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CMS NOTES de la SMC

October /
octobre
2014

Executive Director Notes

Johan Rudnick, CMS Executive Director



After New CMS Bylaws, Less Means More

How many mathematicians does it take to operate a math society? Is 200 too much?

How many committees do you need to manage a math society? Is 17 too few?

How many board members do you need to govern a math society? Is 33 about right?

Leading up to the recent June Annual General Meeting (AGM) where new CMS bylaws were approved, the CMS Board wrestled with these vexing questions and came up with some interesting possibilities—all pointing toward ‘less means more.’

As for the new CMS bylaws themselves, less does prove to mean more.

The old bylaws were quite prescriptive about how everything was to be done. The new CMS bylaws focus instead on what needs to be done, and that consists of just two core considerations: membership and governance. As to all the ‘how’ questions about CMS operations, this is now left to the members and Board to decide. So with the new modernized bylaws in place, the CMS is presented with a unique ‘What now?’ moment to reflect if it can better represent and serve the community.

Less Class, More Rights

For CMS members, in practical terms, the world is little changed. CMS members will continue to include individuals and organizations and those members will continue to have their membership subject to Board approval. The new bylaws now formally place all CMS members into a single class and every member has exactly the same rights—primarily the

right to one vote. So whether someone is an undergraduate student, a graduate student, a post doc, a lecturer, or a professor, each member has the same one vote at the AGM. Whether an organization, big or small, is a sponsor, a partner, or a university, each organization has the same one vote at the AGM. Where the really big change comes is not within the bylaws, but rather within the new Canada Not-for-Profit Corporations Act, the impetus for CMS creating new bylaws. Under the new Act, all membership rights have been codified, which means that if a right is denied, it can now be enforced by the courts. For example, if the CMS refuses to disclose annual financial statements, a member could now go to the court and the court could force CMS to release the information. Fortunately, CMS already has in place measures and practices that meet or exceed requirements under the Act. For example, the CMS publically discloses audited financial statements on the CMS website.

Fewer Rules, More Options

Under the new bylaws, the CMS Board will have at least 3 and no more than 33 members (the current Board size). At the June AGM, members gave the Board the authority to adjust the size of the Board to between 3 and 33 members. Under the old bylaws, such a change would have required an AGM motion to change the bylaws, followed by lawyers filing the change. Now, with a less prescriptive approach and more Board discretion, change is easier to implement.

Under the old bylaws, Board members were elected in advance of the AGM; the new Act stipulates that Board members must be elected at the AGM. Unfortunately, it is hard to envision a 1,000 or so CMS members attending the AGM—no matter how welcome they would be. Fortunately, the new CMS

Robert Dawson, Saint Mary University

Just A Bit Bigger?



This summer, an American jury awarded a widow \$16.8 million in compensatory damages in a lawsuit against R. J. Reynolds Tobacco Co. They also awarded \$23.6 billion in punitive damages. No, that was not a misprint.

This editorial will not comment on the size of the compensatory award; this is a mathematical journal, not a legal one. However, the relative size of the punitive award, deserves attention - more attention than it actually got.

Some sources suggest that the amount is comparable to the entire value of the corporation. If the award were upheld on appeal (which various legal experts have said is unlikely) one side effect might be that there would be nothing left for any other injured party to recover, though that is probably not a matter for the court to consider. Certainly, even for more optimistic estimates of the company's realizable value, two or three awards of this size would clean out everything available.

The question that this raises in the mathematical educator's mind is - how did the jury decide that this number was appropriate? By definition, punitive damages are not based directly on quantifiable damage; and the amount is not a fixed multiple of the compensatory damages. Presumably somebody fished a number out of the air; one would suppose the three-digit precision is spurious, and involves interest payments on a round number.

Suppose the numbers were smaller. It would be hard to imagine a court awarding \$16 damages for (let us say) an inedible restaurant meal and tacking on \$20,000 in punitive damages; and if they did so, the story would have echoed around the "silly season" circuit for months. Or let's go a bit higher. Suppose somebody is awarded \$1,600 damages after a car accident. Can we imagine the court throwing in a cool two million in punitive damages? And if they did, it is certain that the public reaction would be a belly laugh of derision.

But in this case, the ratio really was more than a thousand to one - and this passed almost unremarked, except in technical discussions embedded in articles. There was no astonishment, no headlines screaming "Punitive Damages A Thousand Times Bigger!"

Is it possible that the jury thought "well, sixteen million isn't a lot for a big company to pay. What's the next thing up from sixteen million? Sixteen billion, that's what."

And is it possible that many journalists and members of the public thought the same way? Our society is too complicated for this fancy version of "one, two, many" to be appropriate.

Juste un peu plus gros?

Cet été, un jury aux États-Unis a accordé à une veuve 16,8 millions de dollars en dommages-intérêts compensatoires dans le cadre d'une poursuite qui avait été intentée contre l'entreprise R.J. Reynolds Tobacco Co. Le jury a également accordé 23,6 milliards de dollars en dommages-intérêts punitifs. Non, ce n'est pas une faute de frappe.

Nous ne nous attarderons pas, dans le présent éditorial, au montant compensatoire accordé à cette personne; il s'agit d'une revue de mathématiques et non d'une revue de droit. Il sied toutefois de porter une attention toute particulière à la taille relative du montant punitif accordé – plus d'attention qu'il n'en a en fait reçu.

Selon certaines sources, le montant est comparable à la valeur toute entière de l'entreprise. Si le montant accordé à la veuve est maintenu au cours de l'appel (ce qui est peu probable selon divers juristes), un des effets secondaires serait le suivant : aucune autre partie lésée ne pourrait recouvrir de fonds parce qu'ils auraient été épuisés – même si cette question ne relève probablement pas de la compétence du tribunal qui devra trancher. Certes, même si l'on accepte des estimations plus optimistes de la valeur réalisable de l'entreprise, deux ou trois décisions de la sorte auraient pour effet de vider complètement les coffres.

La question qui est soulevée dans l'esprit de l'enseignant en mathématiques et la suivante : comment le jury a-t-il fait pour établir que ce chiffre était approprié? Par définition, les dommages-intérêts punitifs ne sont pas fondés directement sur des torts quantifiables; et le montant n'est pas un multiple fixe des dommages-intérêts compensatoires. On peut présumer qu'un des membres du jury a lancé un chiffre au hasard; on pourrait supposer que la précision de trois chiffres est fallacieuse et porte sur des paiements d'intérêts calculés sur un chiffre rond.

Imaginons maintenant que les chiffres aient été moins significatifs. On aurait peine à imaginer un tribunal qui accorderait 16 \$ en dommages-intérêts (par exemple) pour un repas peu appétissant dans un restaurant et qui viendrait ajouter à ce montant 20 000 \$ de dommages-intérêts punitifs; et si c'était le cas, on parlerait de cette décision des mois durant. Ou allons-y avec des chiffres un peu plus élevés. Imaginons qu'une personne se voit attribuer 1 600 \$ en dommages-intérêts à la suite d'un accident de la route. Pouvons-nous imaginer que le juge ajoute à ce montant des dommages-intérêts punitifs se chiffrant à deux millions de dollars? Devant pareille décision, le public se tordrait de rire.

Mais dans ce cas en particulier, le rapport était en réalité plus de 1 000:1 – et la décision est passée pratiquement inaperçue, sauf dans des discussions techniques, dans divers articles. Nul n'a été estomaqué, on n'a vu aucun grand titre de journal « Dommages-intérêts punitifs 1 000 fois plus grand! ».

Est-il possible que les membres du jury dans ce dossier se soient dits que « 16 millions de dollars, c'est bien peu à verser pour une grande entreprise? Qu'est-ce qui vient après 16 millions? Seize milliards, voilà ce qui vient après. »

Et est-ce possible que de nombreux journalistes et membres du public aient eu le même raisonnement? Notre société est beaucoup trop complexe pour que cette version loufoque du « un, deux, nombreux » puisse être admise.

Notes du directeur exécutif

Johan Rudnick, Directeur exécutif de la CMS

Après L'entrée En Vigueur Des Nouveaux Règlements Administratifs De La SMC, Moins Veut Dire Plus

Combien faut-il de mathématiciens pour voir au fonctionnement d'une société mathématique? Est-ce que 200 est un nombre démesuré?

Combien faut-il de comités pour gérer une société mathématique? Est-ce que 17 saurait suffire?

Combien faut-il de membres du conseil d'administration pour administrer une société mathématique? Le nombre idéal serait-il 33?

Avant la tenue de l'assemblée générale annuelle (AGA) du mois de juin dernier, rencontre au cours de laquelle les règlements administratifs de la SMC ont été approuvés, le conseil d'administration de la SMC a réfléchi à ces questions difficiles et a trouvé quelques possibilités intéressantes — chacune reposant sur le principe suivant : « moins c'est plus ».

En ce qui a trait aux nouveaux règlements administratifs de la SMC, moins c'est vraiment plus.

Les anciens règlements administratifs étaient très prescriptifs quant au mode d'exécution de toutes les activités. Les nouveaux règlements administratifs de la SMC mettent plutôt l'accent sur ce qui doit être accompli, ce qui n'implique que deux grands thèmes : adhésions et gouvernance. En ce qui concerne les questions qui se rapportent à la façon d'accomplir les activités de la SMC, les décisions en ce sens seront dorénavant du ressort des membres et du conseil d'administration. Les nouveaux règlements administratifs modernisés étant maintenant en vigueur, la SMC se trouve dans une position unique, un moment privilégié où elle peut se poser la question « Et quelle est la suite? » pour mieux représenter et servir la communauté.

Moins de catégories, plus de droits

Pour les membres de la SMC, sur le plan pratique, le monde a peu changé. La SMC aura toujours pour membres des particuliers et des organisations, et l'adhésion de ces membres sera toujours assujettie à l'approbation du conseil d'administration. Les nouveaux règlements administratifs recourent maintenant officiellement tous les membres de la SMC en une seule catégorie, et chaque membre jouit des mêmes droits — essentiellement le droit à une voix. Que la personne soit un étudiant du premier cycle ou du deuxième cycle, un étudiant postdoctoral, un conférencier ou un professeur,

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Letters to the Editors

The Editors of the NOTES welcome letters in English or French on any subject of mathematical interest but reserve the right to condense them. Those accepted for publication will appear in the language of submission. Readers may reach us at the Executive Office or at notes-letters@cms.math.ca

Lettres aux Rédacteurs

Les rédacteurs des NOTES acceptent les lettres en français ou anglais portant sur un sujet d'intérêt mathématique, mais ils se réservent le droit de les comprimer. Les lettres acceptées paraîtront dans la langue soumise. Les lecteurs peuvent nous joindre au bureau administratif de la SMC ou à l'adresse suivante : notes-lettres@smc.math.ca.

NOTES DE LA SMC

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Continued from cover

bylaws allow the Board to hold an advance poll for the election of new Board members. That advance vote would be tallied with the actual vote held during the AGM.

In addition, the election of Board members will be relatively unchanged. Nominations will be open as in the past. Designated Board member positions (e.g., President, Vice-President, etc.) are expected to continue. Advance voting for Board members is expected to continue. The big difference between the old and the new bylaws is that the Board now has discretionary authority to change the nature of the Board without amending the bylaws.

One area where change may occur is in how Board and CMS responsibilities are allocated. Under the old bylaws, the CMS President had dual roles, first as the Chair of the Board and, second, as the designated Chief Executive Officer of the CMS. Under the new bylaws, officer positions are not prescribed and are left to the Board to define. The Board could, therefore, decide to establish a Board Chair position that is completely separate from a President position. Separating Chair and President functions would reinforce the Board authority over the Executive Committee and especially the President, as the Chair would manage Board affairs while the President would report to the Board on CMS operations.

Less Board, More Regions

As part of the deliberations leading to the new CMS bylaws, consideration was given to how big the Board should be and how many VPs are needed.

There was general agreement that a smaller Board made sense, for example, one with 23 members, including about seven executives. At 23 members, a new Board would outnumber the Executive Committee by at least 2:1 which would support a strong Board challenge function to executive action and advice. Fortunately, such a substantive reduction can be achieved fairly quickly through attrition. As coincidence would have it, judicious management of regionally designated Board positions, allowing certain Board positions with terms ending in June 2015 to be eliminated, along with the creation of some new positions, could result in a 24-member Board after the 2015 election. A subsequent lapse of a Director position would bring the Board size to the target 23 members.

As part of the size deliberations, the Board considered balancing regional representation along with activity levels across Canada. What emerged was the concept to establish a VP position for B.C. and redistribute regional Board positions. Responsibilities for the Yukon, the NWT, and Nunavut could then be assigned to VPs from B.C., the West, and Quebec.

A smaller Board with one new region could result in the following Board structure:

Atlantic: 1 VP + 2 Directors;
Quebec: 1 VP + 3 Directors;
Ontario: 1 VP + 4 Directors;
West: 1 VP + 3 Directors; and
B.C.: 1 VP + 3 Directors.

