



The Cal Poly Math Academy: A program to attract more underrepresented students to STEM fields. . . . . **8**

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**CMS**  
**SMC**

# CMS NOTES de la SMC

February/  
février  
2016

## President's Notes / Notes de la Présidente

**Lia Bronsard**, (McMaster), President / Présidente



The 2015 Winter Meeting in Montreal was among our most successful events in recent years. In fact, there were more than 600 participants, almost 30 scientific sessions, and exceptional public lectures given by Isabelle Gallagher (in French) and John Baez (in English), and high-level plenary lectures with Gilles Brassard, Anna Gilbert, Martin Hairer and Caroline Series. Furthermore, the CSHPM plenary lecture given by Jamie Tappenden was superb, and the plenary lecture on education by Bernard Hodgson (held in the two official languages of the CMS), based on the mathematics of Archimedes and addressing the area of a circle and of a segment of parabola, was inspiring. This exceptional program, developed by the scientific committee comprised of Jim Colliander, Henri Darmon, Lisa Jeffrey, Yu-Ru Liu, Nilima Nigam, Christiane Rousseau and Bruce Shepherd, and its scientific director Louigi Addario-Berry, consisted of as many female plenary lecturers as male plenary lecturers—a great achievement! The CMS was piloting an on-site childcare service that we hope to continue, depending on its success. We hope to see many of you at our next conference, which will be held in Edmonton from June 24 to 27, 2016, and will be juxtaposed with the annual CAIMS meeting (June 26 to 30, 2016). The reception on June 26 and the day's events of Monday, June 27, will be held jointly with the CAIMS meeting, and we hope this will allow for much discussion between the members.

The CMS is starting a much-needed fundraising campaign that has been

La réunion d'hiver 2015 à Montréal fut parmi nos plus grands succès des dernières quelques années. En effet, il y eût plus de 600 participants, presque 30 sessions scientifiques, des conférences publiques exceptionnelles données par Isabelle Gallagher (en français) et John Baez (en anglais,) et des conférences plénières du plus haut niveau avec Gilles Brassard, Anna Gilbert, Martin Hairer et Caroline Series. De plus, la conférence plénière de la SCHPM donnée par Jamie Tappenden était superbe, et la conférence plénière en éducation de Bernard Hodgson (tenue dans les deux langues officielles de la SMC) basées sur les mathématiques d'Archimède et portant sur l'aire du cercle et l'aire d'un segment de parabole était inspirante. Ce programme exceptionnel créé par le comité scientifique formé de Jim Colliander, Henri Darmon, Lisa Jeffrey, Yu-Ru Liu, Nilima Nigam, Christiane Rousseau et Bruce Shepherd, et du directeur scientifique Louigi Addario-Berry, contenait en particulier autant de conférencières que de conférenciers pléniers, une belle réussite. La SMC pilotait par ailleurs un programme de garderie offert sur place que nous espérons continuer, dépendant de son succès. Nous espérons vous voir en grand nombre à notre prochaine conférence qui se tiendra à Edmonton du 24 au 27 juin 2016, et qui sera juxtaposée avec la conférence annuelle de la SCMAI (du 26 au 30 juin 2016). La réception du 26 juin ainsi que la journée du lundi 27 juin seront en commun avec la conférence de la SCMAI et nous espérons que ceci permettra beaucoup d'échanges entre les membres.

La SMC commence une levée de fond dont elle a grandement besoin et qui a été délaissée depuis trop longtemps. J'en profite pour vous encourager à y participer. En effet, rappelons que pendant 70 ans, la SMC a contribué à

## New Year Notes from the CMS Notes Editors



**Robert Dawson** – *Editor-in-Chief*  
**Denise Charron** – *Managing Editor*  
and **Therese McCoy** – *Editorial Assistant*



In this New Year, we welcome a new Research Notes Editor to the *Notes*. Patrick Ingram (Colorado State; see page 15 for this month's Member Profile) will be taking over from Florin Diacu (UVic), who has done such a great job of seeking contributions over the last four years. We hope that the column will continue to be as fascinating as ever - but, of course, that depends on you, our readers. Do you have a research topic that you can write about? If so, please drop an email to Patrick at [notes-research@cms.math.ca](mailto:notes-research@cms.math.ca) and let him know.

And don't just think about research notes: if you have articles on math education that you think you could write, you can email Jennifer Hyndman (UNBC) and John McLoughlin (UNB) at [notes-education@cms.math.ca](mailto:notes-education@cms.math.ca), the Education Notes Editors. If there's a book you would like to review, let the Book Reviews Editor Karl Dilcher (Dal) know at [notes-reviews@cms.math.ca](mailto:notes-reviews@cms.math.ca). For other articles, bring it straight to Editors-in-Chief Robert Dawson (SMU) and Srinivasa Swaminathan (Dal) at [notes-editors@cms.math.ca](mailto:notes-editors@cms.math.ca).

While we're on the topic, we'd like to put in a few words on behalf of our sister publication, *Crux Mathematicorum*. As you may know, *Crux* got a bit behind on publication a few years back; but under the capable and energetic editorship of Kseniya Garaschuk (UBC), it's gradually working its way back into real time. That means, of course, that over the next year or so she'll be putting out more than the usual number of issues. And that, of course, means more problems and more articles than usual.

If you dream up an original puzzle in elementary math, *Crux* would be a great home for it. Once your local math contest is over, any new problems that were invented for it can be immortalized between the purple covers instead of fading into obscurity. And *Crux* publishes articles, too - always short, based in mathematical fundamentals, and usually embedded with problems of varying degrees of difficulty. While *Crux* is read by a broad audience, writers should imagine that they are writing for the very brightest high school students - the ones you'd love to have in your classes in a year or two. For more information on submitting there, please visit <https://cms.math.ca/crux/>.

Of course, please remember the Calendar. If you have an event coming up that would be of interest to the math community beyond your own campus, the Notes Calendar is a great way to spread the word. Please email your events to the Managing Editor Denise Charron at [managing-editor@cms.math.ca](mailto:managing-editor@cms.math.ca).

The CMS Notes is your newsletter and we would love to hear from you. Do you have a colleague whom you would like to nominate as a featured member profile, or honour their achievement? Has the mathematical community recently lost an esteemed colleague for whom you want to share an obituary? For general submissions, such as job postings, advertisements or announcements, please reach out to the Editorial Assistant Therese McCoy at [commmsp@cms.math.ca](mailto:commmsp@cms.math.ca).

The CMS Notes Editors welcome your articles, letters and *Notes*. Come find us!

## Notes de la nouvelle année de la part des rédacteurs des Notes de la SMC

En cette nouvelle année, nous accueillons un nouveau Rédacteur des notes de recherches de la SMC au sein de *Notes*. Patrick Ingram (Colorado State) prendra la suite de Florin Diacu (UVic), qui a effectué un incroyable travail en recherchant des contributions dans les quatre dernières années. Nous espérons que cette rubrique continuera d'être aussi fascinante que jamais – même si, bien sûr, tout dépend de vous, chers lecteurs. Avez-vous un sujet de recherche sur lequel vous souhaiteriez écrire ? Si tel devait être le cas, tenez Patrick au courant en lui envoyant un courriel à [notes-recherche@smc.math.ca](mailto:notes-recherche@smc.math.ca).

Ne vous arrêtez pas simplement aux notes de recherche : si vous pensez pouvoir écrire des articles sur l'enseignement des maths, vous pouvez envoyer un courriel à Jennifer Hyndman (UNBC) et John McLoughlin (UNB) à [notes-education@smc.math.ca](mailto:notes-education@smc.math.ca), les Rédacteurs des notes pédagogiques. S'il y a un livre dont vous souhaitez faire la critique, dites-le au Rédacteur des comptes-rendus de livres Karl Dilcher (Dal) à l'adresse suivante : [notes-critiques@smc.math.ca](mailto:notes-critiques@smc.math.ca). Pour d'autres articles, écrivez directement aux Rédacteurs en chef Robert Dawson (SMU) et Srinivasa Swaminathan (Dal) à [notes-redacteurs@smc.math.ca](mailto:notes-redacteurs@smc.math.ca).

Pour continuer dans le même sujet, nous aimerions publier quelques mots au nom de notre publication sœur, *Crux Mathematicorum*. Comme vous le savez peut-être, *Crux* pris un peu de retard, il y a de ça quelques années, mais sous l'énergétique Kseniya Garaschuk (UBC), elle revient graduellement au temps présent. Ce qui veut bien sûr dire que dans la prochaine année elle devrait sortir plus de numéros qu'à son habitude. Ce qui veut aussi dire plus de problèmes et d'articles que d'habitude.


Si jamais vous rêvez d'un puzzle original en maths élémentaires, *Crux* serait l'hôte idéal pour celui-ci. Une fois votre compétition de maths locale terminée, n'importe quel problème nouveau qui aurait été inventé pour votre compétition pourrait être immortalisé entre ses couvertures mauves au lieu de disparaître dans l'obscurité. *Crux* publie des articles aussi – toujours courts et basés sur les fondamentaux mathématiques et normalement intégrés à des problèmes de difficulté variable. Bien que *Crux* soit lu par un large lectorat, ses écrivains devraient imaginer qu'ils rédigent pour les étudiants du secondaire les plus brillants – ceux que vous rêveriez

d'avoir dans votre classe dans une année ou deux. Pour plus d'information sur le processus de soumission d'articles, veuillez visiter <https://cms.math.ca/crux/>.

Bien sûr, veuillez-vous souvenez de l'existence du calendrier. Si vous avez un prochain événement que vous pensez être intéressant pour la communauté mathématique au-delà des frontières de votre campus, le calendrier des Notes est une excellente façon de le faire connaître. Veuillez envoyer un courriel au Rédactrice-gérante, Denise Charron, à [redacteur-gerant@smc.math.ca](mailto:redacteur-gerant@smc.math.ca).

Les Notes de la SMC est votre lettre d'information et nous aimerions beaucoup vous y écouter. Avez-vous un collègue que vous souhaiteriez nommer pour le profil des membres ou dont vous souhaiteriez honorer les accomplissements ? La communauté mathématique a-t-elle perdu un collègue estimé pour qui vous souhaiteriez partager un avis de décès ? Pour les soumissions générales, tels que les offres d'emploi, les publicités ou les annonces, veuillez écrire à l'Adjointe à la rédaction, Thérèse McCoy à [commmsp@smc.math.ca](mailto:commmsp@smc.math.ca).

Les rédacteurs des Notes de la SMC accueillent vos articles, lettres et Notes. Contactez-nous !



## 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](mailto:notes-letters@cms.math.ca)

## Lettres aux Rédacteurs

Les rédacteurs des NOTES acceptent les lettres en français ou en anglais portant sur n'importe quel sujet d'intérêt mathématique, mais ils se réservent le droit de les compresser. 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](mailto:notes-lettres@smc.math.ca).

## NOTES DE LA SMC

Les Notes de la SMC sont publiées par la Société mathématique du Canada (SMC) six fois par année (février, mars/avril, juin, septembre, octobre/novembre et décembre).

