

CMS

NOTES

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FROM THE PRESIDENT'S DESK



Jonathan Borwein

(voir la page 15 pour la version française)

A General Reprise

The year 2000 was a very busy – and for the most part very successful – year for the Society: organizationally, intellectually and even financially. As President I have been forcibly but pleasantly reminded at how hard and effectively our Executive Office works and at how many activities the Society is engaged in.

I can not overstate how well served we are by the voluntary effort of so many of our members, as with the recent review process. Whether we choose the comparison with other Canadian academic societies or with foreign mathematical societies, we take some considerable pleasure in both the scale and level of function we

provide. Through our annual meetings and prizes, active publication programme, sponsored high school competitions and Math Camps (there were eight this year (2000) in six provinces), the Endowment Fund Grants Competition which has just completed its second set of awards funding worthy mathematical projects ... and much else. Information on the Grants Competition can be found via Camel (www.cms.math.ca/Grants/).

Central to last year's activities was the highly successful Math 2000 joint summer meeting (www.cms.math.ca/CMS/Events/-math2000/), held at McMaster University. Hosted by McMaster and the University of Waterloo, the largest 'made in Canada' conference yet run with more than 500 participants and a dozen varied plenary lectures. A profusion of other successful events made for an unparalleled week in Canadian mathematics.

The list of participating societies and diverse talks at the meeting (and our other meetings) — from genomics (we heard a speaker from Celera describe the *Drosophila* genome), control theory, imaging, biostatistics and encryption to logic, symplectic geometry, and history of mathematics — emphasizes our ability to play a key part in the life of the mathematical sciences generally. It was followed by an equally varied and stimulating CMS Winter meeting (www.cms.math.ca/Events/winter00/)

(see PRESIDENT–page 13)

CMS NOTES
NOTES DE LA SMC

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EDITORIAL



Peter Fillmore

In his Killam lecture last fall, Robert Prichard, the past-president of the University of Toronto, strongly supported recent federal initiatives in funding higher education and research, arguing that the changes are so fundamental as to constitute a "new paradigm".

A basic problem for higher education in Canada is that it lies within provincial jurisdiction, and yet is of profound importance for the country as a whole. The post-war federal presence combined transfer grants for universities, loan programmes for students, and the granting councils for research. But the first of these arrangements, and to some extent the second, was increasingly plagued by federal-provincial wrangling, reaching a low point with the budget cuts of 1995.

Beginning in 1997, led by Ministers Paul Martin and John Manley, a new federal approach was developed, focussing on research and innovation while affirming provincial responsibility for university funding. This approach, which includes such initiatives as the Canada Foundation for Innovation, the Networks of Centres of Excellence, and the Canada Research Chairs, has "dramatically enhanced the federal role and reinvigorated our national capacity for research".

Our mathematical community, through such organizations as the research institutes and the CMS, has found itself well-placed to participate in the resulting opportunities. The new Banff Station (see the announcement in this issue) is a good example.

Dans la conférence qu'il a prononcée l'automne dernier à titre de lauréat du prix Killam, Robert Prichard, recteur sortant de l'Université de Toronto, a relaté l'évolution des initiatives récentes du gouvernement fédéral en ce qui concerne le financement de l'enseignement supérieur et de la recherche, et s'est dit extrêmement favorable à ces initiatives. À son avis, l'ampleur des changements est telle qu'on peut même parler de « nouveau paradigme ».

Le grand problème, c'est qu'au Canada, l'enseignement supérieur relève des Provinces même s'il s'agit d'un secteur d'une très grande importance pour l'ensemble du pays. Après la Seconde Guerre mondiale, le gouvernement fédéral a intensifié son rôle en s'occupant des subventions aux universités, des programmes de bourses d'études et du financement de la recherche auprès des organismes subventionnaires. Dans le premier cas, toutefois, et, dans une certaine mesure, le second, le gouvernement fédéral et les Provinces ont toujours été à couteaux tirés. Les paiements de transfert aux provinces ont par ailleurs été à leur plus bas niveau au moment des grandes compressions budgétaires de 1995.

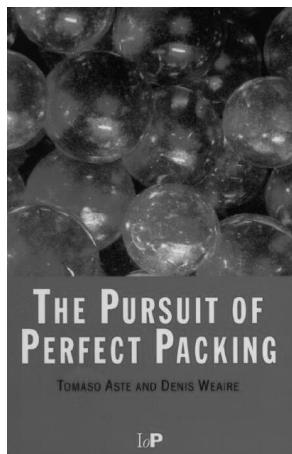
Au début de 1997, sous la houlette des ministres Paul Martin et John Manley, le gouvernement fédéral a adopté une nouvelle orientation, qui mettait davantage l'accent sur la recherche et l'innovation tout en accentuant la responsabilité des provinces quant au financement des universités. Cette orientation, qui a donné lieu à des programmes comme la Fondation canadienne pour l'innovation, le Réseau de centres d'excellence et les Chaires de recherche du Canada, a grandement accru le rôle du gouvernement fédéral dans ce domaine et a donné un nouveau souffle à la recherche au pays.

La communauté mathématique, par l'entremise d'organismes comme les instituts de recherche et la SMC, s'est retrouvée en bonne position pour jouer un rôle actif dans les programmes découlant de cette nouvelle orientation. Le cas du nouveau centre de Banff, qui fait l'objet d'une annonce un peu plus loin, illustre bien la participation de notre communauté.

The Subtleties of Space Filling

Book Review by Robert V. Moody, University of Alberta

The Pursuit of Perfect Packing
by Tomaso Aste & Denis Weaire
Institute of Physics Publishing, Bristol
and Philadelphia, 2000



Given that we are all born and live out our lives in a 3-dimensional world, it is incredible how little we know about it. The number of tantalizingly easy-to-state impossibly-hard-to-solve problems around filling space with similarly shaped objects of various types is probably on a par with the famous puzzles of number theory. Yet packing problems have never had the mystique nor the avid following of number theory. It is for certain that there is no correspondingly elegant theory or canon of sophisticated techniques and ideas. Is this our failure of intuition or is it that these problems are intrinsically less ordered and harder?

What space filling loses in the way of theory it gains in its colourful history. Nature abounds in space filling devices, and from ancient times to the present these have caught the imaginations of scientists, mathematicians, and dilettantes.

To quote the authors of the *Pursuit of Perfect Packing*:

“The history of ideas about packing is peopled by many eminent and

colourful characters. An English reverend gentleman is remembered for his experiments in squashing peas together in the pursuit of geometrical insights. A blind Belgian scientist performed by proxy experiments that laid down the ground rules for serious play with bubbles. An Irishman of unrivaled reputation for dalliance (at least among crystallographers) gave us the rules for random packing of balls. A Scotsman who was the grand old man of Victorian science was briefly obsessed with the parsimonious partitioning of space.