Add in the President, the President-Elect or Past President, plus a Student Director, and the result is a 23-member Board. While the new *Act* does not allow for the unelected 'Appointed Directors'

that existed under the old bylaws, it does allow the Board to appoint a Director if there is vacancy and that appointment is only valid until the next AGM. For students, this regime will require the election of a 'Student' Director and, like the possible separation of Board Chair and President functions, that director may or may not be the Chair of the Student Committee.

Less Span, More Control

Under the old bylaws, the CMS Board delegated responsibilities to 6 editorial Boards and 17 standing committees with 11 associated sub-committees that today collectively totals 268 positions. That means there are 17 Chairs reporting to the Board on what CMS is doing. The committees range from Bilingualism to Publishing to International Affairs to Electronic Services. In principle, the Board oversees what each and every standing committee does. In addition, with six Editorial Boards and the Ottawa Office, the Board span of control covers 24 distinct responsibility centres—an incredible span and level of delegation. Similar to the notion of a smaller CMS Board, one would not be surprised to discover a general agreement that fewer committees reporting to the Board is an excellent idea, one that might enhance the Board's control of standing committees.

Less Society, More Corporation

Since CMS was established, its role has changed substantially. Under the old bylaws established over 30 years ago, the CMS was a 'society' that focused on conferences and research publishing. Under the new Act and bylaws, the CMS is a 'corporation' that also stages competitions and math camps, bestows honours and awards, provides grants, and supports other math organizations. It follows that while the CMS still needs to be a society of mathematicians, the requisite operating model for CMS today will be quite different from the CMS founding tenets of the 1945 congress and the 1979 incorporation. The new CMS bylaws are but one critical element to ensure that how CMS is governed and operates makes sense today.

Less Act, More Action

Although the new bylaws are now in place and allow for change without the onerous process of changing the bylaws, nothing as yet has actually changed for the CMS. With the enactment of the new bylaws, CMS also executed a continuance document that allows the current structure to continue until such time as the Board or the membership makes changes. In real terms, neither the new *Act* nor the new bylaws will change CMS practices per se. What both the *Act* and the new bylaws do, however, is give CMS pause to consider 'What now?'

The answer is that it is a safe bet that the agenda for the December Board meeting will include the creation of a smaller Board, the addition of a VP for B.C., the reallocation of regional Board positions, and the authorization of advance polling for the 2015 election. Another part of the answer will come from the governance review that the Board initiated in June. And, while there may be many more answers to the 'What now?' question, the actions being initiated by the Board should lead to a more efficient CMS, one better positioned to represent and serve the mathematics community.

La calendrier des activités annonce aux lecteurs de la SMC les activités en cours et à venir, sur la scène pancanadienne et internationale, dans les domaines des mathématiques et de l'enseignement des mathématiques. Vos commentaires, suggestions et propositions sont le bienvenue.

Johan Rudnick, Société mathématique du Canada
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10	11	12	13	14	15	16
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24	25	26	27	28	29	30

NOVEMBER 2014

- 2-7 BIRS Geometric Scattering Theory and Applications (14w5105), Banff
- 3 FIELDS The Nathan and Beatrice Keyfitz Lectures in Mathematics and the Social Sciences, Paul Milgrom (Stanford), Toronto
- 6 CMS Sun Life Financial Canadian Open Mathematics Challenge
- 7-8 FIELDS Workshop on Statistical Issues in Biomarker and Drug Co-development, Toronto
- 9-14 BIRS Particle-Based Stochastic Reaction-Diffusion Models in Biology (14w5103), Banff
- 14 PIMS Hugh C. Morris Lecture: Cedric Villani (Lyon and Institut Henri Poincaré), University of Victoria
- 15 PIMS Workshop on Kinetic Theory and Related Topics, University of Victoria
- 16-21 BIRS Algorithms for Linear Groups (14w5031), Banff
- 17-20 FIELDS Fields Medal Symposium, Toronto
- 17-21 MSRI Categorical Structures in Harmonic Analysis, Berkeley, CA
- 20 CRM Measuring Emotional States in Real-Time Grande conférence de Chris Danforth, Montreal
- 23-28 BIRS Algebraic and Model Theoretical Methods in Constraint Satisfaction (14w5136), Banff
- 24-28 FIELDS Conference The Legacy of Vladimir Arnold, Toronto
- 30-D5 BIRS Families of Automorphic Forms and the Trace Formula (14w5120), Banff

DECEMBER 2014

- 1-5 NZMS/CMSA/VUW 38th Australasian Conference on Combinatorial Mathematics and Combinatorial Computing, Wellington, New Zealand
- 5-8 CMS Winter Meeting, Hamilton
- 10 FIELDS Distinguished Lecture Series in Statistical Science: Bin Yu, Toronto
- 8-12 CRM Workshop: New approaches in probabilistic and multiplicative number theory, Montreal

Calendar Notes brings current and upcoming domestic and select international mathematical sciences and education events to the attention of the CMS readership. Comments, suggestions, and submissions are welcome.

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- 15-18 CRM/CANSSI Workshop on New Horizons in Copula Modeling, Montreal

- 15-19 FIELDS/CANSSI Conference on Analysis, Spectra, and Number Theory, Princeton University

JANUARY 2015

- 10-13 AMS/MAA 2015 Joint Mathematics Meeting, San Antonio Convention Center
- 12-23 FIELDS/CANSSI Thematic Program on Statistical Inference, Learning and Models for Big Data, Opening Conference and Boot Camp, Toronto
- 23-25 FIELDS Combinatorial Algebra meets Algebraic Combinatorics, Queen's University
- 26-30 FIELDS/CANSSI Workshop on Big Data and Statistical Machine Learning, Toronto

FEBRUARY 2015

- 9-13 FIELDS/CANSSI Workshop on Optimization and Matrix Methods in Big Data, Toronto
- 16-20 CRM Workshop: Regulators, Mahler measures, and special values of L-functions, Montreal
- 23-27 FIELDS/CANSSI Workshop on Visualization for Big Data: Strategies and Principles, Toronto
- 30 PIMS/UBC Distinguished Colloquium: Tom Hou, University of British Columbia

MARCH 2015

- 9-14 CRM Workshop: p-adic methods in the theory of classical automorphic forms, Montreal
- 13 PIMS/UBC PIMS/UBC Distinguished Colloquium: Jill Pipher, University of British Columbia
- 23-27 FIELDS/CANSSI Workshop on Big Data in Health Policy, Toronto

APRIL 2015

- 6-10 CRM Workshop: The Kudla programme, Montreal
- 13-17 FIELDS/CANSSI Workshop on Big Data for Social Policy, Toronto
- 15-18 NCTM 2015 Annual Meeting and Exposition, Boston

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Book Review Notes brings interesting mathematical sciences and education publications drawn from across the entire spectrum of mathematics to the attention of the CMS readership. Comments, suggestions, and submissions are welcome.

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Ordering Block Designs Gray Codes, Universal Cycles and Configuration Orderings

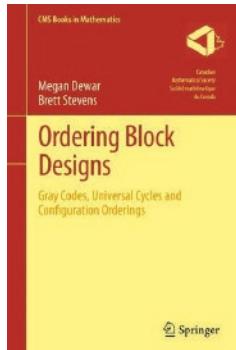
by Megan Dewar and Brett Stevens

CMS Books in Mathematics

Springer, New York, 2012

ISBN: 978-1-4614-4324-7

Reviewed by **David Pike**, Memorial University of Newfoundland



As the book's title aptly suggests, it is about combinatorial block designs and ways in which their blocks can be ordered. Whereas the study of block designs has a history dating back to the nineteenth century, research pertaining to orderings of their blocks is a more recent development. To give a small taste of these topics, consider this definition: a twofold triple system of order v , denoted TTS(v), consists of a v -set

V (typically $V = \{0, 1, \dots, v-1\}$) accompanied by a set \mathcal{B} of 3-subsets of V with the property that each pair of elements of V is a subset of exactly two of the elements (called blocks) of \mathcal{B} . An example given in the book is the TTS(7) comprised of the 3-subsets listed in Table 1 below.

{0, 1, 3}	{2, 4, 5}	{3, 4, 6}	{0, 1, 5}	{0, 2, 6}
{1, 3, 4}	{2, 3, 5}	{0, 4, 6}	{1, 5, 6}	{0, 2, 3}
{1, 2, 4}	{3, 5, 6}	{0, 4, 5}	{1, 2, 6}	

Table 1: Blocks of a TTS(7)

More generally, if the blocks were to each have size k and each 2-subset of V were required to occur as a subset of λ blocks, then the design in question is known as a balanced incomplete block design, denoted BIBD(v, k, λ). As a hypothetical example of the utility of designs, the BIBD(7, 3, 2) illustrated in Table 1, provides us with one way of determining how we might select three students at a time to send on a series of field trips, given that seven students are involved and each pair of students must work together twice. Indeed, by rotating through the blocks of the design we have ourselves a work schedule to ensure that a field station maintains a work force of three students. Within this scenario there may be expenses which we would like to minimise, such as the travel costs incurred when students journey to/from the field station.

Les critiques littéraires présent aux lecteurs de la SMC des ouvrages intéressants sur les mathématiques et l'enseignement des mathématiques dans un large éventail de domaines et sous-dimaines. Vos commentaires, suggestions et propositions sont le bienvenue.

Karl Dilcher, Dalhousie University (notes-reviews@cms.math.ca)

For instance, when reading the blocks of the design in a row-wise manner, the changeover from the first to the second shift would require that we pay for students 0, 1 and 3 to come home at the same time that we pay for students 2, 4 and 5 to venture out. However, if read column-wise, the shift change from $\{0, 1, 3\}$ to $\{1, 3, 4\}$ only requires that two students travel, which is much more cost effective. This is an example of what it is meant to order the blocks of a design. In short, how can the blocks of a design be listed to ensure some desirable property, such as there being a minimal change between consecutive blocks of the ordering? The types of orderings that are the focus of this book come in three varieties: Gray codes for designs, universal cycles and configuration orderings.

A binary Gray code of order n consists of a listing of the 2^n n -tuples of \mathbb{Z}_2^n such that consecutive n -tuples differ in a single coordinate. One can also describe Gray codes for k -subsets of an n -set by requiring that consecutive k -subsets have a prescribed cardinality of overlap (such as $k-1$). This concept naturally generalises to block designs, for which a κ -intersecting Gray code is defined to be an ordering of the blocks of the design such that consecutive blocks intersect in κ elements. When the blocks of Table 1 are read in a column-wise manner, they form a 2-intersecting Gray code for their design. Moreover, this Gray code is cyclic, since the final block $\{0, 2, 3\}$ intersects the initial block with two elements.

The design shown in Table 1 can also be represented with a universal cycle, namely 03142536405162, for which each set of three consecutive digits forms a subset that is a block of the design (this property is also cyclic in nature). In this example the universal cycle (hereafter Ucycle) is one of rank 3, meaning that each block is being represented by three elements of the Ucycle. For some designs it is possible to represent each block with only two elements (thereby yielding a rank 2 Ucycle); for instance, given any BIBD(v, k, λ) where $\lambda = 1$, each pair of points occurs in exactly one block and so naming only two points suffices to identify the whole of the block containing them (this also means that blocks may have multiple different representations).

In design theory, a configuration consists of a collection of blocks and in particular, how they interact with one another. In the context of a triple system, two blocks could be disjoint and thereby form the configuration of points and lines labelled as A_1 in Figure 1, or they could intersect in a single point (configuration A_2), in two points (A_3), or possibly in all three points (not illustrated here).

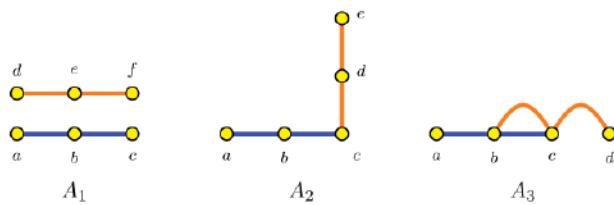


Figure 1: Some Block Configurations

A configuration ordering consists of listing the blocks of design so that consecutive collections of blocks form one of a prescribed set of configurations. An A_3 -ordering for the twofold triple system given in Table 1 is obtained from the column-wise ordering of the blocks in the table. When read row-wise, these blocks yield a \mathcal{C} -ordering where \mathcal{C} consists of the set $\{A_1, A_2\}$ of configurations. It is also possible to order these blocks to obtain an A_2 -ordering, although we leave finding one as an exercise to the reader. Dewar and Stevens have written a text that, for the first time, brings together what is known on orderings of block designs into a single work and with a unified standard of notation and terminology.

In terms of the book's structure, it begins with a brief introductory chapter that is followed by 50-page background chapter. This part of the book provides a thorough overview of foundational concepts and knowledge that are useful in the following chapters that contain the main substance of the book. For any newcomer to the subject, this introduction provides the background and tools with which to proceed, covering such topics as different kinds of designs, theorems from graph theory, Gray codes and de Bruijn sequences, to name a few. Also included are several instructive proofs.