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Les rédacteurs des Notes de la SMC accueillent vos articles, lettres et Notes. Indiquer la section choisie pour votre article et le faire parvenir à l'adresse courriel appropriée ci-dessus.

Les Notes de la SMC, les rédacteurs et la SMC ne peuvent pas être tenus responsables des opinions exprimées par les auteurs.

## CMS NOTES

The CMS Notes is published by the Canadian Mathematical Society (CMS) six times a year (February, March/April, June, September, October/November and December).

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The editors welcome articles, letters and announcements. Indicate the section chosen for your article, and send it to CMS Notes at the appropriate email address indicated above.

No responsibility for the views expressed by authors is assumed by the CMS Notes, the editors or the CMS.

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La Société mathématique du Canada appuie l'avancement, la découverte, l'apprentissage et l'application des mathématiques. L'exécutif de la SMC encourage les questions, commentaires et suggestions des membres de la SMC et de la communauté.

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The CMS promotes the advancement, discovery, learning and application of mathematics. The CMS Executive welcomes queries, comments and suggestions from CMS members and the community.

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*Continued from cover*

neglected for far too long. I would like to take this opportunity to encourage you to participate in the campaign. Indeed, 70 years, the CMS has contributed to the mathematics community in many different ways: the society organizes two scientific meetings each year, publishes high-level scientific journals and monographs, organizes national competitions for school students (almost 6,000 students this year!), helps to organize summer camps across Canada, finances the Canadian team for the International Math Olympiads (where it placed 9th this year out of 104 countries!), in addition to representing Canadians at the International Mathematical Union (IMU). It is remarkable that all of this activity exists because of voluntary hours of contribution by a large number of engaged members of the society. The work of these members is wonderfully supported by the dedicated staff in our head office in Ottawa. To be able to carry on with this mission, we need to launch a fundraising campaign: Gerri Jensen, David Rodgers and Graham Wright will assist us in this endeavour.

Furthermore, with the departure of our executive director, Johan Rudnick, the CMS is re-assessing its future directions and re-adjusting its head office. There is great potential for the CMS to play a growing role in our professional lives. The society took a leadership position in the tex revolution in publishing and for many years our journals made surpluses that have been carefully invested and managed. To realize our potential, we need the continued involvement of you, our community, first of all by taking up or renewing your membership then through work on committees in areas of your own personal interest. Do not hesitate to contact the members of the board of directors about any issue that addresses the way forward for the CMS: We would be delighted to hear your opinions! A list of the current Executive and Board membership is found at <https://cms.math.ca/Docs/commlist.html>.

*Suite de la couverture*

la communauté mathématique de bien des façons : elle organise deux réunions scientifiques par année, elle publie des journaux scientifiques de haut niveau et des monographies, elle organise des compétitions nationales au niveau primaire et secondaire (presque 6000 étudiants cette année !), elle aide à l'organisation de camps d'été au travers du Canada, elle finance l'équipe canadienne pour les Olympiades mathématiques internationales (où elle a terminé 9<sup>ème</sup> cette année, sur 104 pays !) en plus de représenter les canadiens auprès de la IMU (union internationale des mathématiciens.) Tout ce travail est fait grâce à un grand nombre de volontaires de notre société, aidé par notre bureau exécutif hors-pair. Pour pouvoir continuer cette mission, nous devons lancer une levée de fond : Gerri Jensen, David Rodgers and Graham Wright vont nous aider dans cet effort.

Par ailleurs, avec le départ du directeur exécutif, Johan Rudnick, la SMC réévalue ses directions futures, et réajuste son bureau exécutif. La SMC a un grand potentiel de pouvoir continuer à jouer un rôle important dans notre vie professionnelle. La société était en chef de file lors de la révolution Tex dans le domaine de la publication et depuis plusieurs années, nos journaux nous rapportent des surplus que nous continuons à investir et à gérer. Pour réaliser notre potentiel, nous avons besoin de votre support continue, vous les membres de notre communauté, tout d'abord en devenant membre ou en renouvelant votre adhésion, et en contribuant dans les comités qui vous intéressent. N'hésitez pas à contacter les membres du comité de direction sur tout sujet qui touche les directions futures de la SMC : nous serons très heureux d'entendre vos opinions ! Une liste des membres du comité exécutif et du comité de direction se trouve sur le site : <https://cms.math.ca/Docs/comliste.html>.

## Thank You Johan!



**C**MS is bidding farewell to Johan Rudnick, who served as Executive Director of the Canadian Mathematical Society beginning in July 2009.

As he moves forward, Johan can take great pride in his many CMS accomplishments including, for example, the development of new CMS Bylaws and a revitalized CMS

Board structure, and the crafting of two successful international conference bids — namely the MCA 2017 and the ICMP 2018.

As a token of thanks and appreciation, Johan is being honoured with a lifetime CMS membership and is now a member of the CMS President's Advisory Council. CMS is grateful for Johan's contributions and wishes him all the best in his future endeavours. Anyone wishing to contact him can do so at: [jeaurud2015@gmail.com](mailto:jeaurud2015@gmail.com).

## Merci Johan !

**L**a SMC fait ses adieux à Johan Rudnick qui a servi en tant que directeur général de la Société mathématique du Canada, à partir de juillet 2009.

Alors qu'il vogue ailleurs, Johan peut être fier de ses nombreux accomplissements à la SMC incluant, par exemple, le développement des nouveaux statuts d'un nouveau règlement administratif de la SMC, une structure de conseil d'administration revitalisée et l'élaboration de deux offres réussies pour des conférences internationales — nommément le CMA 2017 et l'ICMP 2018.

Afin de lui démontrer notre gratitude et appréciation, Johan est nommé membre à vie de la SMC et fait désormais partie du conseil consultatif de la présidence de la SMC.

La SMC est reconnaissante des contributions de Johan et lui souhaite le meilleur dans ses entreprises futures. Vous pouvez communiquer avec Johan à l'adresse suivante : [jeaurud2015@gmail.com](mailto:jeaurud2015@gmail.com).

*The Calendar 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.*

**Denise Charron**, Canadian Mathematical Society,  
([managing-editor@cms.math.ca](mailto:managing-editor@cms.math.ca))

*Le calendrier 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.*

**Denise Charron**, Société mathématique du Canada  
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## FEBRUARY 2016 FÉVRIER

- Jan 31-Feb 5** CANSSI Mathematical and Statistical Challenges in Neuroimaging Data Analysis, BIRS, Banff, Alta.
- 3-5** FIELDS Semantic Representation of Mathematical Knowledge Workshop, Fields Institute, Toronto, Ont.
- 18** PIMS/UBC Distinguished Colloquium: Maria Chudnovsky, University of British Columbia, Vancouver, B.C.

## MARCH 2016 MARS

- 13-18** CANSSI Improving the Quantitative Interpretation of Simulation Models, BIRS, Banff, Alta.
- 18** PIMS/UBC Distinguished Colloquium: Jacob Lurie, University of British Columbia, Vancouver, B.C.
- 18-22** CRM Nirenberg Lectures in Geometric Analysis at the CRM: Gunther Uhlmann (University of Washington), Montreal, Que.

## MAY 2016 MAI

- 9-13** GIREF Workshop: Applications and New Frontiers for the Finite Element Method, Université Laval, Québec City, Que.
- 12-24** MBI Summer School on Mathematical Epidemiology, Mathematical Biosciences Institute, Columbus, Ohio
- 16-20** AARMS/FIELDS Workshop on Homotopy Type Theory, Fields Institute, Toronto, Ont.
- 16-20** FIELDS Conference on Qualitative aspects of the theory of nonlocal Equations, Fields Institute, Toronto, Ont.
- 16-20** CRM Workshop: New Challenges for the Calculus of Variations Stemming From Problems in the Materials Sciences and Image Processing, Montreal, Que.
- 29-31** CSHPM 2016 Annual Meeting, University of Calgary, Calgary, Alta.
- 30-Jun 1** CORS 2016 Annual Conference, Banff, Alta.
- 30-Jun 11** 2016 Séminaire de Mathématiques Supérieures: Dynamics of Biological Systems, University of Alberta, Edmonton, Alta.

## JUNE 2016 JUIN

- 2-4** FIELDS Workshop on Nonlinear Optimization Algorithms and Industrial Applications, Fields Institute, Toronto, Ont.
- 3-7** CMESG (Canadian Mathematics Education Study Group) Conference, Queen's University, Kingston, Ont.

- 6-10** FIELDS Conference on Recent Trends on Elliptic Nonlocal Equations, Fields Institute, Toronto, Ont.
- 13-16** FIELDS Conference on Geometry, Algebra, Number Theory, and their Information Technology Applications (GANITA), Fields Institute, Toronto, Ont.
- 13-17** PIMS Workshop on Nonlocal Variational Problems and PDEs, University of British Columbia, Vancouver, B.C.
- 19-22** FIELDS Workshop on Mathematics in the Time of Mathematics Open Online Communities (MOOCs), Fields Institute, Toronto, Ont.
- 20-30** CRM Workshop: Partial Order in Materials: Analysis, Simulations and Beyond, Montreal, Que.
- 24-27** 2016 CMS Summer Meeting / Réunion d'été de la SMC 2016, University of Alberta, Edmonton, Alta.
- 26-30** CAIMS 2016 Annual Meeting, University of Alberta, Edmonton, Alta.

## JULY 2016 JUILLET

- 3-9** CRM 12<sup>th</sup> International Conference on Symmetries and Integrability of Difference Equations (SIDE12), Hotel Le Chantecler, Sainte-Adèle, Que.
- 4-8** CRM Workshop: Complex Boundary and Interface Problems: Theoretical models, Applications and Mathematical Challenges, Montreal, Que.
- 4-8** Formal Power Series and Algebraic Combinatorics, Simon Fraser University, Vancouver, B.C.
- 4-14** CRM Summer School: Spectral Theory and Applications, Université Laval, Québec City, Que.
- 11-15** FIELDS World Congress of Probability and Statistics, Fields Institute, Toronto, Ont.
- 11-Aug 5** AARMS Summer School in Category Theory, Combinatorics and Number Theory, Dalhousie University, N.S.
- 18-22** CRM Workshop: Computational Optimal Transportation, Montreal, Que.
- 18-22** Conference on Geometry, Representation Theory and the Baum-Connes Conjecture, Fields Institute, Toronto, Ont.

*Continued on page 13 / Suite à la page 13*

*Book Reviews 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.*

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

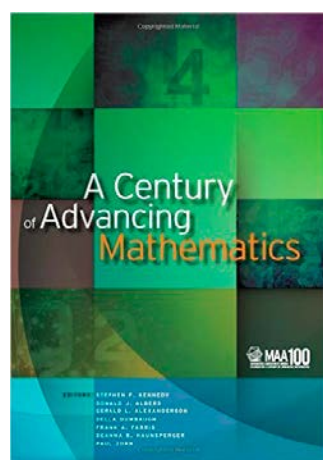
## A Century of Advancing Mathematics

Edited by Stephen F. Kennedy et al.