All of them shared the curiosity of the child at the church bazaar: how many sweets are there in the jar?”

None of these characters is more famous, nor more interesting, than Johannes Kepler. Kepler was a scientist of the first order whose feet seemed to stand firmly both in the scientific age, just dawning, and the receding age, possessed with its medieval sense of mystery and awe. It was Kepler’s interest in the hexagonal form of snow-flakes that led him to look at the densest packing of spheres and to the now famous Kepler problem. As has often been said, every mathematician believes and every physicist knows that the usual cannonball stacking in hexagonally packed layers is the best. In fact this is not a unique packing: each successive layer has two ways of being placed on the former, but they all have the same density. It is quite astounding that even now, in 2001, the final verdict on this is not in, though there seems to be considerable confidence in Thomas Hales’ announced (computer aided) solution to it (<http://www.lsa.umich.edu/hales/-countdown>).

In the same work, Kepler uncovers two famous semi-regular figures, the rhombic-dodecahedron and the lovely triacontrahedron with its 30 rhombic faces. Kepler was also the first person to think about tiling the plane with

figures based on 5-fold symmetry, and his splendid aperiodic tiling is a 400 year old precursor to the famous Penrose tiling and the world of quasicrystals.

In the *Pursuit of Perfect Packing*, Tomaso Aste and Denis Weaire take us on a tour of this familiar, yet not quite so familiar, world, with a blend of mathematical insight, historical incident, and just plain good fun. This is serious mathematics, written in an engaging and amusing style, that ranks at a high level for expository science writing. The authors are both physicists, which only serves to underline the fact that good mathematics and good science are never far apart.

One of the authors (D. Weaire, FRS) has the distinction of being a main contributor in defeating the 100 year old Kelvin conjecture. It was the blind Plateau who, with the help of his visually unchallenged friends, laid down the geometric principles of soap bubbles. Later Lord Kelvin, in his musings on the (long defunct) ether, speculated that it might be a foam and was led to the problem of determining the shape of the cells, equal in volume but minimizing surface area that would fill space. He quickly came up with the space-filling Kelvin cell (already known by Leonardo) as the solution. Doubt continued however, since in real foams the ideal Kelvin cell is nowhere to be found! Weaire and Phelan, using Brakke’s surface evolver (computer software) and some very solid hints from Nature itself, brought an end to the Kelvin conjecture (but the resulting foam is a mixture of 12 and 14 sided cells). (A search of Weaire’s website provides much more information on this, as well as plenty of examples of his Irish wit).

All this and many other marvelous tales, from honeycombs, lattices, sausages, dimples on golf balls,

squashed peas, Apollonian packings, quasicrystals, buckballs, abound in this little book.

Who would enjoy the **Pursuit of Perfect Packing**? I think just about everyone who is mathematically inclined. It is visually appealing (almost every page has some engaging picture) and easy to browse. It is not, however, uniformly easy to read. The au-

thors' mathematical expectations of the reader vary greatly from page to page. Those who want to really understand what is going on will have to go elsewhere. Still, I think that the result is a good compromise.

It conveys the sense of order, structure and wonder in mathematics and Nature that is the life-blood of mathematicians and scientists and a sense of


the excitement and humanness that accompanies all research and experiment.

Finally it leaves in no doubt how little we know about the space we live in and the subtleties of Nature.

The book would make a fine gift or prize for anyone who is mathematically inclined, from high school students upwards.

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Representations of Groups
Bruce N. Allison and Gerald H. Cliff, Editors
Representations of Groups contains papers presented at a Canadian Mathematical Society Annual Seminar. The material addresses representations of Lie groups, algebraic groups, finite groups, and quantum groups and the relationships among these areas. With both survey and research articles, this book offers the latest results on various aspects of representation theory of groups. *Conference Proceedings, Canadian Mathematical Society, Volume 16; 1995; 385 pages; Softcover; ISBN 0-8218-0311-5; List \$110; Individual member \$66; Order code CMSAMS/16CMS01*

Trends in Ring Theory
Vlastimil Dlab, Carleton University, Ottawa, ON, Canada, and László Márki, Hungarian Academy of Sciences, Budapest, Hungary, Editors
 The Ring Theory Conference (University of Miskolc, Hungary) successfully accomplished its two goals: 1) to reflect contemporary trends in the subject area and 2) to offer a meeting place for a large number of Eastern European algebraists and their colleagues from around the world. Particular emphasis was placed on recent developments in the following four areas: representation theory, group algebras, PI algebras, and general ring theory. This book presents 13 of the invited lectures. *Conference Proceedings, Canadian Mathematical Society, Volume 22; 1998; 239 pages; Softcover; ISBN 0-8218-0849-4; List \$49; Individual member \$29; Order code CMSAMS/22CMS01*

Harmonic Analysis and Number Theory
Papers in Honour of Carl S. Herz
S. W. Drury, McGill University, Montreal, PQ, Canada, and M. Ram Murty, Queen's University, Kingston, ON, Canada, Editors
 This volume presents the proceedings of a conference on "Harmonic Analysis and Number Theory" held at McGill University (Montreal). The papers are dedi-

cated to the memory of Carl Herz, who had deep interests in both harmonic analysis and number theory. These two disciplines have a symbiotic relationship that is reflected in the papers in this book. *Conference Proceedings, Canadian Mathematical Society, Volume 21; 1997; 227 pages; Softcover; ISBN 0-8218-0794-3; List \$49; Individual member \$29; Order code CMSAMS/21CMS01*

Seminar on Fermat's Last Theorem
V. Kumar Murty, University of Toronto, ON, Canada, Editor
Anyone who wants to study the proof of Wiles and Taylor-Wiles will find these proceedings valuable and helpful.
—Monatshefte für Mathematik


The most significant recent development in number theory is the work of Andrew Wiles on modular elliptic curves. Besides implying Fermat's Last Theorem, his work establishes a new reciprocity law. Reciprocity laws lie at the heart of number theory. Wiles' work draws on many of the tools of modern number theory and the purpose of this volume is to introduce readers to some of this background material. Based on a seminar held during 1993-1994 at the Fields Institute for Research in Mathematical Sciences, this book contains articles on elliptic curves, modular forms and modular curves, Serre's conjectures, Ribet's theorem, deformations of Galois representations, Euler systems, and annihilators of Selmer groups. All of the authors are well known in their field and have made significant contributions to the general area of elliptic curves, Galois representations, and modular forms.

Features:

- Brings together a unique collection of number theoretic tools.
- Makes accessible the tools needed to understand one of the biggest breakthroughs in mathematics.
- Provides numerous references for further study.