Chapter 3 is still somewhat introductory in nature, but it provides more focus on the various types of block orderings to be considered as well as the distinctions and connections between them.

Chapter 4 specialises on configuration orderings, presenting known results and offering several proofs that convey interesting and useful techniques.

In Chapter 5, attention turns to Gray codes and universal cycles as they apply to combinatorial designs. Many of the new results presented in this chapter originate in Dewar's doctoral thesis, understandably so given that her dissertation was the genesis of this book. Each of these two chapters conclude with conjectures and open problems, providing ample stimuli for future research.

Chapter 6, the final chapter, is a detailed survey of several areas in which block orderings of designs have application. These include erasure-correcting codes that are used in disk arrays, scheduling applications, reliability testing (such as when devising suites of test cases to evaluate software or hardware functionality) and more.

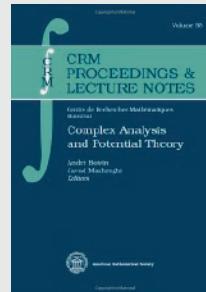
Complex Analysis and Potential Theory

By André Boivin, Javad Mashreghi (Editors)

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AMS 2012. ISBN-13 978-0-8218-9173-5

Reviewed by **S. Swaminathan**, Dalhousie University, Halifax N.S.



This volume contains 24 surveys and research articles from the participants of a conference held in Montréal in June 2011, held in honor of Professors Kohur N. Gowrisankaran (McGill) and Paul M. Gauthier (U. de Montréal), both of whom have had long and distinguished careers for the past four decades. Beginning with short biographies of the eminent professors, the articles range from potential theory on trees to approximation on Riemann surfaces, from universality to inner and outer functions and disc algebra, from branch processes to harmonic extension and capacities, from harmonic mappings and the Harnack principle to integration formulae in several complex variables and the Hartog's phenomenon, from fine harmonicity and plurisubharmonic functions to the binomial identity and Riemann hypothesis, and more. The diversity of subjects reflects the wide range of research interests of the two honored guests.

Here are a few titles of articles selected to indicate the scope and variety of contributions: "A Simple Numerical Approach to the Riemann Hypothesis"; "A Survey of Linear Extremal Problems in Analytic Function Spaces"; "Compactifications of the Plane and Extensions of the Disc Algebra"; "Hartogs Phenomenon on Unbounded Domains—Conjectures and Examples"; "On a Family of Outer Functions"; "On Universality of Series in Banach Spaces"; "Recent Progress on Fine Differentiability and Fine Harmonicity"; "Reversibility Questions in Groups Arising in Analysis"; and "The Generalized Binomial Theorem".

This volume will be a valuable resource for specialists, research mathematicians and graduates from both fields of the title. Further, it will foster cooperation and exchange of ideas and techniques to find new perspectives.

Overall the book is well written and a pleasure to read. Dewar and Stevens noted that their goal was that the book would be a comprehensive source for anyone interested in ordering the blocks of designs, and in this regard they are to be commended for their success. I particularly like that they chose to include many proofs (both for recent results as well as earlier ones) so that the book also serves as a compendium of techniques that helps readers to develop their repertoire of research methodologies. This makes the book especially useful as a text for training students in an active area of design theory. But more than that it is an excellent resource for researchers. I highly recommend it.

Suite de la page 3

elle jouit d'une voix, comme tous les autres membres, voix qu'elle peut exercer à l'AGA. Qu'une organisation, grande ou petite, soit commanditaire, partenaire ou une université, chaque organisation jouit d'une voix qu'elle peut exercer à l'AGA.

Le changement significatif ne se situe pas dans les règlements administratifs, mais plutôt dans la nouvelle Loi canadienne sur les organisations à but non lucratif, qui a été le motif de création des nouveaux règlements administratifs de la SMC. Selon cette nouvelle loi, tous les droits des membres sont codifiés. Ainsi, si l'on refuse un droit à un membre, ce dernier peut s'adresser à un tribunal pour le faire respecter. Par exemple, si la SMC refuse de divulguer des états financiers annuels, un membre peut maintenant s'adresser à un tribunal, qui pourrait obliger la SMC à divulguer l'information. Heureusement, la SMC compte déjà des mesures et des pratiques qui répondaient aux exigences de la loi ou qui dépassaient même ces exigences. Par exemple, la SMC publie les états financiers vérifiés sur son site Web.

Moins de règles, plus d'options

Selon les nouveaux règlements administratifs, le conseil d'administration de la SMC sera constitué d'au moins trois et jamais plus de 33 membres (le nombre actuel de membres siégeant au conseil). Au cours de l'AGA du mois de juin, les membres ont conféré au conseil d'administration le pouvoir d'ajuster sa propre taille, de sorte qu'il puisse compter de trois à 33 membres. Selon les anciens règlements administratifs, un tel changement aurait exigé une motion à l'AGA en faveur d'un changement aux règlements. Par la suite, des avocats auraient inscrits le changement. Grâce à la nouvelle approche moins prescriptive et à une plus grande discrétion du conseil d'administration, on peut apporter des changements plus facilement.

Selon les anciens règlements administratifs, les membres du conseil d'administration étaient élus avant l'AGA; selon la nouvelle loi, les membres du conseil d'administration doivent être élus au cours de l'AGA. Malheureusement, il est difficile d'imaginer 1 000 membres de la SMC ou un nombre semblable se rendant à l'AGA — même s'ils seraient parfaitement les bienvenus. Heureusement, les nouveaux règlements administratifs de la SMC permettent au conseil d'administration d'organiser un scrutin anticipé pour l'élection de ses nouveaux membres. Les résultats de ce scrutin anticipé seraient ajoutés aux résultats obtenus au cours de l'AGA.

De plus, le mode d'élection des membres du conseil d'administration ne changera guère. Les mises en candidature seront ouvertes, comme par le passé. On s'attend à ce que les postes désignés au sein du conseil d'administration (p. ex. celui de président, de vice-président, etc.) restent. On s'attend aussi à ce que le scrutin anticipé pour les membres du conseil d'administration soit maintenu. La différence principale entre les anciens et les nouveaux règlements administratifs est que le conseil d'administration jouit maintenant de l'autorité discrétionnaire lui permettant de modifier

la nature même du conseil d'administration sans modifier les règlements administratifs.

Là où on pourrait apporter des changements est dans la façon dont les responsabilités du conseil d'administration et de la SMC sont réparties. Selon les anciens règlements, le président de la SMC cumulait deux fonctions, à savoir celle de président du conseil d'administration et celle de président-directeur général désigné de la SMC. Selon les nouveaux règlements, les postes d'administrateurs ne sont pas prescrits. Il relève du conseil d'administration de les définir. Le conseil d'administration pourrait donc décider de créer un poste de président du conseil d'administration qui serait complètement séparé du poste de président. Cette séparation de la fonction de président du CA et de président viendrait renforcer l'autorité du conseil d'administration à l'égard du Comité exécutif et surtout du président, car le président du CA gérerait alors les affaires du CA, alors que le président rendrait des comptes au CA au sujet des activités de la SMC.

Moins de conseil d'administration, plus de régions

Au cours des discussions qui ont précédé l'adoption des nouveaux règlements administratifs de la SMC, les membres ont réfléchi à la taille à donner au conseil d'administration et au nombre de vice-présidents qu'il devait compter.

Tous s'entendaient pour dire qu'un plus petit conseil d'administration était préférable, par exemple, un conseil d'administration qui compterait 23 membres, y compris sept membres de la direction environ. S'il comptait 23 membres, le nouveau conseil d'administration surpasserait en nombre le Comité exécutif selon un rapport d'au moins 2:1, ce qui créerait une fonction de contestation solide de la part du CA par rapport aux mesures et aux conseils exécutifs. Heureusement, on peut obtenir assez rapidement une telle réduction marquée par simple attrition. Le hasard faisant bien les choses, une gestion judicieuse de postes au sein du conseil d'administration désignés au niveau régional, exercice qui permettrait d'éliminer certains postes au sein du CA dont le mandat arrive à échéance au mois de juin 2015, de même que la création de quelques nouveaux postes, pourrait aboutir à un conseil d'administration comptant 24 membres après l'élection de 2015. L'arrivée à échéance d'un poste d'administrateur par la suite porterait le nombre de membres siégeant au conseil d'administration à la cible de 23.

Au cours des discussions sur la taille à donner au conseil d'administration, les membres ont étudié la possibilité d'équilibrer la représentation régionale en fonction des niveaux d'activités à travers le Canada. Les membres ont convenu de créer un poste de vice-président pour la Colombie-Britannique et de redistribuer les postes régionaux au sein du conseil d'administration. Les responsabilités pour le Yukon, les Territoires du Nord-Ouest et le Nunavut pourraient ensuite être confiées aux vice-présidents de la Colombie-Britannique, de l'Ouest et du Québec.

La structure pourrait ressembler à ceci si on établissait un plus petit conseil d'administration comptant une nouvelle région :

Atlantique : 1 vice-président + 2 administrateurs;

Québec : 1 vice-président + 3 administrateurs;

Ontario : 1 vice-président + 4 administrateurs;

Ouest : 1 vice-président + 3 administrateurs;

Colombie-Britannique : 1 vice-président + 3 administrateurs.

Si l'on ajoute au groupe le président, le président élu et le président sortant, plus un administrateur étudiant, on obtiendrait un conseil d'administration formé de 23 membres. Si la nouvelle loi n'autorise aucunement des « administrateurs nommés » non élus, comme on avait en vertu des anciens règlements administratifs, elle permet au conseil d'administration de nommer un administrateur en cas de poste vacant. Le mandat de cette personne nommée ne dure alors que jusqu'à la prochaine AGA. Pour les étudiants, ce régime exige forcément l'élection d'un administrateur « étudiant » et, à l'instar de la séparation éventuelle des fonctions de président du conseil d'administration et de président, cet administrateur peut être ou non le président du comité étudiant.

Moins de portée, plus de maîtrise

En vertu des anciens règlements administratifs, le conseil d'administration de la SMC déléguait les responsabilités à six comités de rédaction et à 17 comités permanents comptant 11 sous-comités affiliés représentant tous ensemble aujourd'hui 268 postes. En tout, 17 présidents de comité rendent des comptes au conseil d'administration au sujet des activités de la SMC. Les comités sont chargés de questions allant du bilinguisme à l'édition et des affaires internationales aux services électroniques. En principe, le conseil d'administration surveille les activités de chacun des comités permanents. De plus, si l'on compte les six comités de rédaction et le bureau d'Ottawa, le champ d'influence du conseil d'administration s'étend à 24 centres de responsabilité distincts — une incroyable portée et niveau de délégation étonnant. À l'instar du principe de réduction de la taille du conseil d'administration, on ne serait aucunement surpris d'apprendre que tous s'entendent pour dire qu'un nombre bien moins élevé de comités qui rendraient des comptes au conseil d'administration serait une bonne idée, une qui pourrait améliorer le contrôle qu'exerce le conseil d'administration sur les comités permanents.

Moins de société, plus d'organisation

Le rôle de la SMC a beaucoup changé depuis les débuts de l'organisation. Selon les anciens règlements administratifs établis il y a plus de 30 ans, la SMC était une « société » s'intéressant principalement aux conférences et à la publication d'ouvrages de recherche. Selon la nouvelle loi et les nouveaux règlements administratifs, la SMC est une « organisation » qui organise aussi des concours et des camps mathématiques, remet des mentions honorables et des prix, fournit des bourses et appuie d'autres organisations s'intéressant aux mathématiques. Il s'ensuit que même si la SMC doit demeurer une société de mathématiciens,

le modèle de fonctionnement requis pour l'organisation aujourd'hui sera bien différent des principes fondateurs établis au cours du congrès de 1945 et de la constitution en société, en 1979. Les nouveaux règlements administratifs de la SMC ne sont qu'un des éléments critiques qui font en sorte que la SMC soit administrée et fonctionne selon des principes logiques dans le contexte moderne.

Moins de lois, plus d'action

Même si les nouveaux règlements administratifs ont été adoptés et qu'il est maintenant possible d'apporter des changements à l'organisation sans devoir apporter des modifications onéreuses aux règlements, rien n'a encore changé pour la SMC. En parallèle à l'adoption des nouveaux règlements administratifs, la SMC a également mis à exécution un document de continuité qui permet de conserver la structure actuelle jusqu'à ce que le conseil d'administration ou les membres n'apportent de changements. En réalité, ni la nouvelle loi ni les nouveaux règlements administratifs ne changeront les pratiques de la SMC proprement dit. Ce que la loi et les nouveaux règlements font toutefois, c'est d'accorder à la SMC un moment d'arrêt pour répondre à la question suivante : « Et quelle est la suite ? ».