Mathematical Association of America, 2015

ISBN 978-0-88385-588-1

Reviewed by **Karl Dilcher**



This past year marked the 100<sup>th</sup> anniversary of one of our sister societies, the MAA, which was founded in 1915 with the main purpose of providing a stable home for the then fledgling and financially unstable *American Mathematical Monthly*. To celebrate this centennial, the MAA published the volume under review, following in the tradition of collections of articles of similar scope, by the AMS and also by

the CMS, for various landmark anniversaries. For instance, in 1988 the AMS published the three-volume collection “A Century of Mathematics in America”, the individual articles of which can be downloaded for free from the AMS website. Similarly, the CMS published a three-volume collection at the occasion of the 50<sup>th</sup> anniversary in 1995; these volumes are also still available. In this connection the massive millennial collection “Mathematics Unlimited – 2001 and Beyond” (Springer, 2001) should also be mentioned.

With all similarities to these volumes, “A Century of Advancing Mathematics” has a somewhat stronger focus on the educational aspects of mathematics, and on the culture surrounding mathematics, including short biographies. This is, of course, in keeping with the mandate of the MAA, and the main focus is on American Mathematics. The volume is perhaps best described by the following paragraph quoted from its Preface:

“[...] the MAA’s mission has always been much more than just producing great expository mathematics. That mission—to advance the mathematical sciences, especially at the collegiate level—has been reflected in the Association’s deep engagement with pedagogical practices and public policy issues, with the history and philosophy of mathematics, and with the connections between mathematics and the arts and other sciences. It seems only natural for this volume to sample from the entire broad cultural sweep

*Les comptes-rendus de livres présentent aux lecteurs de la SMC des ouvrages intéressants sur les mathématiques et l’enseignement des mathématiques dans un large éventail de domaines et sous-domaines. Vos commentaires, suggestions et propositions sont le bienvenue.*

**Karl Dilcher**, *Dalhousie University* (notes-critiques@smc.math.ca)

of mathematics throughout the century of the MAA’s existence. To organize this broad collection of material, the present volume is divided thematically into five sections.”

The five sections and the individual articles are as follows:

**I. Mathematical Developments:** *The Hyperbolic Revolution: From Topology to Geometry, and Back*, by Francis Bonahon; *A Century of Complex Dynamics*, by Daniel Alexander and Robert L. Devaney; *Map-Coloring Problems*, by Robin Wilson; *Six Milestones in Geometry*, by Frank Morgan; *Defying God: the Stanley-Wilf Conjecture, Stanley-Wilf Limits, and a Two-Generation Explosion of Combinatorics*, by Eric S. Egge; *What Is the Best Approach to Counting Primes?*, by Andrew Granville; *A Century of Elliptic Curves*, by Joseph H. Silverman.

**II. Historical Developments:** *The Mathematical Association of America: Its First 100 Years*, by David E. Zitarelli; *The Stratification of the American Mathematical Community: The Mathematical Association of America and the American Mathematical Society, 1915–1925*, by Karen Hunger Parshall; *Time and Place: Sustaining the American Mathematical Community*, by Della Dumbaugh; *Abstract (Modern) Algebra in America 1870–1950: A Brief Account*, by Israel Kleiner.

**III. Pedagogical Developments:** *The History of the Undergraduate Program in Mathematics in the United States*, by Alan Tucker; *Inquiry-Based Learning Through the Life of the MAA*, by Michael Starbird; *A Passport to Pleasure*, by Bob Kaplan and Ellen Kaplan; *Strength in Numbers: Broadening the View of the Mathematics Major*, by Rhonda Hughes; *A History of Undergraduate Research in Mathematics*, by Joseph A. Gallian; *The Calculus Reform Movement: A Personal Account*, by Paul Zorn; *Introducing  $e^x$* , by Gilbert Strang.

**IV. Computational Developments:** *Computational Experiences in the Pre-Electronic Days*, by Philip J. Davis; *A Century of Visualization: One Geometer’s View*, by Thomas F. Banchoff; *The Future of Mathematics: 1965 to 2065*, by Jonathan M. Borwein.

**V. Culture and Communities:** *Philosophy of Mathematics: What Has Happened Since Gödel’s Results?*, by Bonnie Gold; *Twelve Classics People who Love Mathematics Should Know; or, “What do you mean, you haven’t read E.T. Bell?”*, by Gerald L. Alexanderson; *The Dramatic Life of Mathematics: A Centennial History of the Intersection of Mathematics and Theater in a Prologue, Three Acts, and an Epilogue*, by Stephen D. Abbott; *2007: The Year of Euler*, by William Dunham; *The Putnam Competition: Origin, Lore, Structure*, by Leonard F. Klosinski; *Getting Involved with the MAA: A Path Less Traveled*, by Ezra “Bud” Brown; *Henry L. Alder*, by Donald J. Albers and Gerald L. Alexanderson; *Lida K. Barrett*, by Kenneth A. Ross; *Ralph P. Boas*, by Daniel Zelinsky; *Leonard Gillman—Reminiscences*, by Martha J. Siegel; *Paul Halmos: No Apologies*, by John Ewing; *Ivan Niven*, by Kenneth A. Ross; *George Pólya and the MAA*, by Gerald L. Alexanderson.



The volume is beautifully produced, with numerous photographs and illustrations; the figures in the second and third article are even in full colour. Members of the MAA can download the volume for free as a pdf with further colour photos and illustrations. But this is a volume you would like to have as a hardcover sitting on your bedside table or next to your armchair.

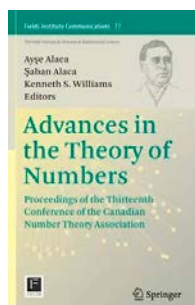
## Advances in the Theory of Numbers

### Proceedings of the Thirteenth Conference of the Canadian Number Theory Association

Edited by Ayşe Alaca, Şaban Alaca and Kenneth S. Williams

Fields Institute Communications, Springer-Verlag, 2015

ISBN 978-1-4939-3200-9



The Canadian Number Theory Association (CNTA) is an informal organization of Canadian number theorists, founded in 1987 through the initiative and efforts of the late Richard Mollin of the University of Calgary. Its sole purpose has always been the organization of regular conferences. Since then, the CNTA meetings have been among the leading number theory conferences internationally; as a regular conference sequence they are perhaps rivaled

only by the European “Journées Arithmétiques”. In fact, since 2002 the CNTA conferences and the “Journées” have taken place in alternating years.

The volume presented here contains the written and refereed versions of some of the talks given at the 13th CNTA conference, which was held at Carleton University from June 16 to 20, 2014. The preface of this volume contains a brief history of past conferences, and an overview of this CNTA-XIII. A complete list of lectures and a list of participants are also provided.

The ten papers in this volume are fairly representative of the wide variety of topics covered at the conference. The papers are:

Bruce C. Berndt and Sun Kim: *Identities for Logarithmic Means: A Survey*; Alain Connes and Caterina Consani: *Universal Thickening of the Field of Real Numbers*; Brian Conrey and Jonathan P. Keating: *Moments of Zeta and Correlations of Divisor-Sums: II*; Tristan Freiberg: *A Note on the Theorem of Maynard and Tao*; Yu-Ru Liu and Craig V. Spencer: *A Prime Analogue of Roth's Theorem in Function Fields*; Florian Luca and Emanuele Tron: *The Distribution of Self-Fibonacci Divisors*; M. Ram Murty and V. Kumar Murty: *Some Remarks on Automorphy and the Sato-Tate Conjecture*; David P. Roberts: *Division Polynomials with Galois Group  $SU_3(3).2 = G_2(2)$* ; Damaris Schindler: *A Variant of Weyl's Inequality for Systems of Forms and Applications*; Claus M. Sorensen: *The Breuil-Schneider Conjecture: A Survey*.

## Book Reviews in Crux Mathematicorum

**C** *Crux Mathematicorum* (<https://cms.math.ca/crux/>), another CMS publication, also has a Book Reviews column, featuring reviews that might interest readers of the CMS Notes as well. On campuses with institutional membership (as is the case with almost all Canadian universities) there will be free electronic access to *Crux Mathematicorum*. During the past two years, the following books were reviewed:

*The Universe in Zero Words: The Story of Mathematics as Told Through Equations*, by Dana Mackenzie. Princeton, 2012. (Vol. 39, #1).

*Jim Totten's Problem of the Week*, edited by John Grant McLoughlin, Joseph Khoury and Bruce Shawyer. World Scientific, 2013. (Vol. 39, #2).

*Calculus and Its Origins*, by David Perkins. MAA, 2012. (Vol. 39, #3).

*Learning Modern Algebra: From Early Attempts to Prove Fermat's Last Theorem*, by Al Cuoco and Joseph J. Rotman. MAA, 2013. (Vol. 39, #4).

*Beyond the Quadratic Formula*, by Ron Irving. MAA, 2013. (Vol. 39, #4).

*Excursions in Classical Analysis: Pathways to Advanced Problem Solving and Undergraduate Research*, by Hongwei Chen. MAA, 2010. (Vol. 39, #5).

*The Joy of  $x$ : A Guided Tour of Math, from One to Infinity*, by Steven Strogatz. Eamon Dolan/Houghton Mifflin Harcourt, 2013. (Vol. 39, #6).

*The Logician and the Engineer: How George Boole and Claude Shannon Created the Information Age*, by Paul J. Nahin. Princeton, 2012. (Vol. 39, #7).

*Towing Icebergs, Falling Dominoes and Other Adventures in Applied Mathematics*, by Robert B. Banks. Princeton, 2013. (Vol. 39, #8).

*Slicing Pizzas, Racing Turtles and Further Adventures in Applied Mathematics*, by Robert B. Banks. Princeton, 2012. (Vol. 39, #8).

*Enlightening Symbols: A Short History of Mathematical Notation and Its Hidden Powers*, by Joseph Mazur. Princeton University Press, 2014. (Vol. 39, #9).

*In Pursuit of the Unknown: 17 Equations That Changed the World*, by Ian Stewart. Basic Books, 2012. (Vol. 39, #10).

*Undiluted Hocus-Pocus: The Autobiography of Martin Gardner*, with foreword by Persi Diaconis and an afterword by James Randi. Princeton University Press, 2013. (Vol. 40, #1).

*Solving Mathematical Problems: a personal perspective*, by Terence Tao. Oxford University Press, 2006. (Vol. 40, #2).

*Will You Be Alive 10 Years from Now? And Numerous Other Curious Questions in Probability*, by Paul J. Nahin. Princeton University Press, 2014. (Vol. 40, #3).

*Borges and Mathematics*, by Guillermo Martinez. Purdue University Press, 2012. (Vol. 40, #4).

*Across the Board: the Mathematics of Chessboard Problems*, by John J. Watkins. Princeton University Press, 2004; reprinted 2012. (Vol. 40, #5).

*The Proof and the Pudding: What Mathematicians, Cooks, and You Have in Common*, by Jim Henle. Princeton University Press, 2015. (Vol. 40, #6).

*Single digits: in praise of small numbers*, by Marc Chamberland. Princeton University Press, 2015. (Vol. 40, #8).

