Nasser Saad.

The summer school is intended for graduate students and promising undergraduate students from all parts of the world. Each participant is expected to register for at least two of the three courses. Each course consists of three hours lecture sessions per day for two weeks. These are graduate courses approved by University of Prince Edward Island and we will facilitate transfer credit to the extent possible. Accommodation and tuition are provided free of charge. The following courses will be offered

Equity-Linked Life Insurance (July 3 – July 15),

Instructors: Dr. Alexander Melnikov (Alberta)

Statistical Modeling in Finance and Insurance: from data to real-time decision making (July 17 – July 28),

Instructor: Dr. Manuel Morales (Montreal)

Stochastic Control with applications to Mathematical Finance (July 17 – July 28), Instructor: Dr. Agnès

Sulem, (Centre de Recherche Inria de Paris)

To apply please visit our website: <https://aarms.math.ca/affiliated/summer2017/>. Or, for further information contact:

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Attending the Academic Sponsors Day at MSRI

Last year, AARMS became an academic sponsor of MSRI. As a result, I went to Berkeley in early March to represent AARMS at the Academic Sponsors Day. It was a lovely experience, which, of course, may have been rose-tinted by the fact that California was in full Spring bloom, while here we were still wading in slush. But in the end, it was the variety of activities and the opportunity to meet mathematicians from various places and disciplines that made my visit memorable.

After coffee in the lobby, where a plaque naming AARMS had been added to the wall of sponsors, we gathered in the Simons Auditorium. This auditorium is the most impressive lecture room I ever visited. Through clever use of natural light and blonde wood, the auditorium evokes the feel of an old-school classroom, while still clearly stating its contemporary design. The complex curvature of the ceiling appeals to a mathematician's esthetic.

The day began with a lecture by Terence Tao, who, in his casual style, gave a clear and concise account of recent interactions between the fields of harmonic analysis and analytic number theory, which are the twin themes of the MSRI program for Spring 2017. Two post-doctoral fellows representing each of the themes elaborated on the topics and showed their own work.

This was followed by a business meeting, where director David Eisenbud, deputy director Helene Barcelo and academic sponsor Chair Judy Walker gave their report. Helene announced the themes of upcoming research programs: Hamiltonian systems, from topology to applications through analysis, in Fall 2018, and twin programs in derived algebraic geometry, and birational geometry and moduli spaces, in Spring 2019.

The afternoon talks showed other facets of the activities at MSRI. Tatiana Shubin gave an inspiring lecture about Navajo Nation Math Circles, which brings math appreciation to First Nation children in the Southern US. As part of her lecture, she showed beautiful pictures of the landscape in the Navajo Nation, and moving pictures of middle school children fully engaged in math puzzles, showing confidence, curiosity and joy in learning.

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This was followed by a lecture by William Stein, who demonstrated Sage Math Cloud, which he developed to make it easier to teach courses using open source math software such as Sage, R, and Latex. Last but definitely not least, the day ended with a lecture by Joseph Teran, who helped make the snow in the movie Frozen look so natural. Teran and his group at UCLA specialize in computational modelling of biomechanics and solid and fluid mechanics. As a consultant, he advises Disney on how to produce real-looking imagery of natural phenomena. He showed convincingly that using models based on physics and math allows for great improvements in portraying movement, sand, smoke and snow in animated movies. And he had the videos to show it: his “before and after” pictures wowed the audience.

The day ended with a great banquet for all the sponsors and the members of the Board of Trustees, which featured a playful dinner speech by Deanna Needell on compressed sensing. Overall, the day left me with admiration for the work of my colleagues, from theory to applications, and a great optimism regarding the mathematical sciences.

- Jeannette Janssen

Benefits of MSRI Sponsorship

The AARMS sponsorship of MSRI brings a number of benefits. Most important is that graduate students from the Atlantic provinces can now apply to attend (and receive funding for) any of the distinguished MSRI summer schools. Not all summer schools are at MSRI; one is held in Montreal, for example. The list of most of the summer schools for 2018 can be found on the MSRI Web page; a full list is announced in August. Before the following November, students interested in attending should contact AARMS. AARMS will then forward the names of selected students to MSRI on December 1. Selection is on first come/first serve basis, and is limited to 2-3 students per year.