La réponse : il est fort à parier que l'ordre du jour de la réunion du conseil d'administration du mois de décembre portera, entre autres, sur la création d'un conseil d'administration de plus petite taille, l'ajout d'un poste de vice-président pour la C.-B., la redistribution des postes régionaux au sein du conseil d'administration et l'autorisation du scrutin anticipé pour l'élection de 2015. Une autre partie de la réponse proviendra de l'exercice d'examen de la gouvernance entamé par le conseil d'administration au mois de juin dernier. Et même s'il peut exister bien d'autres réponses à la question « Et quelle est la suite ? », les mesures qu'adopte actuellement le conseil d'administration devraient accroître l'efficacité de la SMC et mieux disposer l'organisation à représenter et à mieux servir la communauté des mathématiques.

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Education Notes brings mathematical and educational ideas forth to the CMS readership in a manner that promotes discussion of relevant topics including research, activities, and noteworthy news items. Comments, suggestions, and submissions are welcome.

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Continuing with emphasis on mathematical outreach, this issue focuses attention on the many ways that outreach can figure into one person's story. Jean-Marie DeKoninck accepted our invitation to share some of his involvements with outreach in mathematics and science. His efforts are much appreciated.

Partager sa passion pour les mathématiques

Jean-Marie De Koninck, Université Laval

avez-vous déjà pensé que certains adolescents curieux et déjà en réflexion sur leur avenir pourraient souhaiter vous entendre? À vous entendre leur parler de votre passion pour les mathématiques? En réalité, c'est exactement ce que je fais depuis une bonne dizaine d'années. Tout cela a commencé lorsque j'ai été approché par un producteur de films pour animer une série télévisée appelée C'est mathématique! Je lui ai d'abord dit que je ne pouvais pas accepter faute de temps, étant beaucoup trop occupé avec mon enseignement et ma recherche. Mais après avoir partagé cette information avec mes collègues de travail, ceux-ci ont réagi en disant qu'il avait là une formidable occasion de montrer à tous que les mathématiques sont présentes partout dans notre société moderne et également de susciter chez les jeunes un intérêt pour les carrières scientifiques. Le lendemain, je donnais un coup de fil au producteur pour accepter le défi. Nous avons réalisé 16 épisodes de 30 minutes la première année et 13 épisodes d'une heure la deuxième année. La série était diffusée les mardis à 20 h au Canal Z, une chaîne de télé scientifique. Bien que la série n'ait été en ondes que pour une période de deux ans, des reprises ont été diffusées pour encore huit ans sur diverses chaînes, dont TFO (Télévision française de l'Ontario). Somme toute, ce fut une formidable expérience, mais surtout cela m'a permis d'apprendre, à la suite des résultats des sondages, que très peu savaient que les mathématiques sont essentielles au bon fonctionnement de notre société et qu'en réalité les mathématiques sont partout dans notre vie de tous les jours. Par ailleurs, j'ai été heureux de constater que les tout jeunes avaient adoré la série et que leurs enseignants l'avaient apprécié encore davantage en particulier parce qu'on y présentait des applications des mathématiques dont ils n'auraient jamais soupçonné l'existence. C'est ma participation à cette série télévisée qui a marqué le début du partage de ma passion pour la diffusion des mathématiques auprès des jeunes et des moins jeunes.

Les articles sur l'éducation présente des sujets mathématiques et des articles sur l'éducation aux lecteurs de la SMC dans un format qui favorise les discussions sur différents thèmes, dont la recherche, les activités et des nouvelles d'intérêt. Vos commentaires, suggestions et propositions sont le bienvenue.

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La création d'un spectacle multimédia sur les mathématiques

C'est dans ce contexte et avec l'appui de l'Université Laval et de Mitacs que nous avons créé en 2005 le programme SMAC (Sciences et mathématiques en action), dont les principaux objectifs sont de susciter chez les jeunes un intérêt pour les mathématiques et les sciences et de démythifier les mathématiques auprès de la population en général. La voie que nous avons choisie est celle d'offrir des activités ludiques et amusantes telles des jeux et des spectacles. Mais, avant que je ne commence à énumérer quelques-unes de ces activités, je tiens à mentionner que plusieurs initiatives de vulgarisation mathématique ont été proposées ici au Canada par différentes universités de même que par les quatre instituts mathématiques, soit PIMS, Fields, AARMS et CRM. Autrement dit, la contribution de SMAC à la diffusion mathématique ne représente qu'une petite partie des actions faites en ce sens au Canada.

En 2005, nous avons créé pour les écoles secondaires un spectacle multimédia appelé Show Math. Le spectacle fait intervenir sur scène de jeunes comédiens. L'objectif de cette activité est de faire rire les jeunes dans un environnement mathématique et de leur faire réaliser que les maths sont partout. Les sujets abordés dans Show Math incluent : (1) comment Ératosthène s'y est pris pour mesurer la circonférence de la Terre en utilisant seulement des notions rudimentaires de géométrie; (2) les mathématiques qui nous permettent de stocker des centaines de chansons sur un petit appareil MP3; et (3) le paradoxe des anniversaires selon lequel dans une salle où il y a 23 personnes, la probabilité qu'au moins deux d'entre elles aient le même anniversaire est de 50 %, et que dans une salle où il y a 57 personnes, la probabilité grimpe à 99 %.

Comme la plupart des écoles ayant accueilli Show Math souhaitaient avoir une suite, nous avons développé en 2009 Show Math 2. Les sujets abordés comprennent comment la notion de fractal a vu le jour et comment elle est utilisée par les producteurs de films pour créer des paysages fantastiques comme dans Star Trek et Avatar, pourquoi les méthodes de chiffrement les plus sécuritaires reposent sur la difficulté à factoriser de grands nombres et le fait que le GPS utilise l'intersection de trois sphères pour localiser notre emplacement.

Petit Show Math

Pour répondre au souhait exprimé par les directeurs d'écoles primaires, nous avons créé *Petit Show Math*. Il s'agit d'un autre spectacle à saveur mathématique, mais adapté aux plus jeunes. Le fil conducteur est comme suit. Dans une galaxie très lointaine, il existe une petite planète dont les habitants ne connaissent pas la notion de nombre. Un petit garçon, nommé SMATH et habitant sur cette planète, est sur un vaisseau spatial en route vers la planète Terre. Il a entendu dire que sur la Terre on utilise les nombres depuis des milliers d'années et que cela s'est avéré fort utile. Son vaisseau atterrit sur la scène et voilà que SMATH demande si quelqu'un dans la salle connaît les mathématiques. C'est à ce moment que j'interviens et que j'invite SMATH et les jeunes dans la salle à explorer avec moi l'univers fascinant des mathématiques. Nous parcourons alors ensemble trois thèmes: (1) l'histoire des nombres en remontant à leur invention il y a 30 000 ans, (2) le phénomène du son : sa vitesse, son intensité et sa fréquence, et (3) l'exploration spatiale : notre système solaire, ses planètes et ses comètes, ainsi que la taille relative de tous ces objets. À la fin du spectacle, SMATH quitte la Terre avec Léa, une petite fille qu'il a rencontrée au cours du spectacle, tout en déclarant qu'il va partager avec ses amis tout ce qu'il a appris sur les nombres.

Pluton va en appel!

Notre dernière création est *Pluton va en appel!*, une pièce de théâtre dans laquelle l'ancienne planète *Pluton va en appel* devant le Soleil afin de pouvoir réintégrer le rang des planètes. Rappelons d'abord que dans les livres d'astronomie publiés avant 2006, on peut lire que notre système solaire est composé de neuf planètes : les quatre planètes rocheuses (Mercure, Vénus, Terre et Mars), les quatre planètes gazeuses (Jupiter, Saturne, Uranus et Neptune) et enfin Pluton, que l'on croit faite de roche et de glace. Cependant, à compter de 2003, les astronomes se sont mis à découvrir que plusieurs autres corps en orbite autour du Soleil étaient beaucoup plus gros et plus massifs que Pluton et ont ainsi commencé à se demander s'il n'était pas temps d'établir ce qui constituait véritablement une planète. C'est ainsi qu'en 2006, l'Union astronomique internationale a introduit une nouvelle classe d'objets appelés planètes naines et décida d'inclure Pluton dans cette nouvelle catégorie. La décision fut loin d'être unanime et créa du coup toute une controverse. Plusieurs prétendaient que, pour des raisons historiques, Pluton devrait conserver son titre de planète. En mars 2007, la Chambre des députés de l'état du Nouveau-Mexique a même fait adopter une résolution stipulant que Pluton conservera son titre de neuvième planète. J'ai eu l'idée de créer une pièce de théâtre basée sur cette controverse en lisant le livre *The Case for Pluto* d'Alan Boyle. Dans la pièce, Mercure, parlant au nom des planètes rocheuses, soutient que Pluton doit retrouver son titre, alors que Neptune, qui parle au nom des planètes gazeuses, argumente contre, craignant que si Pluton redevient une planète, cela aura pour effet de redonner la majorité aux planètes rocheuses. Le spectacle est un prétexte pour expliquer diverses notions mathématiques telles que celle des points de Lagrange et pour utiliser les mathématiques qui permettent de décrire le phénomène d'assistance gravitationnelle

qui permet aux sondes spatiales de se déplacer dans le système solaire en utilisant la force gravitationnelle exercée par les différentes planètes. Pluton va en appel! sera certes encore plus populaire dans l'année qui vient parce que les médias seront alors très intéressés par les péripéties de la sonde *New Horizons* qui a quitté la Terre en 2006 et qui rejoindra Pluto le 15 juillet 2015.

Les parents font partie de l'équation

Par nos activités, nous montrons aux jeunes que les mathématiques sont importantes, accessibles, voire divertissantes, et nous y arrivons avec la collaboration de leurs enseignants. Cependant, après un certain temps, nous avons réalisé qu'une tierce partie avait une influence énorme sur le succès des jeunes en mathématiques. En effet, nous avons réalisé que les parents font partie de l'équation, en ce sens que sans leur appui, les jeunes sont souvent limités dans leur progrès. Cela nous a amenés à monter une conférence pour les parents des élèves du niveau primaire. Son titre est *Les enfants comptent... et leurs parents aussi*. Quatre thèmes y sont abordés: (1) Les maths, ça sert à quoi? (2) Qu'entend-on par « résolution de problèmes »? (3) Comment aider son enfant à réussir en mathématiques? et (4) Comment intégrer les maths dans la vie de tous les jours? Un des principaux objectifs de cette présentation est de convaincre les parents qu'ils peuvent aider leurs enfants à réussir en mathématiques même si eux-mêmes ne sont pas tout à fait à l'aise avec les mathématiques. Une indication du niveau d'appréciation de cette activité est le fait que chaque fois que nous l'avons offerte, la période de questions a duré plus longtemps que l'exposé lui-même.

Une série de livres mathématiques

En 2007, un éditeur m'a approché pour me suggérer de m'associer à un journaliste pour écrire un livre de mathématiques amusant pour les élèves du secondaire. En collaboration avec Jean-François Cliche, un chroniqueur du journal *Le Soleil*, nous avons publié *En chair et en maths*. Le livre propose au lecteur (1) un voyage dans le temps pour explorer comment les nombres ont surgi et comment ils ont évolué, (2) un regard sur la cryptographie en osant expliquer comment les mathématiques peuvent servir de langue des secrets et (3) une ballade dans l'univers fascinant du hasard. Ayant vendu plus de 5 000 copies, nous avons décidé d'écrire une suite, *En chair et en maths 2*, l'histoire d'un joueur de guitare désespéré qui, ne réussissant pas à trouver une compagnie de disques prête à publier ses magnifiques chansons, accepte de signer un pacte avec le Diable afin de pouvoir réaliser ses ambitions. Le problème, c'est que la première condition de cette entente exige qu'il trouve la 5142058935068-ième décimale du nombre Pi. Il s'embarque alors dans un long périple pour étudier l'histoire de Pi à travers le temps, explorant ainsi divers thèmes incluant les séries infinies, les fractions continues et l'univers fascinant des fractals.

Rejoindre le grand public

De 2009 à 2011, j'étais tous les samedis matins sur les ondes de la radio de Radio-Canada pendant 13 minutes pour parler de l'actualité scientifique. Cela voulait dire que durant toute la semaine qui menait au samedi, je parcourais frénétiquement divers magazines scientifiques

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Art and Mathematics: The Hilbert Curve and Other Stories

Eva Knoll, Faculty of Education, Mount Saint Vincent University

I was with great pleasure that I accepted the offer to participate in the 2013 CMS Summer Meeting, held at Dalhousie and St Mary's Universities. My participation gave me the opportunity to display, and discuss, a selection of the mathematically-inspired art work that I have been making over the past fifteen years.

In my own art practice and my interaction with other, similarly-inspired practitioners, I have found that there appear to be 3 related ways in which mathematics can be incorporated into the making of art.