*What if? Serious Scientific Answers to Absurd Hypothetical Questions*, by Randall Munroe. Houghton Mifflin Harcourt, 2014. (Vol. 40, #10).

*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.*

**Jennifer Hyndman**, University of Northern British Columbia  
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**John McLoughlin**, University of New Brunswick  
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*Notes pédagogiques présentent 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 les nouvelles d'intérêt. Vos commentaires, suggestions et propositions sont le bienvenue.*

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*Amélie Schinck-Mikel and Elsa Medina made a presentation about a collaborative initiative at an international conference in Sicily. The effort on the part of a university mathematics department to develop a program directed to underrepresented students from secondary schools is an example of an outreach effort worth sharing with the readership of Education Notes. We are grateful to the authors for taking up the invitation to prepare an article for the CMS audience. This is a real continental effort as Amélie is from Quebec, Elsa is from Mexico, and they are colleagues in California.*

## The Cal Poly Math Academy: A program to attract more underrepresented students to STEM fields

**Amélie Schinck-Mikel and Elsa Medina**, California Polytechnic State University,  
emedina@calpoly.edu & aschinck@calpoly.edu

The Cal Poly Math Academy is an outreach program running out of California Polytechnic State University (Cal Poly) in San Luis Obispo, California. Established in the summer of 2012, the Math Academy created a partnership between Cal Poly and local high school districts to offer underrepresented students, mainly Hispanic, an opportunity to participate in a one-week intensive problem-solving experience offered on the university campus. This is in contrast to the many remedial programs often targeting these same students. Since the majority of the summer camps or enrichment activities for high school students in the United States can be prohibitively costly, most of the parents of the targeted student

population cannot afford them. For this reason, the Cal Poly Math Academy is completely free of charge to participants through the use of grants. On average, the academy has been able to serve 35 students per summer, however it is the co-directors' hope to expand the number of students served as well as the geographical region.

It is well-documented that Hispanics are underrepresented in STEM fields in the United States. According to the most recent U.S. Census Bureau data from 2010, 16% of the U.S. population is Hispanic, but only 8% of degrees awarded in the STEM fields (2009-2010) were earned by Hispanic students. At the local level, no more than 45 minutes away from Cal Poly, is Santa Maria Joint Union High School District with about 82% Hispanic student population. However, only approximately 13% of Bachelor degrees awarded in the College of Science and Mathematics at Cal Poly were awarded to Hispanic students in 2013-14. The motivation for the Math Academy was to reach out to this population.

The goals of the Math Academy are for the students to:

1. solve non-traditional problems designed to increase their interest in mathematics, as well as their problem solving skills and mathematical confidence,
2. increase their interest in pursuing a career in STEM fields,
3. be better prepared mathematically for university,
4. learn about the requirements and paths towards university entrance, and
5. have fun with mathematics during summer!

The Math Academy has established a strong partnership with the Migrant Education Program (MEP) from the California central coast area and primarily serves their students. The MEP is a federally funded program administered in all 50 states as well as the District of Columbia and Puerto Rico with the main purpose of providing educational opportunities for children of immigrant families.







This program helps ensure that migratory children receive appropriate opportunities to meet the same challenging academic and achievement standards that all children are expected to meet. In addition, it helps these students overcome educational disruption due to cultural and language barriers and other factors to make a successful transition to postsecondary education or employment. The MEP supports student participation in the Math Academy by recruiting these students and providing daily transportation to and from the Cal Poly campus. The partnership between the Math Academy and MEP was natural since both programs aim to serve the same student demographic.

Each day of the academy, students arrive on campus at 8:30 am and, after eating breakfast, work on mathematics problems for the rest of the morning. Four Cal Poly students who are studying to be high school mathematics teachers assist in leading the problem solving sessions. Students are given lunch cards that allow them to purchase meals on campus. This is a time for students who may not have ever set foot on a university campus to experience the campus as a university student does. After lunch, we often explore another mathematics problem and then have an activity or guest speaker that would be likely to increase students' interest in pursuing a career in STEM fields or learn about the paths to university entrance. Past speakers and activities have included a tour of the dairy science building during which students made and ate ice cream, a guided tour of campus, an exciting talk by a police officer

about forensic science, a coding activity led by an entrepreneur in the field of computer science, an inspiring talk by members of the Cal Poly Society of Hispanic Professional Engineers, and more!

Because the Cal Poly Math Academy welcomes students from diverse mathematical backgrounds, the problems posed are rich and have many access points. We made sure that the tasks had a) multiple access points to accommodate students working at a wide range of levels, b) different methods of solving, c) hands-on components, d) a collaboration and communication component, and e) the ability to deepen problem solving skills as well as content knowledge. As an example, students were asked to create two different rectangular prisms - one by folding an 8.5 x 11 inches paper lengthwise, and another by folding the paper widthwise. Students were then prompted to make conjectures about which prism will have the greatest volume. Students then tested those conjectures by filling those prisms with popcorn. Finally, students used the formula for the volume of the prism to calculate and compare both volumes. Students were asked to further their thinking and explain why the prisms do not hold the same volume. Several students had predicted that the volumes would be the same since the prisms were created from the same size pages; this led to a very productive conversation about the difference between volume and surface area.

These types of problems allowed for all students to experience success in problem solving by making their own conjectures, and

## Call for Nominations: Student Committee Roles

The CMS Student Committee is looking for proactive mathematics students interested in joining the Committee in the roles of chair, regional representatives for Quebec and Ontario, and English-to-French translator. Francophone applicants are preferred for the positions of translator and regional representative for Quebec. If you are interested, or know someone who may be, please visit our website <https://studc.math.ca> for more information and an application form. If you have any questions, please contact us at [chair-studc@cms.math.ca](mailto:chair-studc@cms.math.ca).

## Appel à candidature: postes pour le comité étudiant de la SMC

Le comité étudiant de la SMC est à la recherche d'étudiants en mathématiques dynamiques qui seraient intéressés à joindre le comité étudiant pour combler les postes du président, représentants régionaux pour le Québec et pour l'Ontario, et du traducteur anglais-français. Les applicants francophones seront préférés pour les postes du traducteur et du représentatif régional pour le Québec. Si vous êtes intéressé ou connaissez quelqu'un qui pourrait l'être, veuillez consulter notre site web <https://studc.math.ca> pour plus d'informations et pour télécharger le formulaire d'application. Pour toute question, veuillez nous écrire à [pres-studc@smc.math.ca](mailto:pres-studc@smc.math.ca).



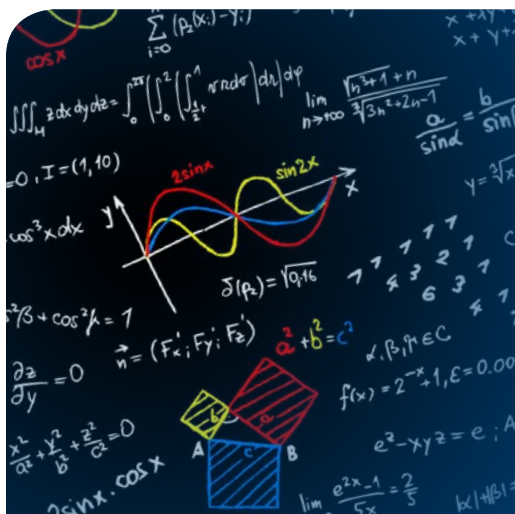
being persistent, all the while sharpening critical thinking skills. By design, the program was structured to give students ownership of the problem solving process by presenting them with authentic problems without a specific method to apply. Students felt free and flexible in their ways of thinking, thus, gaining ownership of the mathematical experience. In particular, all students are invited to present their creative ways of thinking which required them to construct viable arguments to be critiqued by their peers. Students from underrepresented communities may feel that their voices are not heard in a typical mathematics classroom, whether due to language or cultural barriers. During this program, students' contributions were highly valued and they felt very proud of their involvement in the mathematical discourse. This allowed them to gain confidence in their mathematical abilities. For many of these students, this may be the first step towards imagining themselves in careers in STEM fields.

For the first three years of the Math Academy, the assessment focused on getting feedback from participating students in order to improve the academy experience for the next year. The focus was to determine if the mathematics problems used were fun and challenging, and if the speakers and college readiness activities

offered were appropriate and useful to the students. In order to ascertain these facts, we administered surveys at the end of each academy with questions such as: *What was your favorite mathematics problem of the academy?*, *What was the worst part of the academy?* and *What was the best part of the academy? Explain.* This feedback has allowed for focused and continued improvement each year. The following are examples of students' feedback:

- "The best part of this academy was having fun while learning more about math. Meeting people and teachers was also overwhelming. This academy wasn't what I expected, it was more. I loved it and never will forget it".
- "The best part [...] was when the two professors came and talk to us about their experiences. That really motivated me even more to become the nurse or doctor I want to be."
- "The guest speakers [were my favorite] because I learned that you can have the biggest problems and can overcome them."
- "I got inspired from what the teacher from Santa Maria said. That also motivated me to show my parents that I can accomplish what I set my mind to. I enjoyed listening to the speakers and what they had to say."
- "Being able to come up with our own idea and sharing it with everyone else."
- "It made my summer great."

In the fourth year of the academy, other types of data were collected such as students' autobiographies plus questionnaires to evaluate changing attitudes towards college accessibility and beliefs about mathematics and interests in STEM fields. This data is currently being compiled and analyzed. In the future, we plan to use more robust assessment tools to continue improving the academy as we expand to reach out to more students. If you would like to learn more about the Cal Poly Math Academy, feel free to contact the directors Elsa Medina and Amélie Schinck-Mikel at [emedina@calpoly.edu](mailto:emedina@calpoly.edu) and [aschinck@calpoly.edu](mailto:aschinck@calpoly.edu).



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## Der Dreierstoß

**Florin Diacu**, *Department of Mathematics and Statistics, University of Victoria*

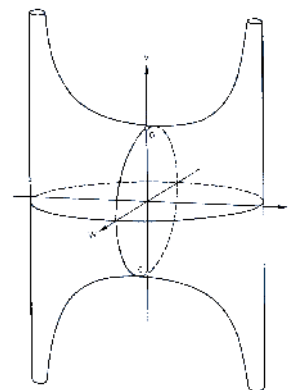
Meaning “the triple collision” in German, the above title describes an intriguing phenomenon. If a billiard ball hits another that is tangent to a third, the motion of the balls is unpredictable. Similarly in tennis, the half-volley (a strike made right after the ball bounces off the ground) is both hard to hit and often imprecise even for top players. The reason for this pain is that the ball, the ground, and the head of the racket come close to a triple collision. These examples suggest the study of motions at and near triple collisions in 3-body problems given by various attraction laws. But how to approach such dynamical systems and what methods to apply?

In the late 1930s, Carl Ludwig Siegel thought of studying the Newtonian 3-body problem from this new angle. His research led to an article entitled *Der Dreierstoß*, published in 1941 in the *Annals of Mathematics*, [3]. Though mostly known for his deep contributions to number theory, Siegel also put his mark in other directions of research. His now classic *Lectures in Celestial Mechanics*, co-authored with his former student Jürgen Moser and published in 1971, is a gem that stemmed from his 1941 paper, [4]. One of the questions the book tries to answer is how the bodies move towards a triple collision.