Conference Proceedings, Canadian Mathematical Society, Volume 17; 1995; 265 pages; Softcover; ISBN 0-8218-0313-1; List \$49; All AMS members \$39; Order code CMSAMS/17CMS01

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2000 DOCTORAL PRIZE LECTURE

Cantor Sets and Continued Fractions

Stephen Astels, University of Georgia

Introduction

Let a_0, a_1, \dots, a_n be integers with $a_i \geq 1$ for $i = 1, \dots, n$. We let the *continued fraction* $[a_0, a_1, \dots, a_n]$ denote the number

$$a_0 + \frac{1}{a_1 + \frac{1}{a_2 + \frac{1}{\dots + \frac{1}{a_n}}}}$$

If a_0, a_1, \dots is an infinite sequence with $a_i \geq 1$ for $i \geq 1$ then we put

$$[a_0, a_1, \dots] = \lim_{n \rightarrow \infty} [a_0, a_1, \dots, a_n] \tag{1}$$

if the limit exists.

A few facts about continued fractions:

- The limit in (1) always exists.
- Every real x has a continued fraction expansion.
- If $x \in \mathbb{Q}$ then the expansion is finite.
- If $x \notin \mathbb{Q}$ then the expansion is unique.

For example, we have

$$\sqrt{2} = [1, 2, 2, 2, \dots] \quad \text{and} \quad e = [2, 1, 2, 1, 1, 4, 1, 1, 6, \dots].$$

Let $x = [a_0, a_1, \dots]$. We call the a_i 's *partial quotients* of x . For $n \geq 0$ put

$$\frac{p_n}{q_n} = [a_0, a_1, \dots, a_n].$$

We call p_n/q_n the n^{th} *convergent* to x .

An important result from the theory of continued fractions is the following.

Theorem 1 *Let p_n/q_n be a convergent to x . Then*

$$\left| x - \frac{p_n}{q_n} \right| < \frac{1}{q_n^2}.$$

It follows from this result that the convergents to x approximate x very well (better, say, than one would expect from a truncation of the decimal expansion of x).

Now, it can be shown that almost all real numbers have arbitrarily large partial quotients. Therefore the set of numbers with small partial quotients is rather sparse.

For $m \in \mathbb{Z}^+$ we define

$$F(m) = \{[t, a_1, a_2, \dots]; t \in \mathbb{Z}, 1 \leq a_i \leq m \text{ for } i \geq 1\}$$

and for any two sets of real numbers A and B we say that the *sum* of A and B is

$$A + B = \{a + b; a \in A \text{ and } b \in B\}.$$

Although sets of the form $F(m)$ are rather sparse, the sum of such sets is often rather large. Previous results concerning these sums include the following.

Theorem 2 (Hall [10], 1947)

$$F(4) + F(4) = \mathbb{R}.$$

Theorem 3 (Diviš [8], 1973)

$$\begin{array}{ll} F(3)+F(3) \neq \mathbb{R} & F(2)+F(2)+F(2) \neq \mathbb{R} \\ F(3)+F(3)+F(3) = \mathbb{R} & 4F(2) = \mathbb{R} \end{array}$$

Theorem 4 (Hlavka [11], 1975)

$$\begin{array}{ll} F(4)+F(3) = \mathbb{R} & F(4)+F(2)+F(2) = \mathbb{R} \\ F(4)+F(2) \neq \mathbb{R} & F(3)+F(3)+F(2) = \mathbb{R} \\ F(7)+F(2) = \mathbb{R} & \end{array}$$

Hlavka also conjectured that

$$F(6) + F(2) \neq \mathbb{R}.$$

This turns out not to be the case.

Theorem 1 (A. [5])

$$F(5) \pm F(2) = \mathbb{R}.$$

We also have the following result.

Theorem 2 (A. [3])

$$F(3) \pm F(2) \pm F(2) = \mathbb{R}.$$

Since $F(m) \subseteq F(n)$ for $m \leq n$, the above theorems completely solve the problem of which $F(m)$'s add together to give all of \mathbb{R} .

The complementary problem

For $l \in \mathbb{Z}^+$ we put

$$G(l) = \{[t, a_1, a_2, \dots]; t \in \mathbb{Z} \text{ and } a_i \geq l \text{ for } i \geq 1\}$$

where we allow $G(l)$ to contain finite continued fractions. The problem of characterizing the sum of $G(l)$'s has been studied by Tom Cusick and Robert Lee.

Theorem 5 (Cusick [6], 1971) $G(2) + G(2) = \mathbb{R}$.

Theorem 6 (Cusick & Lee [7], 1971) *If $l \in \mathbb{Z}^+$ then*

$$lG(l) = R.$$

In this paper we shall discuss ways of adding together different $G(l)$'s.

Theorem 3 (A. [2], 2000) *Let k and l_1, l_2, \dots, l_k be positive integers. Then*

$$G(l_1) \pm \dots \pm G(l_k) = R$$

if and only if

$$\sum_{j=1}^k \frac{1}{l_j} \geq 1.$$

The general problem

For a non-empty set $B \subseteq \mathbb{Z}^+$ we put

$$F(B) = \{[t, a_1, a_2, \dots]; t \in \mathbb{Z}, a_i \in B \text{ for } i \geq 1\}.$$

Thus

$$F(m) = F(\{1, 2, \dots, m\}) \text{ and } G(l) = F(\{l, l+1, \dots\}).$$

We are concerned with the following problem: given sets $B_1, \dots, B_k \subseteq \mathbb{Z}^+$, determine when