- Mathematics can serve as a tool to generate art. If mathematics is understood broadly, to incorporate any thinking that involves patterns, regularities and abstract structures [1,2], almost any art form can claim to be enriched by mathematical ideas, although some more explicitly than others. A good example of this is the oft-mentioned idea that the laws of visual perspective, which were formalized during the Renaissance, can be connected to ideas in projective geometry. Music is another rich example of the integration of mathematical structures into an art form. In general, this approach tends to down-play the role of mathematics.
- Artists have also used visual display to represent, in aesthetically pleasing, attractive ways, mathematical ideas, concepts, relationships, or objects. This practice, of making mathematics the subject of the artwork, became particularly popular with the advent of computer graphics, for example in Generative Art [3]. In this approach, artists tend to play up the mathematics they are representing.
- Finally, mathematics can serve as inspiration for the making of art. This relationship is less literal than the previous: the mathematics is there mostly as the starting point of a process that ends in the production of artwork, but it is not meant to be the focus of the piece. Nor is it merely a tool.

My art belongs to the third category, reflecting my interest in the structures of mathematics in connection with the structures embodied in various techniques or media of visual art: the work aims to make explicit these connected structures. Because of this, the body of work spans across mathematical ideas as well as across art media. In the exhibit of the 2013 Summer Meeting, pieces were made of:

- wood (jigsaw puzzle; lamp: top-right, see below)
- glass (beaded jewelry: top-left and -center; framed frosted glass pattern)

- paper (Origami: bottom-center; polyhedra kits and paper-strip weavings)
- constructed textile (hand-loom-woven lengths of fabric: middle-right, jacquard weave: bottom-left and ribbon weaves: bottom-right)
- print (on paper and on silk: middle-left)

In addition, during the public talk that accompanied the exhibit, I showed a few pieces that only exist virtually (center).



Inspiration for the artwork combined ideas taken from the mathematics cannon and those that are embodied in various cultural traditions, art forms and art theories. The latter included:

- traditional and contemporary weaving techniques [4, 5]
- African sand drawings [6]
- ideas from colour theory [7, 8]
- the work of the Concrete Art group of artists, including Max Bill, Richard Paul Lohse, Hans Hinterreiter, Karl Gerstner, as well as their manifesto [9, 10, 11]
- the work of other artists, including Marcello Morandini and Chris K. Palmer [12, 13]

My mathematical sources of inspiration are as varied as my artistic ones, including: Euclidean and non-Euclidean geometry, proportions, number patterns, fractals, modular arithmetic, image processing, topology, and affine geometry.

In the public talk, in particular, I presented and discussed the work derived from the Hilbert Curve [14], which I like to call a "discrete

fractal" (i.e. a fractal whose finite approximations becomes complex, and therefore interesting, at low-iterations). Of the 27 pieces exhibited, six were inspired by the space-filling curve. In the talk, I showed additional finished work as well as sketches and discussed how the work was derived from the Hilbert Curve, often through a process of encoding that render some of the relationships and patterns inherent to the curve. In particular, the image in the center of the above array shows an encoded, distorted version of the Hilbert Curve. The blue-and-white pattern shows the orientation of the copies of iteration 1 in iteration 7, and the distortion illustrates the analogy between the symmetry relationship of adjacent copies of iterations $n-1$ in the top row of a curve of iteration n and the connection of the torus and the Cartesian plane [15].

The Hilbert Curve has been an important part of my panoply of mathematical inspirations because of its richness and because of an important property: when working on mathematical art, a central concern is to create images that are both complex enough to be interesting, and simple enough that they do not collapse into meaningless "texture". Working within this narrow band-width is made easier when the mathematical source of inspiration has fractal qualities: if the design becomes too complex, move down an iteration or two. If it is too simple, move up an iteration or two. Or, as in the case of my most recent Hilbert Curve-inspired piece, integrate multiple iterations into a single piece!

About the author

Eva Knoll teaches mathematics education to both pre- and in-service teachers at Mount Saint Vincent University in Halifax, Nova Scotia. Her research focuses on the mathematical elements in visual arts practices. Most recently, she has been leading a research team focusing on the mathematical thinking inherent in the design, creation and appreciation of textiles. More images of her work can be found at www.teknology.com.

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et plusieurs sites de science comme www.sciencedaily.com à la recherche de sujets susceptibles d'intéresser mon auditoire. Une expérience formidable, bien que très prenante en terme de temps. Or, en 2011, après une centaine de chroniques, un éditeur me suggérait de regrouper mes meilleures chroniques et d'en faire un manuscrit. C'est ainsi que j'ai écrit *Cette science qui ne cesse de nous étonner*. Bien que le livre raconte comment la science affecte notre quotidien et nous permet de mieux comprendre le monde qui nous entoure, il demeure très teinté de mathématiques. C'est ainsi que de ses 32 chapitres, trois présentent des applications de la fameuse loi de Poisson, incluant le fait que la probabilité que l'équipe qui marque le premier but dans un match de soccer perde la partie est de seulement 14 %.

International Math Outreach Workshop

Durant la dernière semaine de novembre 2015, BIRS sera l'hôte du premier International Math Outreach Workshop. Le comité organisateur de cet événement est constitué de Melania Alvarez

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(PIMS), Matheus Grasselli (Fields), François Bergeron (CRM), Helene Barcelo (MSRI), Janine McIntosh (AMSI) et moi-même.

Le but de cet atelier est d'identifier les meilleures pratiques de « math outreach ». Je suis sûr qu'il s'en dégagera des idées fort intéressantes.

Conclusion

Certains pourraient se demander si le fait de s'engager dans de telles activités auprès des jeunes est en fin de compte beaucoup trop exigeant en termes de temps et d'énergie. Certes, il faut s'investir un peu. Cependant, l'enthousiasme manifesté par les enseignants qui nous accueillent dans leurs institutions est si tangible que l'on constate rapidement que l'investissement en vaut la peine. Par ailleurs, l'étincelle que l'on peut voir dans les yeux des enfants qui comprennent enfin que les mathématiques sont utiles et qu'on peut même avoir beaucoup de plaisir à faire des maths est déjà en soi une source de motivation sans pareille pour celui ou celle qui la provoque!

Research Notes brings mathematical research ideas forth to the CMS readership in a generally accessible manner that promotes discussion of relevant topics including research (both pure and applied), activities, and noteworthy news items. Comments, suggestions, and submissions are welcome.

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Hadamard's Problem Of Diffusion Of Waves

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The problem of diffusion of waves was posed by Hadamard in his 1923 [5]. Such equations may be written in coordinate invariant form as $F(u) := g^{ij}\nabla_i\nabla_j u + A^i\nabla_i u + Cu = 0$, where g^{ij} are the contravariant components of the metric tensor \mathbf{g} of a n -dimensional Lorentzian space (M, \mathbf{g}) of signature $2 - n$ and ∇_i denotes the covariant derivative with respect to the Lorentzian connection. The coefficients g^{ij} , A^i , and C as well as M are assumed to be smooth. In the sequel the above equation will be denoted by (E).

The problem arises in the study of *Cauchy's problem* for (E), which is the problem of determining a solution that assumes given values for u and its normal derivative on a given space-like $(n - 1)$ -dimensional submanifold S . These given values are called the *Cauchy data*. The first general solution to Cauchy's problem for (E) was given by Hadamard [5]. His theory is local in the sense that it is restricted to geodesic simply convex neighbourhoods of M . A modern treatment in terms of distribution theory is given by Friedlander [3]. The considerations of this note are entirely local.

The question of how the value of the solution u at a point $x_0 \in M$ depends on the Cauchy data is of considerable interest. Hadamard shows that in general $u(x_0)$ depends on the data on and in the interior of the intersection of the retrograde characteristic conoid $C^-(x_0)(C(x_0))$ denoting the complete conoid with the initial surface S . If the solution depends only on the data in an arbitrarily small neighbourhood of $S \cap C^-(x_0)$ for every Cauchy problem and for every x_0 , one says that the equation satisfies *Huygens' principle* or is a *Huygens equation*. Examples of such equations are the ordinary wave equations $\frac{\partial^2 u}{\partial x^{12}} - \sum_{i=2}^{2m} \frac{\partial^2 u}{\partial x^i \partial x^2} = 0$, in an even number of variables $n = 2m \geq 4$, which we denote by (E_{2m}). Hadamard asked the fundamental question: *for which equations is Huygens' principle true?* This is called *Hadamard's problem* in the literature. He showed that in order for Huygens' principle to be valid it is necessary that n be even and ≥ 4 . He further showed that a necessary and sufficient condition for its validity is that the elementary solution, which has the form

Les articles de recherché présente des sujets mathématiques aux lecteurs de la SMC dans un format généralement accessible qui favorise les discussions sur divers sujets pertinents, dont la recherche (pure et appliquée), les activités et des nouvelles dignes de mention. Vos commentaries, suggestions et propositions sont le bienvenue.

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$E := V\Gamma^{1-n/2} - \mathcal{V}\log\Gamma$, where Γ is the square of the geodesic distance x_0x and V and \mathcal{V} are certain regular functions, contains no logarithmic term ($\mathcal{V} = 0$). For the case $n = 4$, which is the main subject of this note, the condition is equivalent to $G(V) = 0$ on $C(x_0)$ for every x_0 , where $G(v) := g^{ij}\nabla_i\nabla_j v - \nabla_i(A^i v) + Cv$ is the adjoint of F . Since none other than (E_{2m}) were known, he suggested that, as a first step, one should attempt to prove that every Huygens equation is *equivalent* to one such equation. This suggestion has been called *Hadamard's conjecture* in the literature.

Two equations of the form (E) are said to be *equivalent* if they are related by one of the following transformations called *trivial transformations* that preserve the Huygens property:

- (a) a transformation of coordinates;
- (b) multiplication of the equation by a non-vanishing factor $e^{-2\phi}$, where ϕ is a function on M (this transformation induces a conformal transformation of the metric), and
- (c) replacement of the unknown function u by λu , where λ is a non-vanishing function on M .

An equation (E) which is equivalent to an equation (E_{2m}) is said to be *trivial*.

Any equation (E) which is equivalent to a self-adjoint equation, defined by $A^i = 0$, is said to be *essentially self-adjoint*.

Hadamard's conjecture has been proven in the physically interesting case $n = 4$, (M, \mathbf{g}) flat (vanishing Riemann curvature tensor: $R_{ijkl} = 0$) by Mathisson in 1939 followed by Hadamard in 1942. The proof given by both authors follows from a sequence of necessary conditions on the coefficients which are obtained from the necessary and sufficient condition $G(V) = 0$ on $C(x_0)$ by a power series expansion in normal coordinates about the vertex x_0 . Only the first three conditions of the sequence are required to prove equivalence with (E₄) in this case. This approach to solving Hadamard's problem is called *Mathisson's method*.

However, the conjecture is not true in general. The first counter-examples were given by Stellmacher in 1953 for $n \geq 6$. Further important results for this case have been obtained by Berest in 1998 and Berest and Winternitz in 2000.

Counter examples for $n = 4$, were given by Günther in 1965. These examples arise from the wave equation $\square u = 0$, where $\square := g^{ij}\nabla_i\nabla_j$ denotes the wave operator, on the Lorentzian space

with metric $ds^2 = 2dx^1dx^2 - a_{\alpha\beta}dx^\alpha dx^\beta$, ($\alpha, \beta = 3, 4$) where the symmetric matrix $(a_{\alpha\beta})$ is positive definite with elements that are functions only of x^1 . The above metric may be interpreted in the framework of general relativity as an exact plane wave solution of the vacuum or Einstein-Maxwell field equations. It has been studied in this context by Ehlers and Kundt in a different coordinate system where it has the form $ds^2 = 2dv[du + (Dz^2 + \bar{D}\bar{z}^2 + ezz)dv] - 2dzd\bar{z}$ where D and $e = \bar{e}$ are functions only of v . The Ricci scalar R of the above space vanishes identically. Furthermore, it follows from the second form of the metric and that the space has the following additional key properties: it is *conformally flat* (viz it has vanishing Weyl conformal curvature tensor: $C_{ijkl} = 0$) iff $D = 0$; if $D \neq 0$, the *Weyl tensor is Petrov type N*; it is *conformally Ricci flat* ($R_{ij} = 0$). It follows from the first of these properties that the equation $\square u = 0$ on an exact plane wave background space is non-trivial iff $D \neq 0$. We shall denote this equation for any value of D by E_{PW} .

The next step in the solution of the problem in the case $n = 4$ was made by this author in 1969. I proved that any Huygens equation on a conformally Ricci flat background space is equivalent to (E_{PW}) . Further progress was made by Carminati and this author in 1986. We showed that any self-adjoint Huygens equation on a background space admitting a Weyl tensor of Petrov type N is equivalent to (E_{PW}) . These results suggested that the conjecture be modified as follows: *any Huygens equation is equivalent to (E_{PW})* .

The general procedure employed to prove the modified conjecture is: (i) to use the sequence of necessary conditions derived by Günther (1952), Wünsch (1970), Rinke & Wünsch (1981), and the author (1974) (the first of which is $C = \frac{1}{2}\nabla_i A^i + \frac{1}{4}A^i A_i + \frac{1}{6}R$); and (ii) to consider separately each of the five possible Petrov types of the Weyl tensor.