The problem wasn't new, but nobody before Siegel understood its importance. A few years after the dawn of the 20<sup>th</sup> century, Karl Sundman, a Finn astronomer of Swedish origin, had answered a question for which Poincaré had been awarded an important prize some three decades earlier in spite of not fully answering it. Sundman concluded that an orbit reaching a triple collision could not be extended as an analytic function beyond the singularity this collision induces into the equations of motion because certain denominators vanish, [5]. But Poincaré and Sundman dismissed the singularities as not generic. They wanted to understand whether we could express the general solution of the Newtonian 3-body problem as a convergent power series for all time. The singularities just stayed in the way, the more so the ones induced by triple collisions.

Siegel focused on this bothersome detail. His main result showed that not only do the bodies tend to the triple collision with zero total angular momentum (i.e. such that the system does not rotate), a result already known to Weierstraß, but that the bodies do so by approaching one of two possible configurations: a rectilinear or an equilateral one. This was a beautiful connection between collision orbits and relative equilibria, i.e. rotating solutions that maintain constant mutual distances during the motion. In the 18<sup>th</sup> century Euler and Lagrange had shown that the relative equilibria of the 3-body problem can be either collinear (Eulerian) or equilateral (Lagrangian) orbits. In the former case the bodies are on a straight line, whereas in the latter case they lie at the vertices of an equilateral triangle, each configuration rotating uniformly

around its centre of mass. An open problem (number 6 on Stephen Smale's list of question left for the 21<sup>st</sup> century) is whether, given  $n$  positive masses, the number of relative equilibria is finite or not. We only know that this number is finite for  $n = 2, 3, 4$ , and 5. For  $n \geq 6$  the question is open.



**Figure 1.** McGehee's triple collision manifold

But the real breakthrough in understanding triple collisions came in 1974 through the work of Dick McGehee, [2]. He considered the motion of 3 bodies along a straight line and had the idea to blow up the singularity that occurs because of a triple collision. But near a triple collision, binary collisions may take place too, so he managed to regularize these singularities, i.e. to analytically extend the motion through them. His blow up technique allowed him to look at nearby motions as if under a microscope. Specifically, he defined the triple-collision manifold as a fictitious surface that borders the singularity. This surface, which turned out to look like two joined infinite pants (see Figure 1), does not belong to the original phase space, but can be pasted to it. Thus, studying the behaviour of the flow on this fictitious manifold, McGehee could get information about what happens near the triple collision, in the original phase space. This is possible thanks to a fundamental property of differential equations: the continuity of the solutions with respect to initial data.

So although analytically extending the motion through the triple collision is impossible, as Sundman had shown, McGehee could see clearly what happens very close to the triple collision. In particular he discovered that two of the bodies form a binary and shoot the third body at high speed away from it, i.e. some kind of slingshot effect. You can check this property in practice: place a tennis ball above a basketball and let them drop simultaneously from the height of your extended arms. For the best effect, and to avoid breaking fragile objects in the house, try this experiment outdoors. When the basketball hits the ground, the tennis ball is likely to be slightly above it, so you will encounter an almost triple collision between the two balls and the Earth. The basketball-Earth binary will make the tennis ball bounce up much higher than it would do if you let the tennis ball drop alone.

McGehee's result led to a research boom. Hundreds of papers that exploited this phenomenon were published in the next 30 years.

*Continued on page 13*



## Industrial Mathematics: A Case Study

Huaxiong Huang, *Department of Mathematics and Statistics, York University*

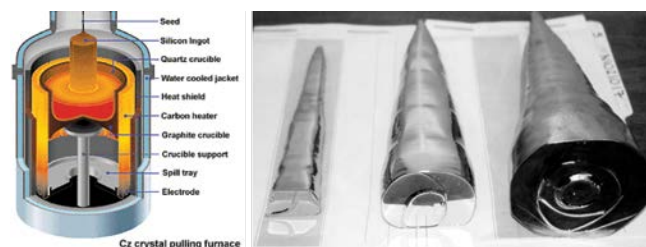
One of the major Canadian industrial mathematics initiatives in the past twenty years is the establishment and success of MITACS, due in a large part to the excellent leadership of its former scientific director Arvind Gupta. The focus of this note is, however, on the *Study Groups with Industry* (SGs), known as the *Industrial Problem Solving Workshops* (IPSWs) in Canada. They were initiated by PIMS in 1997 and are currently held at CRM and Fields. This is a week-long brainstorming workshop originated at the Oxford University in 1968.

The value of SGs (IPSWs) is that they often serve as the first step of successful collaborations between academic and industrial partners. Industry is used to the idea of collaborating with engineers but not with mathematicians. When a technical problem arises in the operation of a company, asking mathematicians for help rarely happens. Worse, when asked whether they have any problems where they need help, they automatically search for *mathematical problems*. However, after they spend time with mathematical scientists at an IPSW, their view of mathematics and its power change. They become strong advocates and longer-term relations often develop. Thus, the IPSWs not only provide the opportunity for the academic to develop new mathematics models for solving industrial problems, but also for industry to change their attitude towards mathematics.

At the 2001 PIMS IPSW held at the University of Washington, Bill Micklethwaite from Firebird Semiconductors, presented a problem. Firebird was a market leader for manufacturing InSb (Indium antimonide), a special compound crystal. It had been trying to increase production yield by growing larger crystals. The technicians at Firebird could easily grow larger crystals. The problem they were facing was these larger crystals do not increase production yield as they are full of defects. The question posed by Bill is: whether it is possible to understand the origin of these grow-in defects by using mathematical models.

After the IPSW, a group of participants (C.S. Bohun, I. Frigaard, T. Myers and myself) followed up by forming a MITACS seed project. Our first finding is that thermal stress (responsible for defect generation) can be reduced by controlling the shape of the crystals. The full problem of pulling a crystal from its melt, as illustrated by Fig. [1] (left panel), is a complex one. It is fully nonlinear due to the existence of free boundaries and phase change. In fact, there was an extensive engineering literature on the same topic [1, 2]. But the existing literature mostly focused on silicon that is much easier to grow. Blindly following the same procedure does not work for InSb due to the crystal's low resistance to stress. For example, the Firebird crystals are not only much smaller than the silicon ones, they also appeared in conic shapes as shown in Fig. 1 (right panel).

This is not desirable as the yield from cylindrical crystals is much higher than the conic ones.



**Figure 1.** Schematics of furnace (left) and InSb ingots (right) grown by Firebird Semiconductors, courtesy of Bill Micklethwaite.

By taking advantage of the specific nature of the growth process (after several onsite visits and numerous discussions), we were able to derive a semi-analytical model for the temperature fields [3]. We showed that thermal stress is proportional to  $|R_z \Theta_z - \Theta|/R$  which consists two components and stress can be reduced by playing with the shape factor  $R_z$ . Here  $R(z)$  is the crystal radius and the subscript  $z$  denote differentiation with respect to the axial coordinate  $z$ . The zeroth-order temperature  $\Theta$  satisfies a very simple equation  $R\Theta_{zz} + 2(R_z\Theta_z - \Theta) = 0$  with  $\Theta_z|_{z=0} = \delta\Theta$  and  $\Theta = 1$  at  $z = S(t)$ , the solidification front. Axis-symmetry was assumed for the first model for convenience and the geometric effect was explored at a later study [5, 7].

Using this simple model, it is easy to see that the stress for a cylindrical crystal is proportional to  $\Theta$ , which reaches its maximum value 1 at the solidification front. For a cone shaped crystal, on the other hand, the thermal stress can be reduced when  $R_z\Theta_z$  is positive or increased when  $R_z\Theta_z$  is negative. Since  $\Theta_z$  is always positive (temperature in the crystal is higher towards the solidification front (positive  $z$  direction), an expanding cone with positive  $R_z$  is more desirable. In dimensional form, thermal stress is also proportional to the radius, which explains why defects start to appear when the size increases.

Our simple model explains why the technicians at Firebird can grow low-defect InSb only in the conic shapes. Our approach was different from most of the engineering literature where full three dimensional models were developed and solved using powerful computers. In our case, we derived our model using asymptotic analysis, which provided more useful insights, thanks to the analytical formula we have obtained. Even though the general techniques were developed previously, it was the first time that the true power of mathematical analysis was demonstrated for a complex *industrial scale* crystal growth procedure, without the aid of a high-performance computer. For more details of the modelling work, readers are referred to the papers [3, 4, 5, 6, 7]. In [7], we proposed a new geometric model for the facet formation, which is another feature of InSb crystals not present in silicon crystals.

It is worthwhile to point out that the source of problems coming from industry in recent years has shifted from the traditional manufacturing to other sectors, most notably the finance industry

and the biomedical community. In addition, the type of problems and the mathematics used to solve these problems have also evolved. There are many examples that new mathematics does arise from problems out of SGs. The *pantography equation* was a new equation derived from a model for the high speed electric train presented to one of the first SGs at Oxford by British Rail [8]. There is a large online depository of the problems from SGs at a mathematics-in-industry website: <http://www.maths-in-industry.org>.

Everyone knows what mathematics is about. Industrial mathematics, on the other hand, is a completely different story. The kind of mathematics associated with industry is often dismissed as *trivial* or a *simple application*. In this research note, I want to make a case that the main difference between mathematics and industrial mathematics is that the latter is motivated by real applications. *It is not a different type of mathematics.*

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*Der Dreierstoß, continued from page 11*

Painlevé's conjecture, stated in 1896, which claimed the existence of non-collision singularities for the Newtonian  $n$ -body problem with  $n \geq 4$ , could be solved almost a century later using this technique. Other research fields, such as the semiclassical theory that studies the dynamics of atoms and molecules as well as the field of neural networks, benefitted from these ideas to make progress in significant directions. The highly successful body of work related to the triple collision is likely to grow in the years to come. The readers interested to go deeper and learn more about these developments can find a detailed account in [1].

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*Calendar continued from page 5 / Calendrier suite de la page 5*

## JULY 2016 JUILLET

- 18-22** EMS 7th European Congress of Mathematics, Technische Universität Berlin, Berlin, Germany
- 24-31** International Commission on Mathematical Instruction (ICME-13), U of Hamburg, Hamburg, Germany
- 25-28** New Trends in Approximation Theory: A Conference in Memory of André Boivin, Fields Institute, Toronto, Ont.
- 27-Aug 5** PIMS Summer School and Workshop on Geometric and Topological Aspects of the Representation Theory of Finite Groups, University of British Columbia, Vancouver, B.C.

## AUGUST 2016 AOÛT

- 3-6** MAA MathFest 2016, Columbus, Ohio
- 15-19** FIELDS 2016 Industrial Problem Solving Workshop, Fields Institute, Toronto, Ont.
- 15-26** Two Weeks in Vancouver - A Summer School for Women in Math, University of British Columbia, Vancouver, B.C.
- 21-26** 24th International Congress of Theoretical and Applied Mechanics (ICTAM 2016), Palais des congrès, Montreal, Que.
- 22-26** FIELDS/CRM Conference on Methods of Modern Mathematical Physics, Fields Institute, Toronto, Ont.
- 28-Sep 1** CRM/FIELDS Frontiers in Mathematical Physics, CRM, Montreal, Que.