$$F(B_1) + \dots + F(B_k) = R.$$

For $B \subseteq \mathbb{Z}^+$ let $C(B)$ denote the set

$$C(B) = \{[0, a_1, a_2, \dots]; a_i \in B \text{ for } i \geq 1\}$$

Then $F(B_1) + \dots + F(B_k) = \mathbb{Z} + C(B_1) + \dots + C(B_k)$

so to solve our problem it suffices to determine

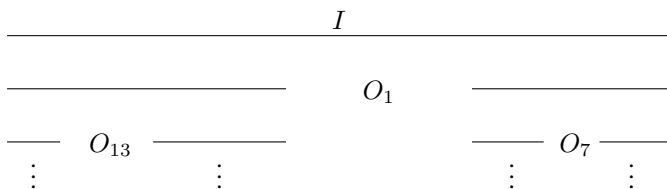
$$C(B_1) + \dots + C(B_k).$$

Cantor sets

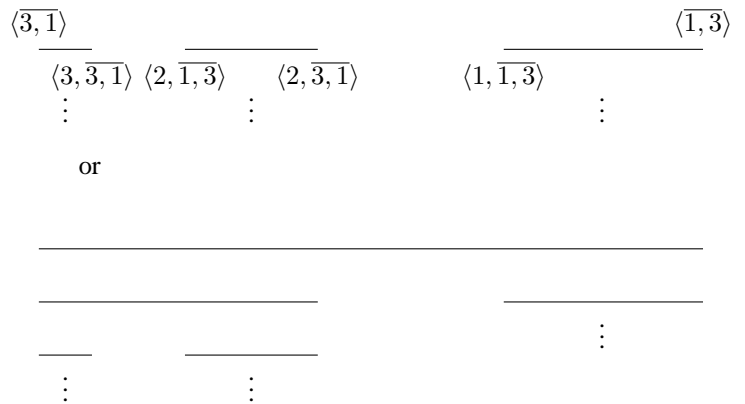
A *Cantor set* is any set C of the form

$$C = I \setminus \{O_i\}$$

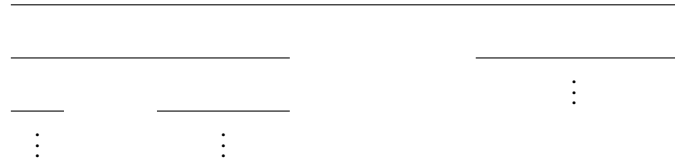
for some finite closed interval I and countable set of open intervals $\{O_i\}$, where each O_i is contained in I . We may construct C from I in a manner similar to the construction of the usual "middle-third" Cantor set.



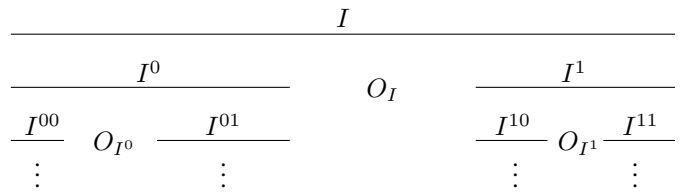
If $B \subseteq \mathbb{Z}^+$ then $C(B)$ is a Cantor set. For example, assume that $B = \{1, 2, 3\}$ and put $\langle a_1, a_2, \dots \rangle = [0, a_1, a_2, \dots]$. We construct $C(B)$ from $[\langle \overline{3}, \overline{1} \rangle, \langle \overline{1}, \overline{3} \rangle]$ as follows (where the bar indicates infinite repetition).



or



To determine $C(B_1) + \dots + C(B_k)$ we will examine sums of general Cantor sets as defined above. Let C be a Cantor set constructed from I . We label the intervals in the construction as follows.



We call the closed intervals in the construction *bridges* and the open intervals removed *gaps*. Let \mathcal{D} be the tree representing the construction. If A is a bridge of \mathcal{D} we say that A *splits* as

$$A = A^0 \cup O_A \cup A^1$$

where A^0 and A^1 are the two bridges immediately beneath A . The construction is called *ordered* if the gaps are removed in order of decreasing length. We will assume for the purposes of this paper that all our constructions are ordered.

Let \mathcal{D} be any (ordered) construction of C . We define the *thickness* of C , denoted $\tau(C)$, by

$$\tau(C) = \inf_A \min \left\{ \frac{|A^0|}{|O_A|}, \frac{|A^1|}{|O_A|} \right\}$$

where the infimum is over all bridges A of \mathcal{D} . For $j = 1, 2$ let C_j be a Cantor set constructed from I_j and let A_j be a bridge of the construction. We say that (A_1, A_2) is *compatible* if

$$|A_1| \geq |O_{A_2}| \quad \text{and} \quad |A_2| \geq |O_{A_1}|.$$

In other words, the two bridges are roughly the same length. The key result in this manuscript is the following.

Theorem 4 (A. [2], 2000) *For $j = 1, 2$ let C_j be a Cantor set constructed from I_j . Assume that (I_1, I_2) is compatible.*

1. If $\tau(C_1)\tau(C_2) \geq 1$ then $C_1 + C_2 = I_1 + I_2$.

2. If $\tau(C_1)\tau(C_2) < 1$ then

$$\tau(C_1 + C_2) \geq \frac{\tau(C_1) + \tau(C_2) + 2\tau(C_1)\tau(C_2)}{1 - \tau(C_1)\tau(C_2)}.$$

It should be noted that Part 1 of Theorem 4 follows from work of Sheldon Newhouse [12] done in 1979. It is Part 2, however, that will allow us to examine sums of more than two Cantor sets.

We shall prove only the first part of the theorem. Our proof will be different from that of Newhouse, and in fact is similar to the proof of Part 2 (details may be found in [2]). Assume that $\tau(C_1)\tau(C_2) \geq 1$, and for $j = 1, 2$ let \mathcal{D}_j be a construction of C_j from I_j .

Let A and B be bridges of \mathcal{D}_1 and \mathcal{D}_2 respectively with (A, B) compatible. We will prove that

$$A + B \subseteq (C_1 \cap A) + (C_2 \cap B)$$

which will imply the desired result, since (I_1, I_2) is compatible. Now,

$$\frac{\min\{|A^0|, |A^1|\}}{|O_A|} \cdot \frac{\min\{|B^0|, |B^1|\}}{|O_B|} \geq \tau(C_1)\tau(C_2) \geq 1$$

so

$$\min\{|A^0|, |A^1|\} \min\{|B^0|, |B^1|\} \geq |O_A| \cdot |O_B|,$$

thus either

$$\min\{|A^0|, |A^1|\} \geq |O_B|$$

or

$$\min\{|B^0|, |B^1|\} \geq |O_A|.$$

Assume that the first holds. We have

$$|O_{A^0}| \leq |O_A| \leq |B| \quad \text{and} \quad |O_{A^1}| \leq |O_A| \leq |B|$$

since the constructions are ordered and (A, B) is compatible. By our assumption we have

$$|O_B| \leq |A^0| \quad \text{and} \quad |O_B| \leq |A^1|$$

whence (A^0, B) and (A^1, B) are compatible. Since (A, B) is compatible, we know that $A^0 + B$ overlaps $A^1 + B$. Hence we have shown that

$$A + B = (A^0 + B) \cup (A^1 + B)$$

with both (A^0, B) and (A^1, B) compatible. By induction and taking a limit we have

$$A + B \subseteq (C_1 \cap A) + (C_2 \cap B)$$

as required.