This is a natural approach since Petrov type is a conformally invariant property. The conjecture has been proved for Petrov types N and III for the general equation (E) and for type D for the essentially self-adjoint equation. Some preliminary results have been obtained for type II, but nothing is known in the case of type I the most general. The proofs required the use of up to the first seven necessary conditions in the sequence. See Czapor and McLenaghan [2] for a review of these results. Günther [4] and Belger, Schimming, Wünsch [1] for other reviews on Huygens' principle.

In spite of the supportive results described above, Czapor and I have recently shown that the modified conjecture is not true in the essentially non-self-adjoint case [2]. Consider a background space (M, g) with metric and one-form \mathbf{A} given respectively by $ds^2 = 2[1 - \frac{1}{3}Ruv]^{-2}dudv - 2[1 - \frac{1}{12}Rz\bar{z}]^{-2}dzd\bar{z}$, $\mathbf{A} = H_3(1 - \alpha uv)^{-1}(vdu - udv)$, $\mathbf{A} = H_3(1 - \alpha uv)^{-1}$ where H_3 is real with $H_3 = \pm\frac{1}{6}R$ and $\alpha = \frac{1}{3}R$, $\delta = -\frac{1}{12}R$.

We shall denote the equation (E) , where g^{ij} is defined by the above metric, $A^i = g^{ij}A_j$ by the above one-form, and C by the relation given earlier, by (E_{RB}) . It can be shown that $G(V) = 0$ on every $C(x_0)$ which implies that (E_{RB}) is a Huygens equation. Furthermore, it is an essentially non-self-adjoint equation (i.e., it is not equivalent to any self-adjoint equation). This property follows from the fact that $R \neq 0$, which implies that $d\mathbf{A} \neq 0$. Thus \mathbf{A} is not a closed one-form; however, \mathbf{A} closed is a necessary condition for the existence of a trivial transformation to set $\mathbf{A} = 0$. One concludes that (E_{RB}) is a Huygens equation which is equivalent to neither (E_4) nor (E_{PW}) , both of which are self-adjoint equations.

We have seen how Mathisson's method together with the Petrov classification have been used to partially solve Hadamard's problem for the equation (E) for $n = 4$. The problem has been completely solved for the degenerate Petrov types III and N. It has also been completely solved for any essentially self-adjoint equation for Petrov type D. However, the problem remains open for essentially non-self-adjoint equation on type D background spaces. The existence of (E_{RB}) shows that the solution may be richer than previously thought. Some preliminary results have been obtained for essentially self-adjoint equations for type II. However, the complete solution of the equations for type II and those arising from the generic case of type I appear intractable even with the use of powerful computer algebra packages that helped solve the more degenerate cases.

It thus seems that Mathisson's method, conceived almost seventy years ago, has been exploited to its fullest extent. Further progress on the solution of Hadamard's problem will depend on a new approach. Such an approach may involve a deeper analysis of Hadamard's necessary and sufficient condition on the entire null conoid rather than the study of the (infinite) sequence of necessary conditions that arise from it at the vertex, which is the essence of Mathisson's method.

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QSS – From Heuristics To Algorithmic Algebra

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We give here a short non-technical account of lengthy and mostly technical matters concerning quasi-steady state (QSS) phenomena. The new aspect of our work neither lies in the biochemical interpretation (we build on Segel and Slemrod [6] and many others), nor in singular perturbation theory (we do not go beyond Tikhonov's [7] and Fenichel's [2] classical work). Methods of algorithmic algebra have been employed for QSS before, (e.g. Boulier et al. [1] and extensive references can be found in Goeke [3] [4] [5]). Our point is that for polynomial (or rational) systems of reaction equations the reduction in the presence of "small parameters", as well as their identification, naturally fit into the framework of (algorithmic) algebra.

1. *QSS – Background.* In biochemical reaction networks it is frequently observed or conjectured that the rate of change for certain chemical species (or certain reactions) is considerably slower than the overall rate of change. Mathematically, one wishes to use such a property to reduce the dimension of the corresponding equation system (and anticipate possible problems with parameter identification).

2. The reversible Michaelis-Menten reaction, as presented in Segel, Slemrod [6], leads to

$$(1) \quad \begin{aligned} \dot{s} &= -k_1 e_0 s + (k_1 s + k_{-1})c, \\ \dot{c} &= k_1 e_0 s - (k_1 s + k_{-1} + k_2) \\ &\quad c + k_{-2}(e_0 - c)(s_0 - s - c), \end{aligned}$$

for the concentrations of substrate S and complex C , with initial values $s(0) = s_0 > 0$ and $c(0) = 0$. The initial enzyme concentration e_0 and all rate constants k_i are > 0 . A classical QSS setting here is that c changes very slowly after a short initial phase. In an ad-hoc manner this assumption is being used to equate the second entry on the right hand side of (1) to zero, solve the resulting equation for c and substitute the result, thus obtaining a single equation for s . (This involves square roots; the irreversible case with $k_{-2} = 0$ looks less complicated.)

3. *Translating QSS to mathematics.* There remains the question of 'How and under what circumstances can the procedure sketched above be justified or improved?' A natural mathematical approach to QSS, seen as slow-fast phenomenon, is to employ singular perturbation theory; this is actually a crucial and critical step. We will work with the singular perturbation interpretation herein and thus consider a system with a "small parameter."

4. *Reduction for rational systems.* Consider a sufficiently smooth system of ordinary differential equations

$$(2) \quad \dot{x} = h^{(0)}(x) + \varepsilon h^{(1)}(x) + \varepsilon^2 \dots, x \in \mathbb{R}^n$$

as the "small parameter" ($\varepsilon \rightarrow 0$). The scenario is assumed to be singular in the sense that the zero set ($\mathcal{V}(h^{(0)})$) contains a submanifold Z of dimension $s > 0$, and we are interested in the asymptotic behavior on this "slow manifold".

The system can be reduced via the classical Tikhonov-Fenichel theorem (including convergence properties as $\varepsilon \rightarrow 0$) in some neighborhood of $x_0 \in Z$ if and only if:

- (i) the rank of $Dh^{(0)}(x_0)$ is equal to $n - s$;
- (ii) one has a direct sum decomposition $\mathbb{R}^n = \text{Ker } Dh^{(0)}(x_0) \oplus \text{Im } Dh^{(0)}(x_0)$; and
- (iii) the nonzero eigenvalues of $Dh^{(0)}(x_0)$ have real part < 0 . (This characterization is essentially due to Fenichel [2].)

However, a straightforward application of Tikhonov's theorem seems to require a coordinate transformation, which cannot be determined explicitly in general.

A new contribution by Goeke [3] [4] to the reduction theory provides an explicit determination of a reduced system for equations with rational right-hand side. Consider system (2) with rational $h^{(0)}$, and let $a \in \mathbb{R}^n$ be a simple point of the variety $(\mathcal{V}(h^{(0)}))$, with $(r = \text{rank } Dh^{(0)}(a) < n)$. Locally $(\mathcal{V}(h^{(0)}))$ is a submanifold Z of dimension $s = n - r$. Assume moreover that conditions (ii) and (iii) hold.

Decomposition: On a Zariski-open neighborhood U_a of a there is a product decomposition with matrices $(\mu(x) \in \mathbb{R}(x)^{r \times 1}, P(x) \in (R)(x)^{n \times r})$ such that

$$h^{(0)}(x) = P(x)\mu(x),$$

with $\text{rank } P(a) = r$, $\text{rank } D\mu(a) = r$, and $\mathcal{V}(h^{(0)}) \cap U_a = \mathcal{V}(\mu) \cap U_a$ is an s -dimensional submanifold. The entries of μ may be taken as any r entries of $h^{(0)}$ that are functionally independent near a , and P can be determined via standard bases (a variant of Gröbner bases).

Reduction: The following system is defined on a Zariski neighborhood of a in \mathbb{R}^n , admits an invariant relatively Zariski-open neighborhood of a in $(\mathcal{V}(h^{(0)}))$, containing Z , and corresponds on Z to Tikhonov's reduced system as $\varepsilon \rightarrow 0$:

$$(3) \quad \begin{aligned} \dot{x} &= \varepsilon [I_n - P(x)A(x)^{-1}D\mu(x)] h^{(1)}(x), \\ &\quad \text{with } A(x) := D\mu(x)P(x). \end{aligned}$$

Note that any reduced system of a rational equation is again rational.

5. *Example.* For the reversible Michaelis-Menten system, with small parameter $\varepsilon = e_0$, the reduction procedure yields $Z = \{(s, c); c = 0\}$ and the reduced equation (with guaranteed convergence)

$$\dot{s} = -e_0 \cdot \frac{s(k_1 k_2 + k_{-1} k_{-2}) - k_{-1} k_{-2} s_0}{k_1 s + k_{-1} + k_2 + k_{-2}(s_0 - s)}.$$

This differs appreciably from the ad-hoc result; on the other hand (by accident) the irreversible case $k_{-2} = 0$ yields the same reduction as the ad-hoc method.

6. *Identifying "small parameters."* In most applications system (2) is actually a parameter-dependent system with one distinguished "small parameter" and the remaining ones being "frozen." For a given parameter-dependent equation:

$$(4) \quad \dot{x} = h^{(0)}(x) + \varepsilon h^{(1)}(x) + \varepsilon^2 \dots, x \in \mathbb{R}^n$$

this raises the question: How to identify potential small parameters? Segel and Slemrod's method [6] (emulated in many subsequent papers), works by estimating and comparing various time scales, based on a QSS hypothesis for certain species. Our alternative approach starts from a mathematical argument, and in principle allows to find all possible settings where Tikhonov-Fenichel reduction is applicable. Again we restrict ourselves to rational systems.

The ansatz $\pi = \pi^* + \varepsilon v$ (with $v \neq 0$), yields a system for which the reduction criteria can be checked, and this provides criteria on $h^{(0)} = h(\cdot, \pi^*)$, hence on π^* ; there must exist an x_0 such that the zero set of $h(\cdot, \pi^*)$ is locally an s -dimensional manifold ($s > 0$), and conditions (ii) and (iii) above hold. We call π^* a Tikhonov parameter value (TPV) in this case. The following rather weak consequence indicates why algorithmic algebra (e.g., elimination ideals) is efficient in finding TPV's.

Observation: At a Tikhonov parameter value π^* the entries of $h(\cdot, \pi^*)$ and $d = \det D_1 h(\cdot, \pi^*)$ have a common zero.

7. *Example.* For the irreversible Michaelis-Menten system ($k_{-2} = 0$), consider the ideal generated by d and the entries of the right-hand side. The elimination ideal with respect to s and c is generated by $k_1 k_2 e_0$, hence the only possible "small parameters" are e_0 , k_1 and k_2 . One can check that these indeed lead to Tikhonov-Fenichel reduction.
8. *Structural matters.* To obtain necessary and sufficient conditions for TPV's, one also invokes properties of certain minimal polynomials and the Routh-Hurwitz criteria. One result is that for system (4) on a semi-algebraic set D (e.g., the positive orthant), the TPV's form a semi-algebraic set.

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- [5] A. Goeke, S. Walcher, E. Zerz: Determining "small parameters" for quasi-steady state. Preprint, 35 pp. (2014).
- [6] L.A. Segel, M. Slemrod: The quasi-steady-state assumption: A case study in perturbation. *SIAM Review* 31 (1989), 446 – 477.
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In memoriam: André Boivin (1955-2014)



André Boivin passed away at University Hospital on Friday, October 17, 2014, as a result of heart failure.

Professor Boivin completed his PhD at the Université de Montréal in 1984 under the direction of Paul Gauthier. He took up a position at the University of Western Ontario as an Assistant Professor in 1986, after holding postdoctoral fellowships at UCLA and University College, London. He was promoted to Associate Professor in 1991, and then to Professor in 2004. He was appointed as Chair of Western's Department of Mathematics in 2011.

His research specialties were complex analysis and approximation theory, and he was the author of multiple papers in these areas. His main topics of investigation were approximation by holomorphic functions of one or several variables, approximation by harmonic functions, and solutions of elliptic partial differential equations. Much of this work involved Fourier analysis and functional analysis. Gauthier was Boivin's main collaborator, but he had many other collaborators in North America, Russia, Spain and Germany.

His PhD thesis demonstrates that a topological condition of Gauthier is necessary and sufficient for a pair of spaces (E, D) to form a Carleman pair, where the space E is a closed subset of an open Riemann surface D . This theorem builds on results of Carleman, Gauthier and Nersessian, and amounts to a generalization of the classical Weierstrass approximation theorem. He went on to a study of the characterization of Arakelian pairs on Riemann surfaces that occupied much of his career – this problem is still unsolved, but his students are working on it.

He also worked on many other problems in approximation theory, in various types of function spaces. He and Paramanov developed an axiomatic theory which gave a set of natural conditions on a space of functions X and a subspace Y for a local to global principle for approximations of functions in X by functions in Y . Examples of this theory included approximation theorems for solutions elliptic partial differential equations.

He gave tireless service to granting agencies and selection committees in Québec and Ontario, and was a frequent conference organizer.

He served with distinction as Graduate Student Chair before becoming Chair of the Department, and supervised many graduate students during the course of his career. Caring, warmth and passion were the hallmarks of his relationships with students and colleagues.