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*CSHPM Notes brings scholarly work on the history and philosophy of mathematics to the broader mathematics community. Authors are members of the Canadian Society for History and Philosophy of Mathematics (CSHPM). Comments and suggestions are welcome; they may be directed to either of the column's co-editors.*

**Amy Ackerberg-Hastings**, *University of Maryland University College* (aackerbe@verizon.net)

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

## A New Look at General-Education Mathematics Courses

**Amy Shell-Gellasch**, *Montgomery College*,  
**J.B. Thoo**, *Yuba College*

Until recently, the vast majority of undergraduate students had to take college algebra, even if they were never going to take another mathematics course. To us, that is like requiring all students to take at least one semester of a foreign language (which is not a bad idea in itself), but making that first course be only on conjugating verbs. Luckily, many post-secondary institutions have moved past this limited approach to the one-mathematics-course minimum requirement. These institutions now offer one or more quantitative-literacy or general-education mathematics courses from a long list that has been developed in the last decade or two. We suggest another alternative: an introductory course that uses history as the vehicle for exploring topics in elementary mathematics.

General-education mathematics courses usually have high school algebra as their prerequisite. They are general in nature, focusing on a few topics that could be useful in students' further college programs or their day-to-day lives. The most common general-education mathematics course is often referred to as "survey of college mathematics" or "discrete mathematics", and it includes topics such as matrices and linear programming. Other general-education courses present mathematics that could be useful beyond college, including topics such as introductory statistics and probability. A third type of course offers non-standard but appealing topics: graph theory, the mathematics of sports, and game theory. All of these courses have the common goal of increasing the students' proficiency in mathematical reasoning while avoiding losing them in the details of mathematics they will most likely never use again.

Since the audience for all of these courses consists of students who are not entering the STEM fields (Science, Technology, Engineering and Mathematics), and who are often math-phobic, the idea of giving them at least one engaging (and maybe even "fun") experience in mathematics before they sail away from the subject forever is laudable. We often see students who steered away from mathematics for as long as possible leave these courses grudgingly admitting that they did see some interesting things and that maybe mathematics is not so bad after all. But we also see many students who still struggle in these courses because their mathematical preparation is so limited or their aversion to the subject is so severe that they cannot see the

*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 membres de la Société canadienne d'histoire et de philosophie des mathématiques (SCHPM). Vos commentaires et suggestions sont le bienvenue; ils peuvent être adressées à l'une des co-rédacteurs.*

**Amy Ackerberg-Hastings**, *University of Maryland University College* (aackerbe@verizon.net)

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

important trees through the dark forest that is "MATH 100." So, there is still work to be done.

The alternative we offer is a 100-level mathematics course that specifically leverages these students' often much stronger backgrounds and interests in language arts and the humanities. The course covers much of the mathematics to which they may have been exposed in high school, but it does so from an historical perspective. It is not a low-level history-of-mathematics course. Rather, it presents elementary mathematics and intermediate algebra as they were practiced historically. Like a special topic or theme in other general-education courses, history is the vehicle that moves the mathematics forward. Because much of the material is at a level applicable to many K-12 classrooms, this course is also appropriate for pre-service and in-service teachers.

Students benefit in several ways from encountering mathematics that they likely have seen before through a perspective that is new to them. First and foremost, the framework allows them to revisit the material outside of a remedial setting. Second, looking at the original context in which the mathematics was developed is often a much more holistic and intuitive approach than the polished and formulaic presentation of modern texts. An example of such mathematics is the method of false position and double false position. In this problem-solving technique from the late Middle Ages, a "guess" is used that works easily with the problem, and then proportional reasoning is used to scale the guess up or down to arrive at the correct answer. We have found over the years that students who are not comfortable with algebra often intuitively use *ad hoc* methods that are very similar to this. If students are shown this holistic approach first, they can transition to the algebraic reasoning, and then more readily extend their understanding to the algebraic solution found in modern texts. The students not only are then able to solve the problem algebraically, they also have a much stronger sense of how one solves problems in general, as well as an affirmation that their intuitive approach is valid. In addition to the historical methods mentioned above, hands-on projects can be used in class, such as making or using an abacus while discussing the different types of abaci, or making and using Napier's Bones to showcase the lattice method of multiplication. Bringing such objects or models into the classroom adds to the historical as well as the mathematical experience for the students.

As we mentioned earlier, an historical approach also leverages students' humanities and writing skills. This is possible through the use of assignments that fit naturally into these non-STEM courses: discussions, readings, papers, presentations, projects, videos,



performances, essay exams, and so on. Of course, mathematical homework and exam problems would still be assigned, but they can comprise a much smaller part of the course.

An historical approach can fulfill mathematical or quantitative-literacy requirements while letting the students engage the bulk of the material in a manner with which they are more comfortable. We have seen students leave the course excited that they actually learned mathematics. They also leave realizing that they do understand “basic” mathematics, and possibly know something about the subject that its “majors” might not.

Topics in a mathematics course in which history is the main thread can include number systems and number bases, leading up to the decimal place value system; mathematical notation; methods from various times and cultures for arithmetic calculations (for instance, Greek, Babylonian, Chinese, European); solutions of polynomial equations up to the cubic; exponentiation and logarithms; Greek number theory; and set theory, to name a few possibilities. Including a fair amount of traditional history and discussion also showcases the interplay of tradition, religion, and societal beliefs that shape and often guide mathematical and scientific advances. This allows students to see the wider context of the mathematics and the cultural influences involved, which is now a requirement of many college curricula.

A general-education course whose vehicle is the historical development of mathematics gives non-mathematical students a solid understanding of the subject’s role, development, and uses in society, in a form that is intrinsically interesting to them. A new general-education mathematics text, *Algebra in Context: Introductory Algebra from Origins to Applications*, published by the Johns Hopkins University Press in 2015, covers the mathematics with the historical and contextual focus described above. A website for *Algebra in Context*, with further ideas for how to develop such a course, can be found at [jhupbooks.press.jhu.edu/additional-resources-algebra-context](http://jhupbooks.press.jhu.edu/additional-resources-algebra-context).

*Amy Shell-Gellasch is an Associate Professor of Mathematics at Montgomery College in Rockville, Maryland. She also does research on historical mathematical devices at the Smithsonian National Museum of American History. She is co-founder and chair of the History of Mathematics Special Interest Group of the Mathematical Association of America.*

*John Thoo is a Professor of Mathematics at Yuba College in Marysville, California, where he has been since 1995. John’s interest in the history of mathematics has grown over the last decade. In fact, he knows just enough to be dangerous to himself. Now John encourages everyone to explore the history of mathematics.*

## CMS Member Profile / Profil membre de la SMC

### Patrick Ingram

**HOME/ACCUEIL:** Toronto, at the moment. I’m currently taking a year off (“off”) from academia to be a stay-at-home Dad, and to support my wife’s career.

**CMS MEMBER SINCE/SMC MEMBRE DEPUIS:** I’ve been a lifetime member for the last seven years. I had a spotty membership record before then.

**RESEARCH/RECHERCHE:** Number theory, with applications to holomorphic dynamics.

**MEMORABLE MATH MOMENT/MOMENTS MÉMORABLES EN MATHÉMATIQUES:** I took Introduction to Analysis (with Brian Thomson) in my first year of university and loved it so much that I decided to major in math. When I teach linear algebra, I can relate to my students being a little less enthusiastic at times, but when I teach analysis I’m always a little surprised that not everyone finds it as amazing as I did.

**HOBBIES/LOISIRS:** In my current role as a full-time Dad, my most consuming hobby is mathematics.

**WHAT I’M CURRENTLY READING/DERNIER LIVRE LU:** “Potential Theory and Dynamics on the Berkovich Projective Line,” by Matt Baker and Robert Rumely, and “Kitchen Confidential” by Anthony Bourdain. I’ll let you guess which one works better for dinner party conversation.

**MY LATEST PUBLICATIONS/DERNIÈRE PUBLICATION:** “Rigidity and height bounds for certain post-critically finite endomorphisms of  $P^N$ ,” in the Canadian Journal of Mathematics

**WHAT I WOULD CHANGE (ABOUT THE CMS)/CE QUE JE VOUDRAIS CHANGER (À PROPOS DE LA SMC):** The CMS needs to find new ways to raise public awareness and opinion of mathematics. The tone of public discourse on scientific research these days leans heavily towards commercial applications, and organizations like the CMS need to make a strong public case for basic research.

**CMS ROLES/RÔLES DE LA SMC:** Board of Directors (2013-2015), now the Publications Committee member and Research Editor for the CMS Notes.



**WHY I BELONG TO THE CMS/POURQUOI JE APPARTIENS À LA SMC:** It’s essential that mathematics be represented at a national level in Canada, by an organization legitimized by the participation of a broad section of the mathematical community. The semi-annual meetings are also a great chance to meet Canadian mathematicians outside of my immediate research circle, and get an introduction to their work.



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## Call for Submissions to Crux Mathematicorum



We invite you to submit articles and problems to *Crux Mathematicorum*.

*Crux Mathematicorum* is an internationally respected source of unique and challenging mathematical problems published by the CMS. Designed primarily for the secondary and undergraduate levels, and also

containing some pre-secondary material, it has been referred to as « the best problem solving journal in the world ».

Articles should be carefully written, reasonably short (4-5 pages) and expository in nature. A Crux article can focus on a particular problem or a problem solving technique; it can also provide a problem solving introduction into research mathematics at the appropriate level. Articles usually have embedded problems of varying degrees of difficulty to provide the reader with a full hands-on experience. Crux articles should be sent to Robert Dawson, Department of Mathematics and Computing Science, Saint Mary's University, Halifax, NS, Canada, B3H 3C3, or emailed to [crux-articles@cms.math.ca](mailto:crux-articles@cms.math.ca).

We also invite you to submit problem proposals. Each problem proposal should be accompanied by a solution or at least some references or insights to indicate that the problem is appropriate for the audience. The problems can come from local contests organized by your institution (in which case they should be cited); original problems are especially solicited. Problem proposals should be sent to Canadian Mathematical Society, 209 - 1725 St. Laurent Blvd, Ottawa, ON, K1G 3V4, Canada, or emailed to [crux-psol@cms.math.ca](mailto:crux-psol@cms.math.ca).

The Editor-in-Chief also welcomes other original contributions, such as puzzles, mathematical games, art and humour as well as comments and suggestions, which should be sent to Kseniya Garaschuk at [crux-editors@cms.math.ca](mailto:crux-editors@cms.math.ca).

Submissions are welcome in English and in French.



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**Therese McCoy**, *Communications and Special Projects Officer - Canadian Mathematical Society* ([commsp@cms.math.ca](mailto:commsp@cms.math.ca))

This year, the CMS welcomed over 600 mathematicians in Montreal for the 2015 Winter Meeting from December 4<sup>th</sup> through the 7<sup>th</sup>. Attendees participated in twenty eight scientific sessions, and ten lectures during the four day meeting.