Sums of more than two Cantor sets

We next generalize our definition of compatibility. For $j = 1, \dots, k$ let C_j be a Cantor set constructed from I_j and let A_j be a bridge of the construction. We say that (A_1, A_2, \dots, A_k) is *compatible* if for $r = 1, \dots, k-1$, $|A_{r+1}| \geq |O_{A_j}|$ for $j = 1, \dots, r$, and $|A_1| + \dots + |A_r| \geq |O_{A_{r+1}}|$. We define the *normalized thickness* of a Cantor set C by

$$\gamma(C) = \frac{\tau(C)}{\tau(C) + 1}.$$

It is easy to show that

$$\tau(C_1)\tau(C_2) \geq 1 \quad \text{iff} \quad \gamma(C_1) + \gamma(C_2) \geq 1$$

and that

$$\tau(C_1 + C_2) \geq \frac{\tau(C_1) + \tau(C_2) + 2\tau(C_1)\tau(C_2)}{1 - \tau(C_1)\tau(C_2)}$$

is equivalent to

$$\gamma(C_1 + C_2) \geq \gamma(C_1) + \gamma(C_2).$$

By Theorem 4 and induction on the number of Cantor sets we have the following result.

Theorem 5 (A. [2], 2000) *Let k be a positive integer and for $j = 1, 2, \dots, k$ let C_j be a Cantor set constructed from I_j . Assume that (I_1, \dots, I_k) is compatible and put $S_\gamma = \sum \gamma(C_j)$.*

1. If $S_\gamma \geq 1$ then

$$C_1 + \dots + C_k = I_1 + \dots + I_k.$$

2. If $S_\gamma < 1$ then

$$\gamma(C_1 + \dots + C_k) \geq S_\gamma.$$

Back to number theory

Let $B \subset \mathbb{Z}^+$ be non-empty and put $\gamma(B) = \gamma(C(B))$. It is usually not difficult to calculate $\gamma(B)$. For example,

$$\gamma(\{l, l + \Delta, l + 2\Delta, \dots\}) = \frac{1}{\Delta l}.$$

We may cast Theorem 5 in terms of continued fractions in the following manner.

Theorem 6 (A. [2], 2000) Let k be a positive integer and B_1, B_2, \dots, B_k be non-empty sets of positive integers. If

$$\gamma(B_1) + \dots + \gamma(B_k) \geq 1$$

then

$$F(B_1) \pm \dots \pm F(B_k) = R.$$

Theorem 6 can be used to obtain results for particular cases of interest. For example, we have the following.

Corollary 1 Let B_o denote the set of positive odd integers. Then

$$F(B_o) + F(B_o) = R.$$

Furthermore, if B is any finite set of odd positive integers then

$$F(B) + F(B) \neq R.$$

Note that for $l \in \mathbb{Z}^+$, $\gamma(\{l, l+1, l+2, \dots\}) = 1/l$, and so Theorem 3 is a consequence of Theorem 6.

Products and quotients

We may also examine products and quotients of $F(B)$'s. If $C \subseteq (0, \infty)$ is a Cantor set then $\log(C)$ will also be a Cantor set, with a related construction.

Theorem 7 (Hall [10], 1947)

$$[1, \infty) \subseteq F(4) \cdot F(4).$$

For positive integers m we define $g(m)$ by

$$g(m) = \frac{-m + \sqrt{m^2 + 4m}}{2}.$$

Define \mathcal{E} to be the following set of n -tuples,

$$\mathcal{E} = \{(t, 2) ; 2 \leq t \leq 6\} \cup \{(3, 3), (3, 2, 2)\}$$

where we consider the components of each n -tuple in \mathcal{E} to be unordered. We may completely describe the products $F(m_1)F(m_2) \cdots F(m_k)$ in all cases except for those where (m_1, m_2, \dots, m_k) is a member of \mathcal{E} .

Theorem 7 (A. [4]) Let $m_1 \geq m_2 \geq \dots \geq m_k \geq 2$ be integers for some $k \geq 2$. If $(m_1, \dots, m_k) \notin \mathcal{E}$ then

$$F(m_1) \cdots F(m_k) = (\infty, -L] \cup [U, \infty)$$

for some L and U depending on m_1, \dots, m_k . More precisely, we have

$$L = \begin{cases} \frac{g(m_1)}{m_1} (1 - g(m_2)) \cdots (1 - g(m_k)), & \text{if } k \text{ is even,} \\ (1 - g(m_1)) \cdots (1 - g(m_k)), & \text{if } k \text{ is odd} \end{cases}$$

and

$$U = \begin{cases} (1 - g(m_1)) \cdots (1 - g(m_k)), & \text{if } k \text{ is even,} \\ \frac{g(m_1)}{m_1} (1 - g(m_2)) \cdots (1 - g(m_k)), & \text{if } k \text{ is odd.} \end{cases}$$

Theorem 8 (A. [4]) Let $m_1, \dots, m_k \geq 2$ and $n_1, \dots, n_l \geq 2$ be integers for some $k, l \geq 1$. If $(m_1, \dots, m_k, n_1, \dots, n_l) \notin \mathcal{E}$ then

$$\frac{F(m_1) \cdots F(m_k)}{F(n_1) \cdots F(n_l)} = R \setminus \{0\}.$$

We may also examine the product of sets of numbers with large partial quotients.

Theorem 8 (Cusick [6], 1971)

$$[1, \infty) \subseteq G(2) \cdot G(2).$$

Theorem 9 (A. [2], 2000) If k and l_1, l_2, \dots, l_k are positive integers with

$$\sum_{j=1}^k \frac{1}{l_j} \geq 1$$

then

$$G(l_1)G(l_k) = R.$$

F(5) \pm F(2) and F(3) \pm F(3)

For $m \in \mathbb{Z}^+$ put $C(m) = C(\{1, 2, \dots, m\})$. Unfortunately

$$\gamma(C(5)) + \gamma(C(2)) = 0.908\dots < 1$$

so Theorem 6 cannot be used to prove Theorem 1.

Instead we use a different approach which is similar but much more complicated. For example, instead of needing to compute only two numbers (the normalized thicknesses) we must find 25 different constants (see [5] for details). These new techniques also us to examine $F(3) \pm F(3)$ (in this case requiring 91 constants). Recall that $F(3) + F(3) \neq R$.