In addition, there is partial funding available for MSRI members to visit one of our universities and give a colloquium or seminar talk. There is also partial funding for a post-doc or junior faculty member to attend a workshop at BIRS. In addition, from time to time MSRI holds events that are of general interest to the mathematical community. Academic Sponsors are invited to send representatives, funded by MSRI.

AARMS PDF Report: Marzieh Bayeh



After graduating from the University of Regina, I am now pleased to hold an AARMS Postdoctoral Fellowship at Dalhousie University under the supervision of Dorette Pronk. My research involves algebraic topology, topological invariants and category theory. In particular,

Dorette and I are working on the LS-category and topological complexity of orbifolds.

The topological complexity of the configuration space of a mechanical system, such as a robot, was introduced to estimate the complexity of a motion planning algorithm. We want to take the effect of symmetry on the mechanical system or its configuration space into consideration, and the notion of orbifold was developed to model objects with local symmetry described by the action of a finite group. Thus far, this aspect of robotics and motion planning has not been considered and it is leading us to an interesting research area with many exciting questions. For example, if we have a (smooth or linear) path between two points x and y in our orbifold, what can we say about the existence of such paths between any point in the orbit of x (with respect to the symmetry) and any point in the orbit of y ?

This is leading us to consider equivariant versions of these topological invariants. In the existing literature, there are two approaches toward the development of an equivariant version of topological complexity. Both have their own advantages and disadvantages. However, for our purposes, neither has the right kind of properties. So, our goal is to develop a new definition which is a suitable generalization of the classical notion for ordinary topological spaces and characterizes the types of features encountered in motion planning for a system with symmetry. Thus far, we are working toward two publications: one on the LS-category of groupoids and one on a new notion of equivariant topological complexity.

The AARMS Postdoctoral Fellowship has provided a very supportive environment which provides me the opportunity to participate in many activities besides research, including teaching and holding training sessions for mathematical competitions. Dorette, Christopher Duffy, Asmita Sodhi and I enjoy coaching the Math Challenge Club in Dalhousie University. This club provides weekly training sessions to prepare junior high-school students for math competitions. Each Monday from 5 till 7 PM we engage about 20 students in challenging math problems related to concepts they have seen in their school education. The students come because they enjoy mathematics, but not all are at the same level. So a fair amount of individual help is needed.

In the fall semester, Dorette and I organized a preparation program for undergraduate students who are interested in attending mathematical competitions such as the Science Atlantic Mathematical Competition and the Putnam Contest. This program was comprised of a series of weekly problem solving sessions, and the accomplishments of our students in these competitions (one of our teams returned with the second prize) are a testament to the success of this program. Also, I enjoyed judging the undergraduate presentations at Science Atlantic 2016, as well as marking the Science Atlantic Mathematics Competition.

Dr. Richard Nowakowski: some words of appreciation



This year Richard Nowakowski turns 65, and as part of the celebrations CanaDAM 2017 is hosting 3 sessions in his honour. Richard obtained his Ph.D. in 1978 from the University of Calgary, under the supervision of Richard K. Guy and he began his career at Dalhousie University the following year.

Richard's program of research has greatly influenced two disciplines,

graph theory and combinatorial game theory. He has published over 80 articles in graph theory and 23 in game theory. He has co-authors two books, one in combinatorial game theory, and other in the well studied graph game of cops & robbers – a field study which he has created.

The Atlantic region has been greatly influenced by Richard. He has supervised over 25 graduate students and almost every university in Atlantic Canada has a faculty member that was supervised by Richard. This means that graph theory students in Atlantic Canada are familiar with at least 6 different graph products!

Richard's accolades span both his research and teaching career. He has been the recipient of NSERC Grants and awarded the title of University Research Professor. He was given the 2008 CMS Adrien Pouliot Award for teaching excellence and he has been awarded a Dalhousie Faculty of Science teaching award. His teaching has gone beyond the university classroom to include working with NS Math Circles, the NS Math League and a variety of other math camps and outreach events.

Though Richard is retiring this year, it is safe to say that he will still be actively involved in research. Happy Birthday and Happy Retirement, Richard!