André Boivin is survived by his wife Yinghui Jiang, son Alexandre, daughter Mélanie and step son JP. He was well loved and respected by his colleagues, students and coworkers, and he will be sorely missed. Memorial contributions to Foundation Western would be gratefully acknowledged.

CSHPM Notes brings scholarly work on the history and philosophy of mathematics to the broader mathematics. Authors are typically members of the Canadian Society for History and Philosophy of Mathematics (CSHPM). Comments, suggestions, and submissions are welcome.

Amy Ackerberg-Hastings, University of Maryland

University College (aackerbe@verizon.net)

Hardy Grant, York University [retired] (hardygrant@yahoo.com)

Les articles de la SCHPM présentent des travaux de recherche en histoire et en philosophie des mathématiques à la communauté mathématique élargie. Les auteurs sont généralement membres de la Société canadienne d'histoire et de philosophie des mathématiques (SCHPM). Vos commentaires, suggestions et propositions sont le bienvenue.

Amy Ackerberg-Hastings, University of Maryland

University College (aackerbe@verizon.net)

Hardy Grant, York University [retired] (hardygrant@yahoo.com)

Archives for History of Mathematics

David Orenstein, Toronto District School Board

Essentially, mathematics develops a set of ideas through a rigorous and thorough logical consistency, but history of mathematics is an empirical discipline built on concrete evidence. Archeological sites, museums, libraries and living witnesses are all evidential sources. So too are archives, where documents—whether written, visual or sonic—are collected, presented and organised. Despite overlap, libraries concentrate on published works, museums on physical artefacts, and archives on manuscript and audiovisual collections.

In researching history of mathematics, I've visited many Canadian archives, mostly in Ontario and Quebec, which store the records of Canadian mathematics, but also reflect the wider world. I can walk from my home to the University of Toronto's Thomas Fisher Rare Books Library, (fisher.library.utoronto.ca) where books books and pamphlets, but also the manuscript collections, have a strong concentration on history of mathematics and science, overseen by a dedicated librarian.

The Stillman Drake Collection reflects Drake's mastery of Galileo studies. The couple thousand books and several manuscripts include a holograph Galileo letter on the variability of the obliquity of the ecliptic. This letter has been published and also translated and analysed. Using a beautiful and legible hand, Galileo gently indicates in Italian the errors of his diligent and sincere amateur correspondent. The letter is carefully preserved in a clothbound folder, stored in a hardboard box.

From the Fisher Library I take the elevator up three floors to the University of Toronto Archives (utarms.library.utoronto.ca). The university Calendars are available on open shelves, enabling readers to trace the evolution of the mathematics department, its staff (often including home addresses) and curriculum (including textbooks assigned).

Specifically mathematical collections include records of the students' Mathematical and Physical Society. Here are published volumes of papers delivered to the Society between 1901 and 1904, and a file of clippings maintained by the Office of the President of the University. Mathematics professor J. C. Fields (of Fields Medal fame) left three boxes of lecture notes from pursuing

postdoctoral studies in Germany in the 1890s: Frobenius on number theory; Hilbert on functions of complex variables; Planck on mathematical physics; and so on.

It's ten hours by VIA train from Toronto to Quebec City for my annual visit. Usually I spend a few days in Montreal on either the outbound or return trip. There I've encountered a first edition of Johannes Kepler's *Harmonices mundi*, where proportion is the principle of the world, much like the vogue for chaos theory, in the Rare Books Special Collections of McGill University's McLennan Library (www.mcgill.ca/library/branches/rarebooks).

In Quebec City, the Archives from the Séminaire de Quebec, (www.mcq.org/fr/collections/consultation), represent a unique Canadian research opportunity. The books, journals, lecture notes, letters, and mathematical and scientific apparatus were acquired since its establishment in 1663. The material is enriched by the Séminaire's inheritance of the educational mission and library of the nearby Collège des Jésuites (est. 1632) after British forces were barracked in the Collège in 1759. Jean Talon, the first intendant of the Crown Colony of Nouvelle-France, donated much of his personal library before he returned to France. Talon's copy of Kepler's *Rudolphine Tables* is bound in light brown leather and stamped in gold with the Talon family coat of arms. The *Tables* demonstrate early application of eight-place logarithms to cutting-edge astronomical calculations.

The mathematical works were used. In Antoine Deparcieux's *Nouveaux traités de trigonométrie rectiligne et sphérique* (1741), the facing initial pages of the Logarithms of Sines and Cosines have an extensive marginalia in a period hand, which demonstrates how to extend the precision of the table by a factor of 100 and (implicitly) indefinitely.

When Université Laval was being established in the 1850s, teaching fathers were sent to France for advanced education. One of them, Père Thomas Hamel, at the *École des Carmes*, in Paris, compiled in three stout bound volumes lecture notes from his mathematics professor: the staunch Catholic monarchist, Augustin Cauchy.

Heading west from Toronto, by suburban GO train, it's an easy day trip to Hamilton's McMaster University. There the William Ready Archives and Research Collections in the basement of the Mills Memorial Library (library.mcmaster.ca/archives), house the Bertrand Russell Archives (www.mcmaster.ca/russdocs/russell.htm).

I visited this year to prepare a history-of-mathematics paper about the great mathematical foundationist Giuseppe Peano's visit to the 1924 International Mathematical Congress held at the University of Toronto. After writing in advance for any Russell-Peano correspondence, I found waiting for me a list of thirteen items from the earliest years of the twentieth century and a couple from the 1960s with a different Peano, Augusto.

This correspondence included the original manuscript letters from Peano to Russell and their typed transcriptions. One small scrap of paper reads "from Peano, and therefore precious". The earliest letter, dated Turin, March 19, 1901, thanks Russell in French for his submission to Peano's journal *Rivista di Matematica*. "I will publish your interesting memoir as soon as possible", it says, and it continues with typographical issues for various symbols for mathematical logic.

Switching to Italian on March 27, 1903, Peano wrote: "Most prestigious colleague: Thank you for your book *The Principles of Mathematics*.... Your book ... marks an epoch in the field of mathematical philosophy...." He promises to share it with Italian colleagues.

A couple of the letters are extensive discussions of substantial issues in mathematical logic with references to colleagues such as Zermelo. There are personal comments about Peano's travels and the state of his health. In a letter from 1912, Peano explains his offer to use *Latine sine flexione* (Latin without inflections) in his talk at the International Congress of Mathematicians at the University of Cambridge that year. Peano used the same language to deliver "*De Aequalitate*" in Toronto.

This extensive archive contains more than just Russell's massive correspondence. For example, Box 3.36, "Article Manuscripts, 1900 - 1902", contains the manuscript "On the Logic of Relations", dated October 1901, and its translation "Sur la logique des relations", published in *Rivista di matematica*, Torino, in 1901, divided between issues 2 and 3. Of course, Russell's co-author on *Principia Mathematica*, Alfred North Whitehead, is substantially present in the correspondence, as is Russell's student Ludwig Wittgenstein as well as Gottlob Frege.

The Russell Archives recreates the great philosopher's study, displaying his desk and his books shelved in their original order. They include his personal copies of Peano's two journals, the *Rivista* and the *Formulaire de Mathématique*. In the reading room Russell's presence is felt from the gaze of his bronze portrait head, sculpted in 1953 by Sir Jacob Epstein. An index to the Russell correspondence can be found at the BRACERS website (russell.humanities.mcmaster.ca/bracers/default.htm), where each item is catalogued by reference number, date, author, recipient(s) and a concise content description.

Researchers may order photocopies or scans, priced according to quantity and able to be forwarded electronically. As is typical for archives, the hours are somewhat restricted: Monday to Friday,

9:00 am to 5:00 pm. As is also typical of Canadian archives, the staff at McMaster are very helpful and friendly.

Canadian archives provide us with a convenient and welcoming opportunity for connecting with the history of mathematics, whether local, national or international, and from many different time periods. Furthermore an archive might be interested in acquiring your own material, possibly when you're moving or retiring. For example, I've been donating my undergraduate course notes from the 1970s to the University of Toronto Archives. Archival studies have many aspects and many rewards, but the main value that I find in their pursuit is the joy of encountering the personal connections in the web of mathematical development.

David Orenstein (david.orenstein@utoronto.ca) has recently retired from teaching mathematics at Danforth CI, an inner city high school in Toronto. This leaves him more time for researching the history of Canadian mathematics and science, currently focusing on early international conferences that took place in Canada, such as the 1924 Toronto International Mathematical Congress.

University of Toronto, Assistant Professor in Mathematics and Computer Science



The University of Toronto invites applications for a tenure-stream appointment in Mathematics and Computer Science. The position is 75% in the Department of Mathematics and 25% in the Department of Computer Science. The appointment is at the rank of Assistant Professor and will begin on July 1, 2015. Areas of interest include applied computational geometry, discrete differential geometry, analysis/visualization of multidimensional data, security/privacy, and complexity.

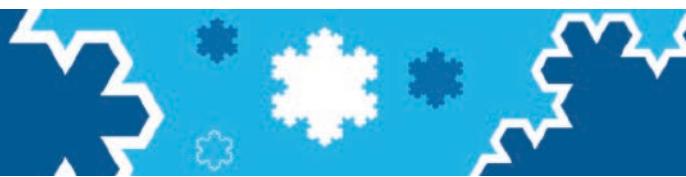
All qualified candidates are invited to apply by clicking the following link <https://www.mathjobs.org/jobs/jobs/6272>. To receive full consideration, applications should be received by **December 15, 2014**.

The University offers the opportunity to teach, conduct research, and live in one of the most diverse metropolitan areas in the world. The University of Toronto is strongly committed to diversity within its community and especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to the further diversification of ideas. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.



2014 CMS Winter Meeting

December 5 - 8, 2014 • Hamilton, Ontario



2014 CMS Winter Meeting

December 5 - 8, 2014, Hamilton (Ontario)
Hamilton Sheraton
Host: McMaster University
cms.math.ca/events/winter14

Prizes | Prix

Jeffery-Williams Prize | Prix Jeffery-Williams

Askold Khovanskii (University of Toronto)

Doctoral Prize | Prix de doctorat

Xiangwen Zhang (McGill)

Graham Wright Award for Distinguished Service

Prix Graham Wright pour service méritoire

Shawn Godin (Cairine Wilson S.S.)

Adrien Pouliot Award | Prix Adrien-Pouliot

Frédéric Gourdeau (Laval)

David Borwein Distinguished Career Award

Prix David-Borwein de mathématicien émérite pour l'ensemble d'une carrière

Kenneth R. Davidson (University of Waterloo)

G. de B. Robinson Award | Prix G. de B. Robinson

Jonathan M. Borwein (Newcastle, NSW)

Armin Straub (Illinois)

James Wan (Newcastle, NSW)

Wadim Zudilin (Newcastle, NSW)

J. Nekovár (Université Pierre et Marie Curie)



Réunion d'hiver 2014 de la SMC

5-8 décembre 2014, Hamilton (Ontario)
Hamilton Sheraton
Hôte : Université McMaster
smc.math.ca/reunions/hiver14

Public Lectures | Conférence publiques

Jeffrey Rosenthal (Toronto)

Plenary Lectures | Conférences plénierées

Robert Beiko (Dalhousie), Isaac Goldbring (UIC),
Miroslav Lovric (McMaster), Laure St. Raymond (École normale supérieure), Jacques Vanneste (University of Edinburgh)

Inaugural Borwein Lecture

Conférence Inaugurale Borwein

Kenneth R. Davidson (Waterloo)

Scientific Director | Directeur Scientifique

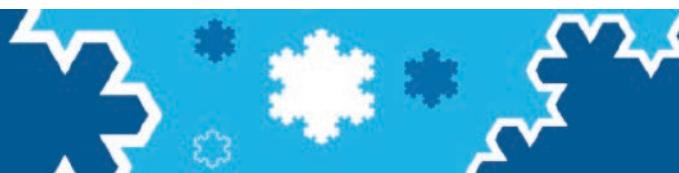
Nicholas Kevlahan : kevlahan@mcmaster.ca

Deirdre Haskell : haskell@math.mcmaster.ca

Related Events | Événements liés

The CMS Town Hall meeting and NSERC Update on Institute Innovation Platform Funding will occur on Saturday, December 6, from 12:30 - 14:00. All CMS members and meeting participants are invited to join the CMS Executive and NSERC to engage on upcoming plans and to discuss any interests or concerns that members of our community may have. A light lunch will be provided courtesy of NSERC's partnership. / La réunion-débat de la SMC et la mise à jour du CRSNG sur l'innovation institutionnelle d'une plateforme de financement auront lieu le samedi 6 décembre, à partir de 12h30-14h00. Tous les membres de la SMC et participants à la réunion sont invités à se joindre à l'exécutif de la SMC et le CRSNG à s'engager sur les plans à venir et de discuter des préoccupations ou des intérêts que les membres de notre communauté peuvent avoir. Un léger goûter sera gracieusement fourni par le partenariat du CRSNG.