Theorem 9 (Schecker [13], 1972)

$$[.629\dots, 1.523\dots] \subseteq C(3) + C(3).$$

If $v = d_1 d_2 \cdots d_k$ is a word then we put

$$\begin{aligned} \langle v, a_1, a_2, \dots \rangle &= \langle d_1, d_2, \dots, d_k, a_1, a_2, \dots \rangle \\ &= [0, d_1, d_2, \dots, d_k, a_1, a_2, \dots] \end{aligned}$$

Let \mathcal{M} be the set of finite words $v = d_1 \cdots d_t$ with $t \geq 0$, $d_i \in \{1, 3\}$ for $1 \leq i \leq t$ and if $d_k = 1$ for some k then $t \geq k+1$ and $d_{k+1} = 3$. For any numbers x and y let $[[x, y]]$ denote the interval $[\min(x, y), \max(x, y)]$. Put

$$S = \bigcup_{v \in \mathcal{M}} [[\langle v, \overline{3}, 1 \rangle + \langle v, \overline{2}, \overline{1}, 3 \rangle, \langle v, \overline{1}, 3 \rangle + \langle v, 1, 2, \overline{1}, 3 \rangle]].$$

Theorem 10 (Freiman [9], 1977)

$$S \subseteq C(3) + C(3).$$

Theorem 10 (A. [1], 1999) Let

$$T = \{2\langle d_1, d_2, \dots \rangle; \quad \{d_i \in \{1, 3\} \text{ and if } d_i = 1 \\ ; \text{ then } d_{i+1} = 3, \text{ for } i \geq 1\}.$$

Then

$$C(3) + C(3) = S \cup T.$$

This means that $F(3) + F(3) = Z + (S \cup T)$, a rather complicated set with many gaps. Surprisingly, $F(3) - F(3)$ has a much more satisfying description.

Theorem 11 (A. [1], 1999)

$$F(3) - F(3) = R.$$

Acknowledgments

I would like to express my gratitude to my supervisor, Cameron Stewart, for his support, motivation, and assistance during my graduate studies.

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CMS Winter Meeting 2001 December 8-10

Toronto Colony Hotel Toronto, Ontario

We are happy to announce the provisional outline for the Canadian Mathematical Society Winter Meeting 2001. Look for the First Announcement in the September 2001 issue of the *CMS Notes* or at <http://www.cms.math.ca/Events/winter01>.

HOST : Department of Mathematics & Statistics, York University.

PRIZES : Coxeter-James Lecture, **Kai Behrend** (UBC), Adrien Pouliot Prize, Doctoral Prize.

SYMPOSIA : **Dynamical Systems**, Org: Bill Langford (Guelph) and Jianhong Wu (York) ; **Free Probability** Org: Andu Nica (Waterloo) ; **Kac-Moody Lie Algebras**, Org: Yun Gao (York) and Nantel Bergeron (York) ; **Non-linear Analysis**, Org: Robert McCann (Toronto); **Mathematical Education**, Org: Pat Rogers (York).

MEETING DIRECTOR : Tom Salisbury (York).

LOCAL ARRANGEMENTS : Stanley Kochman (York).

Banff International Research Station

David Eisenbud, Director, Mathematical Science Research Institute (Berkeley), and Nassif Ghoussoub, Director, Pacific Institute for the Mathematical Sciences, have announced that the Board of Trustees of MSRI and the Board of Directors of PIMS have given a unanimous endorsement for the development of the Banff International Research Station for Mathematical Innovation and Discovery and the go-ahead to seek funding as outlined below. The mathematical sciences community is warmly invited to provide its input, critique and support to help this initiative serve mathematical research, education and outreach as effectively as possible.

The International Research Station is a collaborative Canada-US venture that will provide an Oberwolfach-style infrastructure and ambience to attract leading researchers in the mathematical sciences from around the world to workshops and meetings for the exchange, dissemination, and creation of new ideas. Its purpose is to foster innovation and discovery through scientific interaction, problem solving, and post-graduate training in every aspect of the mathematical, computational and statistical sciences and their applications. On-going support and participation will be provided by the Fields Institute, CRM and MITACS.

The intention is to establish the station in Corbett Hall at the Banff Conference Centre in Alberta. The facility will accommodate up to 50 participants. Lecture rooms and computer labs with high speed internet connections will be located on the bottom floor of the adjacent Max Bell building. An independent dining facility will be located in the adjacent Don Cameron Hall.

The station will initially operate for 40 weeks of the year. It will host workshops in the mathematical sciences and in cross-disciplines in which mathematics, computer science and statistics are used in deep and novel ways. Many workshops will be run in a format of 5 days with about 40 researchers (Oberwolfach/Luminy mode), but there will also be possibilities to have several groups in residence together

for longer stays in the Summers (Aspen mode) and some with other formats. The Banff center has also good facilities for workshops up to several hundred people.

Applications for workshops will be evaluated on a competitive international basis, using the criteria of excellence and relevance, by a scientific panel of experts drawn from across the entire breadth of the mathematical sciences.

Built around the industrial program of the Mathematics of Information Technology and Complex Systems NCE (MITACS) recently developed by the three Canadian mathematics institutes, BIRS will provide the ideal setting for a myriad of industrial activities in the mathematical sciences. In addition the International Research Station will make opportunities for programs devoted to education in the mathematical sciences.

The first Scientific Director of the Station is Robert V. Moody, who with the Scientific Advisory Board will oversee all the research and intellectual aspects of the BIRS program. The Board is comprised of up to 26 members representing a broad and expert coverage of the Mathematical Sciences and will include the directors of PIMS, MSRI, CRM, Fields and MITACS.

In addition to the substantial funds committed by the institutes, PIMS, Fields and CRM are applying for NSERC's support through the MFA program (Major Facility Access), while MSRI is applying to NSF for a supplement earmarked for the Banff station. PIMS is also counting on the support of the Alberta Ministry of Innovation and Science. Additional support is also expected from various industrial partners. To make the Station accessible to all mathematical scientists, regardless of their geographic location, a special effort will be made to secure a travel budget to support visiting scientists.

The President of the CMS, Jonathan Borwein, has offered his congratulations on the establishment of BIRS, adding that "the CMS looks forward to playing an active role in nurturing this wonderful new initiative."

LETTER TO THE EDITORS

It would be really nice to see the National Mathematics Camp listed as an upcoming event in the Calander of Events. The next camp is June 16th to 23rd, and is being held at Huron College in London on the UWO campus for the best 24 grades 8 to 10 stu-

dents in Canada. Students are selected on the results of various Mathematics Contests, mainly the Grade 10 Canadian Invitational.

It would also be good to see some mention of the camp in the Education Notes. I am the administrative director

of the camp, and I believe that it would be beneficial if members of CMS knew of the valuable work they are financing in conjunction with Imperial Oil, and that CMS is involved with helping budding mathematicians.

Tom Griffiths (Western)

RESEARCH NOTES

Ian Putnam, Column Editor

Crafoord Prize to Alain Connes



Alain Connes at the Fields Institute

The Royal Swedish Academy of Sciences has awarded the 2001 Crafoord Prize to Alain Connes of IHES and the Collège de France, Paris. Professor Connes was cited for “his penetrating work on the theory of operator algebras and for having been a founder of non-commutative geometry.”

Connes is counted among the world’s foremost mathematicians. He has made pioneering and unique contributions to the theory of operator algebras and non-commutative geometry. The latter is a new field of mathematics, in the creation of which Alain Connes has played a decisive part.