- Danielle Cox

Math Challenge Club at Dalhousie

At about 5:05 on Mondays on the third floor of the Chase building at Dalhousie University the noise begins to build. Over the course of the next two hours (including an important break for pizza) sounds of frustration and confusion mostly give way to understanding and appreciation. Voices from somewhere between 20 and 25 young students, of a variety of ages and mathematical ability, question, confuse, ponder and wonder at the Math Challenge Club.

Originally started as an outreach program with the aim of preparing young girls for mathematics competition, the Math Challenge Club has developed a reputation as a place for open

learning, interesting extra-curricular mathematics and boisterous discussion (much to the chagrin of graduate students working late at the office). With minimal advertising, the program has grown by word of mouth from teachers and parents. At present, the weekly club attracts talented students from as early as grade four. Though some of these students are using these sessions to prepare to compete in provincial and national contests; for most of the students, it is a chance to see their friends, learn some cool mathematics and devour some pizza.

As spring gives way to summer, the Math Challenge Club will go the way of school bells, attendance and recess. Though just as surely as the undergraduates invade again in September, so too will the third floor of the Chase building be invaded every Monday evening by budding (and noisy!) mathematicians.

The Math Challenge Club runs weekly from 5 - 7pm at Dalhousie University. For more information contact Dr. Dorette Pronk (dorette.Pronk@dal.ca)

- Chris Duffy

AAC Minicourse Report

During the week from March 6 to March 10, the AARMS-AAC-mini course 'Hopf algebras and their generalizations from a categorical point of view' took place at the Atlantic Algebra Centre of Memorial University. Professor Gabriella Böhm of the Hungarian Academy of Sciences gave five lectures on Hopf algebras and their generalizations, such as weak Hopf algebras, within monoidal categories. Professor Böhm is one of the leading experts in the area and has published widely on the subject. The now intensively studied concept of a weak Hopf algebra was introduced by her.

Professor Böhm lectured on monoidal categories, monoidal structures on functors between such categories, monads and bimonads in these categories, Hopf algebras and Hopf algebroids, weak Hopf algebras, and duoidal categories. She had prepared lecture notes, which are now available from the page of the mini course at the web site of the Atlantic Algebra Centre. The approximately twenty participants ranged from faculty members to undergraduate students and from specialists on Hopf algebras to students writing their thesis in the field. While most participants came from Memorial University, there were also external guests from the University of New Brunswick and the Université Libre de Bruxelles, who experienced an intense week with many mathematical discussions in a relaxed atmosphere.

The next events at the Atlantic Algebra Centre are already on the way. A workshop 'Combinatorics of group actions and its applications' is in the planning stage for the end of August and beginning of September.



Recent and Upcoming Events

AARMS Workshops and Minicourses

Hopf Algebras and Their Generalizations from a Categorical Point of View

Organizers: Yuri Bahturin, Mikhail Kotchetov, Yorck Sommerhauser

Location: Memorial University, St. John's

Date: March 6 – 10, 2017

Contact Information: Yorck Sommerhauser (sommerh@mun.ca)

Atlantic General Relativity 2017

Organizers: Ivan Booth

Location: Memorial University, St. John's

Date: June 1 – 2, 2017

Contact Information: Ivan Booth (ibooth@mun.ca)

CAIMS 2017 – Public Lecture

Organizers: David Iron, Theo Kolokolnikov, Paul Muir

Location: Dalhousie University, Halifax

Date: June 17 – 21, 2017

Contact Information: Paul Muir (muir@smu.ca)

12th East Coast Combinatorics Conference

Organizers: Tim Alderson, Andrea Burgess

Location: Memorial University, St. John's

Date: July 20 – 21, 2017

Contact Information: Tim Alderson (tim@unb.ca)

AARMS-Sponsored Events

CanaDAM 2017

Organizers: Gary MacGillivray

Location: Ryerson University, Toronto

Date: June 12-16, 2017

Contact Information: Gary MacGillivray (gmacgill@math.uvic.ca)

The XI Americas Conference on Differential Equations and Nonlinear Analysis

Organizers: Xiaoqiang Zhao et al

Location: University of Alberta, Edmonton

Date: August 12-19, 2017

NOTE: travel funding available for students and postdocs from Atlantic Canada

Contact Information: Xiaoqiang Zhao (zhao@mun.ca)

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“Increasingly, the mathematics will demand the courage to face its implications.”

—Michael Crichton, Jurassic Park