Hundreds of attendees were eager to learn the question as asked by John Baez (U.C. Riverside) to which we already know the "Answer to the Ultimate Question of Life, the Universe and Everything".

Just as Isabelle Gallagher (University of Paris-Diderot) asked the important question as to whether or not mathematics could be used to predict time.

This year's Winter Meeting introduced a few firsts as well. Attendees were invited to pre-register or peruse job postings on site at the first career fair hosted by CRM. Attendees who had need, were supported with onsite Child Care for children through to youth; and this year, attendees were rewarded for staying in touch with the first Twitter Engagement Contest – where attendees won CMS gifts and gear, including the Grand Prize winner Dr. Jenna Carpenter winning a complimentary year of CMS Membership!

The CMS Awards Banquet recognized individuals with exceptional performance in the area of mathematical research and education. The event included the CRM-Fields-PIMS Prize announcement of Daniel Wise (McGill University) and a special recognition award presented to the Mathematical Association of America (MAA.org) who is celebrating a century of advancing mathematics.

**Thérèse McCoy**, *Communications et projets spéciaux - Société mathématique du Canada* ([commsp@smc.math.ca](mailto:commsp@smc.math.ca))

Cette année, la SMC a accueilli plus de 600 mathématiciens à Montréal pour la Réunion d'hiver 2015, du 4 au 7 décembre. Les participants ont pu suivre vingt-huit conférences scientifiques, et dix conférences durant les quatre jours de la réunion.

Des centaines de participants avaient hâte de connaître la question posée par John Baez (U.C. Riverside) à laquelle nous connaissons déjà la « Réponse à la grande question sur la vie, l'univers et le reste ».

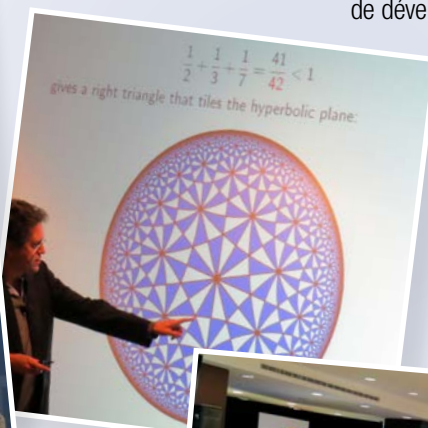
Alors qu'Isabelle Gallagher (Université de Paris-Diderot) posait l'importante question à savoir si les mathématiques pouvaient ou non être utilisées afin de prédire le temps.

La Réunion d'hiver de cette année a aussi introduit des nouveautés. Les participants étaient invités à s'enregistrer à l'avance ou lire attentivement les offres d'emploi sur le site du premier salon de l'emploi organisé par le CRM. Les participants qui le nécessitaient étaient soutenus par un service de garde d'enfants pour tous âges ; et cette année, les participants étaient récompensés de leur sens de la communication à travers le premier concours d'engagement Twitter – où les participants ont gagné des cadeaux et équipements de la SMC, incluant la gagnante du grand prix, Dr. Jenna Carpenter, qui a gagné une adhésion d'un an gratuite de la SMC!

Le banquet des prix de la SMC reconnaissait des personnes aux performances exceptionnelles en recherche et enseignement en mathématique. L'événement incluait l'annonce du prix CRM-Fields-PIMS présenté à Daniel Wise (Université McGill) et un prix de reconnaissance exceptionnel présenté à l'Association Mathématique d'Amérique (MAA.org) qui célébrait un centenaire de développement en mathématiques.



CMS Members won prizes totaling over \$350 during the #CMSWinter Twitter Engagement Contest / Les membres de la SMC ont gagné des prix totalisant plus de 350\$ durant le concours d'engagement Twitter #hiverSMC



John Baez presenting a public lecture with standing room only / John Baez présentant une conférence publique à une salle comble



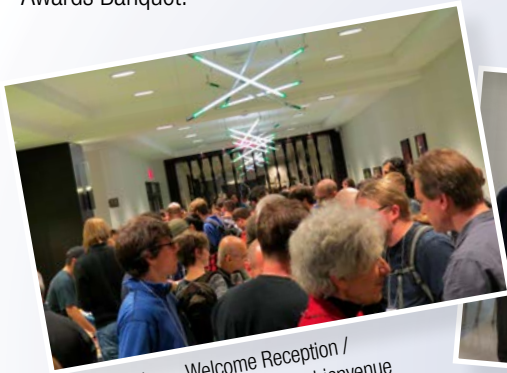
Isabelle Gallagher presenting to a full house / Isabelle Gallagher présentant à une salle comble



Dr. Jenna Carpenter accepting the award on behalf of the Mathematical Association of America / Dr. Jenna Carpenter acceptant le prix au nom de l'Association mathématique de l'Amérique

The photos below capture just some of the CMS Winter Meeting highlights including the scientific sessions, award winner talks, AARMS-CMS Student Poster Sessions, and the CMS Awards Banquet.

Les photos ci-dessous capturent quelques-uns des moments marquants incluant les conférences scientifiques, les discours des gagnants de récompenses, la session de présentation par affiches pour étudiants AARMS – SMC et le banquet de prix de la SMC.



CMS Meeting – Welcome Reception /  
La réunion SMC – Réception de bienvenue



CMS Women in Mathematics Committee Breakfast / Petit  
déjeuner du comité des femmes en mathématiques de la SMC



The Institutes Innovation Platform / La Plateforme  
d'Innovations des Instituts



CMS Awards Banquet / Banquet de prix de la SMC



AARMS-CMS Student Poster Session / Session de présentations par affiches pour  
étudiants AARMS – SMC

*Continued on next page / Suite à la page suivante*

## CMS Winter Meeting by the numbers:

- Over 420 speakers providing a public, plenary lecture or session talk
- 28 Scientific Sessions
- 14 poster presenters at the AARMS-CMS Student Poster Session
- 11 Prizes and awards presented
- 2 Student Committee hosted workshops
- 2 Public Lectures with standing room only
- 1<sup>st</sup> Career Fair – Institutes Innovation Platform
- 1<sup>st</sup> Twitter Engagement Contest with 4 Daily Prizes and 1 Grand Prize Awarded; and
- An Education, History and Philosophy of Mathematics lecture

## La Réunion d'hiver de la SMC en chiffres :

- Plus de 420 conférenciers offrant des conférences publiques, plénières ou en panels
- 28 conférences scientifiques
- 14 présentateurs d'affichages lors de la session de présentation par affichage AARMS-SMC
- 11 prix et récompenses présentés
- 2 ateliers organisés par des comités étudiants
- 2 conférences publiques à salle comble
- Le premier salon de l'emploi – Plateforme d'Innovation des Instituts
- Le premier concours de mobilisation Twitter avec 4 prix quotidiens et un grand prix final ; et
- Une conférence sur l'enseignement, l'histoire et la philosophie des mathématiques



The following research and education awards were presented at the CMS banquet to honour and recognize exceptional performance.

Les récompenses suivantes en recherche et en éducation ont été présentées au banquet de prix de la SMC afin d'honorer et de reconnaître les performances exceptionnelles.



StudC Poster Award Winner – Chelsea Battell with presenter Svenja Huntemann, the Graduate Student Poster Session organizer / Le gagnant de la récompense StudC d'affichage – Chelsea Battell avec la présentatrice Svenja Huntemann, l'organisatrice de la session de présentation par affichage.



Doctoral Prize winner – Yuval Filmus (University of Toronto) with presenter Ailana Fraser, Chair, Research Committee / Le gagnant du prix de doctorat – Yuval Filmus (Université de Toronto) avec la présentatrice Ailana Fraser, Présidente du comité de recherche



AARMS Poster Award Winner – Jose Manuel Rodriguez with presenter Dorette Pronk, AARMS representative / Le gagnant de la présentation par affichage AARMS – Jose Manuel Rodriguez avec la présentatrice Dorette Pronk, la représentante AARMS



Doctoral Prize winner – Héctor H. Pastén Vázquez (Queen's University) with presenter Ailana Fraser, Chair, Research Committee / Le gagnant du prix de doctorat – Héctor H. Pastén Vázquez (Queen's University) avec la présentatrice Ailana Fraser, Présidente du comité de recherche



Jeffery-Williams Prize – Alejandro Adem (UBC) with presenter Ailana Fraser, Chair, Research Committee / Le prix Jeffery-Williams – Alejandro Adem (UBC) avec la présentatrice Ailana Fraser, Présidente du comité de recherche



G. de B. Robinson winner – Philippe Gille (Université Claude Bernard Lyon 1) with presenter Karl Dilcher, Chair of Publications Committee / Le gagnant du prix G. de B. Robinson – Philippe Gille (Université Claude Bernard Lyon 1) avec le présentateur Karl Dilcher, Président du comité des publications



Adrien Pouliot Award – Mark MacLean (UBC) with presenter Malgorzata Dubiel – Chair of CMS Education Committee / Le prix Adrien Pouliot – Marc MacLean (UBC) avec la présentatrice Malgorzata Dubiel, Présidente du comité d'éducation de la SMC



Graham wright award winner – Tom Salisbury (York University) / Le gagnant du prix Graham Wright – Tom Salisbury (Université York)

The following awards, not shown here, were also presented: CRM-FIELDS-PIMS Prize Winner - Daniel Wise (McGill University); CMS Poster Award Winner - Jennifer Vaughan; and special recognition to the MAA in celebration of one century of advancing mathematics. Les prix suivantes ont été présentés aussi, mais sans images ici: le Prix CRM-FIELDS-PIMS - Daniel Wise (Université McGill) ; Prix d'affiches des étudiants - Jennifer Vaughan ; et une reconnaissance spéciale au MAA qui célébrait un centenaire de développements en mathématiques.



## New Funding Key to CMS Success

The CMS will undertake a new fundraising program in 2016 in hopes of expanding the funds available to support CMS meeting sessions; and to provide travel and accommodations for students and graduate students at CMS meetings. The **CMS Annual Giving Campaign** has been underway since mid-December. We are seeking donations from members and friends of CMS that can be used to support CMS programs.

Sponsorships and donations are also being sought from foundations and corporations, who often have programs that **match** their employee's donations. Fundraising efforts also continue to support on-going CMS programs such as the Math Competitions, Canada's IMO Team, Endowment Grants for Research, and CMS Meetings. We are also positioning the CMS to accept donations by **Planned or Estate Giving**.

### You can help by:

Contributing to the CMS. Your donation can be designated for a specific program or activity, or can be made for general use. For more information about the programs the CMS supports, go to <http://funding.cms.math.ca>. Donate online at [cms.math.ca](http://cms.math.ca).

- Identifying mathematicians who work in private industry who we can contact to seek donations.
- Volunteering for CMS committees.
- Encouraging colleagues to join the CMS.

Working together, we can promote and advance the discovery, learning, and application of mathematics. If you have questions or want more information, please contact [giving@funding.cms.math.ca](mailto:giving@funding.cms.math.ca).