At the beginning of the 1930s the Hungarian-American mathematician John von Neumann started developing a theory for the algebras of operators in Hilbert space. He was inspired by developments in quantum mechanics where these algebras played a central part. Von Neumann delimited a particular type of such algebras, which mathematicians now term “von Neumann algebras,” together with a special type of building-block of which such algebras are formed, termed factors. Together with F. J. Murray, von Neumann roughly classified these algebras into three types, I, II and III. von Neumann later turned to other interests and it was not until the period between 1966 and 1971 that the development was resumed and many different type-III factors were constructed. It was here that Alain Connes entered the picture, in 1972. While a good deal of preparatory work had been done, during the next ten years Connes totally revolutionised this picture by solving most of the unsolved problems in the area. For this he was awarded the Fields Prize in 1983.

By further developing this theory, Alain Connes soon entered new, untrodden territory. An entirely new area of mathematics began to take shape: the non-commutative geometry. Geometry as it has developed from Descartes onwards is based on the notion of points in systems of coordinates. Geometric properties are reflected in algebraic properties of functions where points in space represent variables. The algebras that can be constructed in this way are usually commutative.

But in the study of the algebras of operators one often encounters non-commutative properties. Matrix multiplication is an example of something that is not normally commutative. Alain Connes’ idea is, using such a non-commutative algebra as a base, to consider it as an expression of a fictitious “non-commutative” space. Such a space requires a different and more abstract conceptual apparatus than what we are used to from classical geometry. The concept of point, for example, is meaningless in non-commutative geometry.

Alain Connes’ work has also provided powerful new methods useable in theoretical physics for treating e.g. renormalization theory and the standard model of quantum and particle physics. He has also demonstrated that these new mathematical tools can be used for understanding and attacking the Riemann hypothesis of the zeta function, considered the most famous open problem in mathematics.

Alain Connes, 53, was born in Draguignan (Var), France on 1 April 1947. He attended the Ecole Normale Supérieure (ENS) in Paris 1966-70. Since 1979 he has held the Léon Motchane Professorship at the Institut des Hautes Études Scientifiques (IHES) at Bures-sur-Yvette outside Paris, and since 1984 also a professorship in analysis and geometry at the Collège de France in Paris. He received the Fields Medal in 1983 and is a member of many scientific academies.

The 2001 Crafoord Prize will be presented by H.M. the King of Sweden on 26 September 2001 at a ceremony at the Royal Swedish Academy of Sciences in Stockholm. The prize consists of a gold medal and 500,000 USD.

The Anna-Greta and Holger Crafoord Foundation was established in 1980 for promoting basic research in mathematics, astronomy, the biosciences (particularly ecology), the geosciences and polyarthritis (joint rheumatism). The prize was awarded for the first time in 1982 in mathematics and has since been awarded by subject area in the order given above.

Earlier laureates in mathematics are Vladimir I. Arnold, Russia and Louis Nirenberg, USA (1982), Pierre Deligne, Belgium and USA and Alexandre Grothendieck, France (1988), and Simon Donaldson, England and Shing-Tung Yau, USA (1994).

from a Royal Swedish Academy of Sciences press release

EDUCATION NOTES

Ed Barbeau and Harry White, Column Editors

Mathematics camp of the AMQ

Each year a mathematics camp is offered to the 24 students at the college-level who scored highest on the college mathematics contest (which is offered in French and in English), administered by the Association mathématique du Québec. The goals of the camp are to have students who are talented in mathematics interact with professional mathematicians, to interest them in the various domains within mathematics, and to encourage them to pursue advanced study in the mathematical sciences or related disciplines. In this paper, I give some information about the history, organization, and financial aspect of these camps.

Objectifs et fonctionnement

Chaque année, les 24 étudiantes et étudiants qui se sont les mieux classés au concours collégial de mathématiques sont invités à participer gratuitement au camp mathématique de l'AMQ qui dure environ une dizaine de jours, et débute à la fin du mois de mai. Les objectifs poursuivis par le camp mathématique sont de mettre en contact des élèves doués pour les mathématiques avec des mathématiciennes et des mathématiciens professionnels; de les intéresser à différents domaines des mathématiques; de les encourager à poursuivre des études avancées en mathématiques en informatique, en sciences, en génie, en gestion. Les professeurs animateurs proviennent de différentes universités et présentent des sujets concernant des mathématiques fondamentales ou appliquées. Les sujets abordés incluent par exemple : la théorie des nombres, la topologie, l'algèbre, la combinatoire, la géométrie, les statistiques, les probabilités, les mathématiques financières, la programmation, l'utilisation des logiciels de calculs symboliques, *etc.* Durant la fin de semaine, il y a des activités telles que des visites de musées, ou de centres à vocation scientifique.

Historique

Les premiers camps ont eu lieu au Collège de Joliette de 1964 à 1967. Après une longue période d'absence due à des raisons financières, les camps ont repris en 1980, et se sont poursuivis sans interruption. De 1980 à 1989, c'est l'Université de Sherbrooke qui a accueilli le camp. En 1990, c'était au tour de l'Université du Québec à Chicoutimi. De 1991 à 1993, c'est l'Université Laval qui a pris la relève. De 1994 jusqu'en 1997, c'est à l'Université de Montréal que le camp a eu lieu. De 1998 à 2000, c'est l'Université du Québec à Trois-Rivières qui fut l'hôte du camp mathématique. En 2001, c'est l'Université du Québec à Montréal qui accueillera le camp.

Financement

Les campeuses et les campeurs sont logés dans les résidences de l'université hôte et les repas sont pris sur place de façon à encourager les interactions et l'esprit d'équipe. Les coûts directs (transport, logement, repas, excursions) et indirects (réceptions, photocopie, matériel, ...) s'élèvent à environ 500\$ par campeurs. Le financement est assuré par le Fonds Maurice L'Abbé auquel contribuent des entreprises privées ou coopératives, des universités, des collèges, et des dons personnels.

This year, the mathematics camp of the AMQ will be held at Université du Québec à Montréal from May 27 to June 7. Professor Pierre Bouchard is the camp organizer.

Brief Notes

US NRC Report

The National Research Council in the United States has just issued a report under the title *Adding it up: helping children learn mathematics*. It was prepared over a period of two years by a 16-member panel of mathematicians, mathematics educators, cognitive scientists and practitioners chaired by Jeremy Kilpatrick, a professor of mathematics education at the University of Georgia. Kilpatrick noted that it was necessary to move past the debate that pitted skills against understanding. The report offers a definition of mathematical proficiency that includes both conceptual understanding and procedural fluency. It emphasizes the importance of solving problems, thinking logically, and seeing mathematics as useful and worthwhile. The report has been praised for its emphasis on the teacher preparation.