The Canadian Mathematical Society invites you to their awards banquet on Sunday December 7 to highlight exceptional performance in the area of mathematical research and education at the Art Gallery Hamilton. Prizes will be awarded during the event. / La Société mathématique du Canada vous invite à son banquet le dimanche le 7 décembre pour souligner des contributions exceptionnelles en recherche mathématique et en enseignement des mathématiques au Centre d'art d'Hamilton. Les prix seront remis durant la soirée.



Regular Sessions | Sessions générales

Algebraic Geometry of Moduli Spaces | Géométrie algébrique des espaces de formes modulaires

Ruxandra Moraru (Waterloo), Steven Rayan (Toronto)

Arithmetic Algebraic Geometry

Géométrie algébrique arithmétique

Manfred Kolster (McMaster)

Automorphic Forms and Representation Theory

Formes automorphiques et théorie des représentations

Moshe Adrian (Toronto)

Commutative Algebra: Interactions with Algebraic Combinatorics, Algebraic Geometry, and Representation Theory | Algèbre commutative : interactions avec la combinatoire algébrique, la géométrie algébrique et la théorie des représentations

Tony Geramita (Queens), Adam van Tuyl (Lakehead)

Computability Theory | Théorie de la calculabilité

Peter Cholak (Notre Dame), Barbara Csima (Waterloo)

Differential Geometry | Géométrie différentielle

Benoit Charbonneau (Waterloo), Spiro Karigiannis (Waterloo),
McKenzie Wang (McMaster)

Dynamical Systems with Applications in Mathematical Biology | Systèmes dynamiques et applications en biologie mathématique

Hermann Eberl (Guelph), Gail Wolkowicz (McMaster)

Dynamics of Biological Systems

Dynamique des systèmes biologiques

Ben Bolker (McMaster), Jonathan Dushoff (McMaster)

Environmental and Geophysical Fluid Dynamics

Dynamique des fluides en géophysique et en science de l'environnement

Francis Poulin (Waterloo)

Financial Mathematics | Mathématiques financières

Minsuk Kwak (McMaster), Traian Pirvu (McMaster)

Frames, Fractals, Tiling, and Wavelets, in Connection with the Fuglede's Conjecture | Cadres, fractales, pavages et ondelettes, par rapport à la conjecture de Fuglede

Jean-Pierre Gabardo (McMaster), Chun-Kit Lai (McMaster)

Geometric Discretization Methods and Adaptivity

Méthodes de discréétisation géométrique et adaptativité

Marc Laforest (polytechnique Montreal), Gantumur Tsogtgerel (McGill)

Geometry and Topology of Manifolds in Low-Dimensions | Géométrie et topologie de variétés en basse dimension

Hans U. Boden (McMaster), Liam Watson (Glasgow)

Graduate Student Research Presentations | Exposés de recherche par les étudiants gradués

Irena Papst (McMaster), Adrien Thierry (McMaster)

Integrable Systems: Recent Developments | Les récents développements dans les systèmes intégrables

Stephen Anco (Brock), Dmitry Pelinovsky (McMaster)

Model Theory | Théorie des modèles

Omar Sanchez (McMaster), Patrick Speissegger (McMaster)

Non-linear PDE of Mathematical Physics | Les EDP nonlinéaires venant de la physique mathématique

Stan Alama (McMaster), Lia Bronsard (McMaster)

Operator Algebras and Operator Theory

Algèbres d'opérateurs et théorie des opérateurs

Ken Davidson (Waterloo), Matthew Kennedy (Carleton)

Origin and Evolution of Bacterial Genomes

Origine et évolution des génomes bactériens

Paul Higgs (McMaster), Ralph Pudritz (McMaster)

Recent Advances in Variational Analysis and Linear Optimization | Percées récentes en analyse variationnelle et en optimisation linéaire

Antoine Deza (McMaster), Henry Wolkowicz (Waterloo)

Stochastic Models and Applications | Modèles stochastiques et applications

Shui Feng (McMaster), Bruno Remillard (HEC Montreal)

Teaching Introduction to Proofs Courses | Enseigner l'introduction aux preuves

Shay Fuchs (Toronto), Jaimal Thind (Toronto)

Toric and Combinatorial Algebraic Geometry

Géométrie algébrique torique et combinatoire

Eric Katz (Waterloo), Jessie Yang (McMaster)

Undergraduate Mathematics Education in 21st Century: Rethinking Curriculum | L'enseignement des mathématiques au premier cycle au 21^e siècle : repenser le curriculum

Chantal Buteau (Brock), Miroslav Lovric (McMaster)

Contributed Papers | Communications libres

Jamie Foster (McMaster)

AARMS-CMS Student Poster Session

Présentations par affiches pour étudiants - AARMS-SMC



MAY 2015

- 4-8** FIELDS Short Thematic Program: **Differential equations with variable delay**, Toronto
- 6-8** FIELDS **Algorithms and Complexity in Mathematics, Epistemology and Science (ACMES)**, Western University
- 7-10** FIELDS **Representation Theory and Analysis on Lie Groups over Local Fields**, University of Ottawa
- 11-15** FIELDS Short Thematic Program: **Delay-Differential equations in physical sciences and engineering**, Toronto
- 15-17** CRM XVIII^e colloque panquébécois des étudiants de l'Institut des Sciences Mathématiques (ISM), Montréal
- 19-22** FIELDS Short Thematic Program: **Structured delay systems**, Toronto
- 25-29** FIELDS Short Thematic Program: **Delay differential equations in life sciences and medicine**, Toronto

JUNE 2015

- 1-4** CanaDam 5th biennial Canadian Discrete and Algorithmic Mathematics Conference, University of Saskatchewan
- 5-8** CMS Summer Meeting, University of Prince Edward Island, Charlottetown
- 5-9** CMESG 2015 Meeting, University of Moncton, Moncton
- 7-12** CAIMS 2015 Annual Meeting, Waterloo
- 12-14** FIELDS Symposium on Mathematics Education And Coding Modelling Mathematics Relationships With Code, Faculty of Education, Western University
- 13-14** FIELDS/CANSSI Thematic Program on Statistical Inference, Learning and Models for Big Data, **Closing Conference**, Toronto
- 14-17** CORS Joint International Meeting Canadian Operational Research Society
- 14-17** SSC 2015 Annual Meeting, Dalhousie University, Halifax Institute for Operations Research and the Management Sciences, Montreal
- 15-16** FIELDS/CRM Séminaire de Mathématiques Supérieures - Geometric and Computational Spectral Theory, Montréal
- 29** PIMS Symposium on the Geometry and Topology of Manifolds, University of British Columbia

JULY 2015

- 6-8** AARMS International Symposium in Statistics 2015, Memorial University, St. John's
- 17-21** AARMS AHA 2015, Dalhousie University, Halifax



AARMS Summer School 2015 In Differential Equations And Numerical Computing

July 6-31, 2015, Dalhousie University, Halifax

<http://www.mathstat.dal.ca/~tkolokol/summer>

This summer school is intended for graduate and senior undergraduate students, as well as young researchers. Each participant is expected to register for two of the four courses. Each course consists of five ninety-minute lecture sessions each week. These are graduate courses approved by Dalhousie and we will facilitate transfer credit to the extent possible.

Funding is available for student travel and local accommodations. We have student residences reserved for students outside of Halifax attending the summer school.

Organizers: Theodore Kolokolnikov and Hermann Brunner.

Course descriptions

Course 1: Waves and patterns in nonlinear systems

Instructors: Andrea Bertozzi and Ricardo Carretero

Course 2: Topics in Reaction-Diffusion Systems: Theory and Applications

Instructors: Michael Ward and Juncheng Wei

Course 3: Structure-preserving discretization of differential equations

Instructors: Elena Celledoni and Brynjulf Owren

Course 4: Numerical analysis of singularly perturbed ODEs and PDES

Instructor: Martin Stynes

For more information including course descriptions, teacher biographies and how to apply, please visit

<http://www.mathstat.dal.ca/~tkolokol/summer>



Réunion d'été 2015
de la SMC
Charlottetown - 5-8 juin

2015 CMS
Summer Meeting
Charlottetown - June 5-8



June 5-8, 2015, Charlottetown (PEI)
University of Prince Edward Island
Host: University of Prince Edward Island

CALL FOR SESSIONS 2015 CMS Summer Meeting

The Canadian Mathematical Society (CMS) and the University of PEI welcomes and invites proposals for sessions for the 2015 Summer Meeting in Charlottetown from June 5th to 8th, 2015. Proposals should include a brief description of the focus and purpose of the session, the expected number of speakers, as well as the organizer's name, complete address, telephone number, e-mail address, etc. All sessions will be advertised in the CMS Notes, on the web site and in the AMS Notices. Speakers will be requested to submit abstracts, which will be published on the web site and in the meeting program. Those wishing to organize a session should send a proposal to the Scientific Directors by January 30, 2015.

Scientific Directors:

Gordon MacDonald: gmacdonald@upei.ca
Shannon Fitzpatrick: sfitzpatrick@upei.ca

Du 5 au 8 juin 2015, Charlottetown (Î.-P.-É.)
L'Université de l'Île du Prince-Édouard (UPEI)
Hôte : Université de l'Île-du-Prince-Édouard

APPEL DE PROPOSITIONS DE SÉANCES Réunion d'été 2015 de la SMC

La Société mathématique du Canada (SMC) et l'Université de l'Île du Prince-Édouard vous invitent à proposer des séances pour la réunion d'été 2015 qui aura lieu à l'Île-du-Prince-Édouard du 5 au 8 juin 2015. Ces propositions doivent compter une brève description de l'orientation et des objectifs de la séance, le nombre de conférenciers prévu, de même que le nom, l'adresse complète, le numéro de téléphone et l'adresse électronique de l'organisateur. Toutes les séances seront annoncées dans les Notes de la SMC, sur le site Web et dans les AMS Notices. Les conférenciers devront présenter un résumé, qui sera publié sur le site Web et dans le programme de la réunion. Toute personne qui souhaiterait organiser une séance est priée de faire parvenir une proposition aux directeurs scientifiques au plus tard le 30 janvier 2015.

Directeurs scientifiques :

Gordon MacDonald : gmacdonald@upei.ca
Shannon Fitzpatrick : sfitzpatrick@upei.ca

York University, Assistant Professor in Actuarial Mathematics

Applications are invited for a tenure-track appointment in Actuarial Mathematics at the Assistant Professor level in the Department of Mathematics and Statistics, Faculty of Science, York University to commence July 1, 2015, subject to budgetary approval. The successful candidate will have completed all the requirements for a Ph.D. in Mathematics or a related discipline by the start date, and have a file that provides documentation of excellence (or, for very junior candidates, the promise of excellence) in both research and teaching. This candidate will also be suitable for prompt appointment to the Faculty of Graduate Studies and be capable of, and willing to, assume a leadership role in the Department's actuarial program. The ideal candidate will be a Fellow of one of the following professional societies: Canadian Institute of Actuaries (CIA), Society of Actuaries (SoA), Casualty Actuarial Society (CAS), Faculty and Institute of Actuaries (FIA), or Institute of Actuaries of Australia (IAA). Candidates willing to commit to prompt achievement of Associate status, followed by Fellowship will also be considered. York University is an Affirmative Action (AA) employer and strongly values diversity, including gender and sexual diversity, within its community. The AA program,

which applies to Aboriginal people, visible minorities, people with disabilities, and women, can be found at www.yorku.ca/acadjobs or by calling the AA office at 416-736-5713. All qualified candidates are encouraged to apply; however, Canadian citizens and permanent residents will be given priority.

Applications must be received by January 5, 2015. Applicants should post their curriculum vitae, an outline of their research plan and a description of teaching interests on MathJobs.org. They should also arrange for three letters of recommendation (one of which should address teaching) to be sent there. Questions regarding application procedures for this position should be directed to:

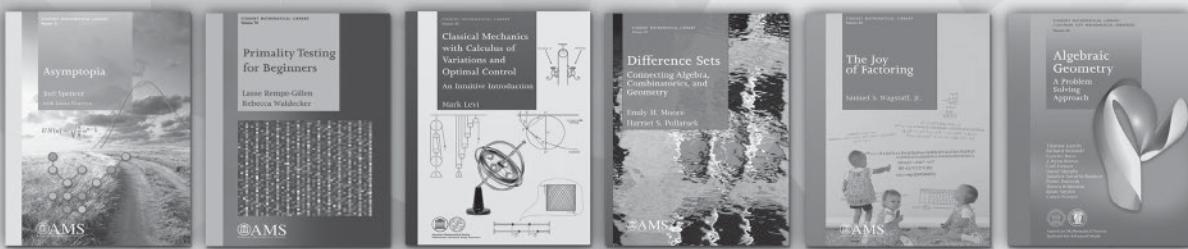
Susan Rainey, Faculty Secretary, Chair's Office,
Mathematics & Statistics, Faculty of Science

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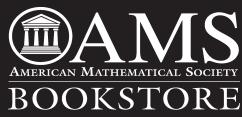
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