## Une nouvelle ronde de financement, clé du succès de la SMC

La SMC lancera une nouvelle ronde de financement en 2016 dans l'espoir d'augmenter les fonds disponibles afin de soutenir les conférences des réunions de la SMC et de subventionner les voyages et hébergements des étudiants et diplômés, aux réunions de la SMC. **La campagne annuelle de financement de la SMC** est en cours depuis la mi-décembre. Nous recherchons des dons de la part des membres et des amis de la SMC, qui peuvent être utilisés afin de soutenir les programmes de la SMC.

Nous recherchons aussi des parrainages et des dons de la part de fondations et d'entreprises qui offrent souvent des programmes de **dons équivalents** à ceux effectués par leurs employés. Les efforts de financement continuent aussi de soutenir les programmes en cours de la SMC, tels que les défis mathématiques, l'équipe canadienne de l'OIM, les fonds de dotations pour la recherche et les réunions de la SMC. Nous acceptons aussi les **dons planifiés** ou les **dons de biens**.

### Vous pouvez aider en :

Contribuant à la SMC. Votre don peut être ciblé envers un programme ou une activité spécifique ou pour utilisation générale à la SMC. Pour plus d'informations à propos des programmes que la SMC soutient, consultez <http://funding.cms.math.ca/>. Donnez en ligne à <https://cms.math.ca/f>.

- Identifiant des mathématiciens qui travaillent au privé et que nous pouvons contacter afin d'obtenir des dons de leur part.
- Étant bénévole sur un comité de la SMC.
- En encourageant des collègues à adhérer à la SMC.

En travaillant ensemble, nous pouvons promouvoir et favoriser la découverte, l'avancement, l'apprentissage et l'application des mathématiques. Si vous avez des questions ou souhaitez obtenir plus d'informations, veuillez contacter [giving@funding.cms.math.ca](mailto:giving@funding.cms.math.ca).





## Rémi Vaillancourt

It is with great sadness that I inform the Canadian mathematics community that our dear friend and colleague Rémi Vaillancourt passed away peacefully on November 29 at the age of 81.

Rémi was a regular professor in the Department of Mathematics and Statistics at the University of Ottawa since 1970, after completing a Ph.D. under the supervision of Kurt Friedrichs at NYU, and a postdoctoral fellowship at the University of Chicago. Although he officially retired in 1999, he was still afterwards among the most active members of this department (as an Adjunct Professor) by teaching courses, supervising graduate students, and being extremely productive in research, holding one of the largest NSERC grants in the department.

Rémi had a truly illustrious career, excelling in all aspects of a professor's job. As a researcher, he was a pioneer in introducing applied mathematics and scientific computation in the Courant Institute style in Canada. He published over 170 high quality papers in refereed journals, and co-authored eight books. He supervised approximately 50 graduate level theses in applied mathematics (many of these students being foreign nationals), and has thus contributed to the overall vibrancy of this area of mathematics within Canada and throughout the world.

As a teacher, Rémi was heavily involved in the training of engineering and applied mathematics students. He was a regular instructor of courses in differential equations, numerical analysis and applied linear algebra, at both the undergraduate and graduate levels, and received excellent evaluations from his students. As a former departmental chairman, I was very happy to be able to count on Rémi's experience, professionalism and generosity when assigning courses. I think that it is worth mentioning that after his retirement, in lieu of receiving a salary stipend for his teaching, Rémi's wish was to receive his compensation in the form of a research grant, so that he could provide better financial support to his graduate students. Such generosity and concern for his students and colleagues was Rémi's trademark.



Rémi's generosity also shines through when one looks at his contributions to academic service.

From very early on in his career, Rémi took on a leadership role by becoming Director of the Department of Mathematics and Statistics - when he was only an Assistant Professor! As director, he was instrumental in shaping the department by introducing key curriculum changes and development.

Later, Rémi served as President of the Canadian Mathematical Society (1977-79), and of the Canadian Applied Mathematics Society (1993-97). Indeed, he is the only person to have served as president of both mathematical societies. Rémi also served on NSERC scholarship selection committees, and was president (for 6 years) of the Canadian National Committee for the IMU.

In 2007, our department nominated Rémi for the David Borwein award. As part of the nomination package, I included letters of recommendation from several world-renowned mathematicians. All letters were quite unequivocal in their praise for Rémi. I was particularly touched by the letter written by one eminent professor. When I asked this professor if he would be willing to write a letter for Rémi, he quickly and enthusiastically agreed to do so. A little while after accepting to write the letter, I received an email from this professor's wife informing me that he had been in an accident, and was in hospital. It seems that this professor was so worried that he would not be able to get his letter to me in time for the nomination, that he dictated his letter to his wife from his hospital bed, which she then forwarded to me in time to include in the nomination package. I think that this speaks volumes as to the impact that Rémi has had on his colleagues in the mathematical community, and how this community values him as both a colleague and a friend.

On a personal level, Rémi Vaillancourt was an exceptional colleague - both a mentor, and a friend. I will forever remember and miss his contagious smile and good humour. His passing is a great loss to the mathematics community. He will be missed by all who knew him.

**Victor G. LeBlanc**  
Mathematics and Statistics  
University of Ottawa



## CJM Editors-In-Chief



The CMS invites expressions of interest for the Editors-In-Chief (EIC) of the CJM; **two EICs are being solicited, with a term scheduled to commence January 1, 2017.** Funding support from the CMS is available for both these EIC positions.

Since 1949, the **Canadian Journal of Mathematics** has been committed to publishing original mathematical research of high standard following rigorous academic peer review. New research papers are published continuously online and are collated into print issues six times each year.

Expressions of interest should include a cover letter, your curriculum vitae, and an expression of views regarding the publication. Since being EIC of CJM is a large responsibility that may require a lessening of responsibilities in an individual's normal work, individuals should review their candidacy with their university department and include a letter of support.

Please submit your expression of interest electronically to: **CJM-EIC-2015@cms.math.ca** before **May 15, 2016**.

### Current CJM/CMB Editorial Board

Henry Kim (Toronto)	12/2016	Editor-in-Chief CJM
Robert McCann (Toronto)	12/2016	Editor-in-Chief CJM
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Louigi Addario-Berry (McGill)	12/2018	Associate Editor
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Hans Boden (McMaster)	12/2020	Associate Editor
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Efim Zelmanov (UCSD)	12/2016	Associate Editor

## Rédacteurs en chef pour le JCM

La SMC invite les personnes intéressées par un poste de rédacteurs en chef au JCM à lui faire part de leur intérêt. **Deux postes de rédacteurs en chef sont à pourvoir, pour un mandat qui commencera le 1 janvier 2017.** La SMC offre du soutien financier pour ces deux postes.

Depuis 1949, le **Journal Canadien de Mathématiques** s'engage à publier des recherches en mathématiques, originales et de haut niveau, suivant de rigoureux examens par des pairs. Les articles de recherches sont disponibles en tout temps en ligne et sont rassemblés en six éditions imprimées par année.

Les propositions de candidature comprendront les éléments suivants : une lettre de présentation, votre curriculum vitae et un texte dans lequel vous exprimez votre opinion et vos idées par rapport à la publication. Puisque devenir rédacteur en chef de la JCM est une grande responsabilité qui peut nécessiter une réduction dans la charge normale de travail, les individu(e)s devraient vérifier leur candidature avec leur département et veuillez ajouter une preuve du soutien.

Veuillez faire parvenir votre candidature par courriel à : **CJM-EIC-2015@smc.math.ca** au plus tard le **15 mai 2016**.

### Conseil de rédaction pour le JCM et le BCM à présent :

Henry Kim (Toronto)	12/2016	Rédacteur en chef du JCM
Robert McCann (Toronto)	12/2016	Rédacteur en chef du JCM
Jie Xiao (Memorial)	12/2019	Rédacteur en chef du JCM
Xiaoqiang Zhao (Memorial)	12/2019	Rédacteur en chef du JCM
Louigi Addario-Berry (McGill)	12/2018	Rédacteur associé
Jason Bell (Waterloo)	12/2020	Rédacteur associé
Hans Boden (McMaster)	12/2020	Rédacteur associé
Alexander Brudnyi (Calgary)	12/2020	Rédacteur associé
Florin Diacu (Victoria)	12/2016	Rédacteur associé
Ilijas Farah (York)	12/2020	Rédacteur associé
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Eyal Goren (McGill)	12/2018	Rédacteur associé
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Anthony To-Ming Lau (Alberta)	12/2016	Rédacteur associé
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Javad Mashreghi (Laval)	12/2020	Rédacteur associé
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Assaf Naor (Princeton)	12/2018	Rédacteur associé
Erhard Neher (Ottawa)	12/2016	Rédacteur associé
Nilima Nigam (Simon Fraser)	12/2020	Rédactrice associée
McKenzie Wang (McMaster)	12/2016	Rédacteur associé
Juncheng Wei (UBC Vancouver)	12/2018	Rédacteur associé
Daniel Wise (McGill)	12/2018	Rédacteur associé
Efim Zelmanov (UCSD)	12/2016	Rédacteur associé



# MATHEMATICAL CONGRESS OF THE AMERICAS CONGRÈS MATHÉMATIQUE DES AMÉRIQUES

# MCA 2017

## JULY 24-28 JUILLET MONTRÉAL, CANADA



The second Mathematical Congress of the Americas (MCA) will take place on July 24-28, 2017, at Centre Mont-Royal and McGill University, Montreal, Canada. The congress is expected to attract mathematicians and students from throughout North America, Central America, South America and the Caribbean.

MCA 2017 highlights mathematical achievements of the Americas and fosters collaboration between the continents' mathematical communities. The congress is a collective initiative of the **Mathematical Council of the Americas** (MCofA). MCA 2017 is being supported by a Canadian organizing committee that includes the Pacific Institute for the Mathematical Sciences (PIMS), the Fields Institute (FIELDS), Le Centre de recherches mathématiques (CRM), the Atlantic Association for Research in the Mathematical Sciences (AARMS) and the CMS, which is staging the event.

Le deuxième Congrès mathématique des Amériques (CMA) aura lieu du 24 au 28 juillet 2017 au Centre Mont-Royal et l'Université McGill, à Montréal, Canada. L'événement devrait attirer des mathématiciens et mathématiciennes ainsi que des étudiantes et étudiants de partout à travers l'Amérique du Nord, l'Amérique centrale, l'Amérique du Sud et les Caraïbes.

Le CMA 2017 met en lumière les accomplissements mathématiques des Amériques et encourage la collaboration entre les différentes communautés mathématiques du continent. Le congrès est une initiative collective du **Mathematical Council of the Americas** (MCofA). Le CMA 2017 est financé par un comité canadien incluant le Pacific Institute for the Mathematical Sciences (PIMS), l'institut Fields (FIELDS), le Centre de recherches mathématiques (CRM), l'Atlantic Association for Research in the Mathematical Sciences (AARMS) et la SMC, qui organise aussi l'événement.

[mca2017.org](http://mca2017.org)

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