The selection of the committee seems to have been done quite gingerly. The Mathematical Sciences Education Board, seen by some as soft on skills, was by-passed and an ad hoc Mathematics Learning Study Committee was created to take on the task, as well as an oversight committee for the selection of panelists and reviewers.

To access the report, visit the website www.nationalacademies.org, click on Publications and use the search engine.

Identifying outstanding teachers in the US

In the December, 2000 issue of the *NCTM News Bulletin*, there is an article on an assessment of the effectiveness of a decade-old teacher assessment program in the US. Since 1987, the National Board for Professional Teaching Standards (NBPTS) has certified 4804 teachers in 19 categories. Candidates have to submit a portfolio which includes

written and video-taped documentation of classroom instruction, as well as take a four-hour examination that probes their subject-matter knowledge and how topics should be taught to children. As well, they should possess a bachelor's degree and have taught for at least three years.

The Board has recently completed a study comparing the effectiveness of certified and non-certified teachers under the title of *Accomplished teaching: a validation of National Board Certification*. Recently retired and practising teachers evaluated sixty-five teachers, all of whom went through the certification process, but only thirty-one of whom successfully obtained certification.

In 11 or 13 key dimensions, certified teachers received higher mean scores; 74% of work samples from pupils of certified teachers reflected a high level of comprehension of topics taught as opposed to 29% for non-certified teachers; there was no significant difference in the professional involvement of the two groups outside of the classroom. The Board is planning further studies on the type of teacher that succeeds in being certified, how much parents know about the program, and the effects on student learning of certified teachers. The Board can be visited at www.nbpts.org/where.

Math Bridge

My wife heard an interview on the radio with Marc Busch of Queen's University that described an interesting school outreach program in mathematics, so I visited the website

<http://mathbridge.org/links.html> to get some more information. Math Bridge is a Queen's student organization that sends undergraduate and graduate students into elementary schools to mentor children in mathematics. They make a brief presentation, and then follow up alongside the teachers in small group work.

For a future issue, I hope to get further information on this and similar ventures, as I am sure that all over the country, there are similar projects being implemented. Perhaps the readers of this column would be willing to submit accounts of what is happening within their own areas.

Singapore mathematics

On March 4, 2001, the Boston *Globe* ran an article by Laura Peppano on the teaching of a curriculum developed by the Singapore Ministry of Education in certain US schools. The emphasis is put on mastering and then putting to use mathematical skills, and finally combining these skills in multi-stage problems. Early results indicate that pupils are able to handle mathematics to a depth not previously thought possible. In one pupil's opinion, "being harder makes it easier". The curriculum seems to engender greater class participation and self-confidence among the students, but there is some concern about the ability of some teachers to handle the material. The textbooks apparently are quite inexpensive. This is a development worth following.

(PRESIDENT—continued from page 1)

that formed a fitting conclusion to our many activities in World Math Year 2000. It was hosted by the University of British Columbia which has a long and distinguished record of hosting CMS and other mathematical conferences. As with all our activities, our meetings rely on a great deal of local effort for which I express the Society's gratitude.

I wish also to acknowledge the generous support of the National Programme Committee of the three Canadian Research Institutes (Fields, CRM and PIMS) and the Mathematics of Information Technology and Complex Systems Network (MITACS–NCE) at both of our annual meetings.

Let me highlight some of the Society's recent activities, for the most part avoiding things described in other Reports.

Olympiad and Putnam

In June, during our Summer meeting, I had the good fortune to attend the twentieth anniversary reunion of Canadian participation in the International Mathematical Olympiad, in Toronto. More than 60 of our 86 former team members were present, which certainly evidences how significant an event participation in the IMO is for most team members. On July 4, I was also present at the annual team send off at Simon Fraser. The six students who represented Canada in Seoul, South Korea from July 16-25 collected a gold, two silver, and

one bronze medals and finished 17th out of 82 competing nations. David Arthur from Upper Canada College, the gold medalist, was 7th out of 461 contestants.

Similarly, let me record our spectacular national performance on the 1999 Putnam Competition in which three of the top ten teams and three of the top six individuals (7 of 25) were Canadian. A recent MAA Monthly notes that in the past decade there have been 8 Canadian Putnam Fellows and only two from US public universities. As I write, we eagerly attend the 2000 results. Perhaps not surprisingly former Olympiad team members did very well. At the SFU send off I emphasized, for the media and administrators present, what a strong endorsement of Canadian undergraduate mathematics education the entire suite of results represented.

Publications and Electronic Information

Our publications continue to do well in an uncertain and increasingly digital world. All the Society's journals are now "fully online". We have to make very significant decisions, this coming year, such as how best to integrate our electronic and paper publishing; and whether to scale up or down our present spectrum of publishing activities.

An ad-hoc subcommittee was struck in October (chaired by Tom Salisbury) to consider these matters further. We shall return to these questions and others throughout 2001. I record

that a small technological step was taken when, on November 30, 2000, the Executive, held a very productive two hour phone meeting for the first time – as a precursor to a much briefer than usual meeting at the CMS Winter Meeting. We shall try to do this more frequently.

In the publishing context, we are exploring ways of assisting or collaborating with the new European Mathematics Press in the process of co-development, producing, hosting and distributing their electronic journals. We have also been engaged in various discussions with the Euclid project (based at Cornell, which has significant Sloane foundation funding to assist mathematics journals in going digital), and with CISTI-NRC Press about prospective joint ventures. The CMS has now completed the move of its CMS Books in Mathematics series to Springer New York, and the first ten volumes are now published or in press. There were four titles on sale (and meaningful sales figures) at the Winter Meeting where Springer hosted a reception. Reviews will I am sure, continue to appear in the CMS Notes.

In June 2000, the CMS launched a parallel series of shorter books CMS Tracts in Mathematics to be published by the American Mathematical Society, edited by Ken Davidson and Cam Stewart from the University of Waterloo. Each of these series hopes to publish broadly and we invite members of other Canadian mathematical science societies to consider publishing their work through these vehicles. Guidelines for authors are nearing completion in the TeX office. Early adherence to these guidelines by authors dramatically reduces the pain of producing a book for the author and publisher.

Our many other publications continue to prosper but all need vigorous marketing and distribution – perhaps by third parties. This is clearly true of our "A Taste of Mathematics" (ATOM) work booklets for high school students. This is an excellent series that has a large market potential outside our usual audience.

Combined Membership List

The Board in December agreed to having our membership list integrated with or appended to the Combined Membership List of the AMS/MAA/SIAM. This could start in 2002 if all technical issues are resolved. We shall of course maintain our own CMS list. I note in passing, that as CMS President, I sit as an observer on AMS Council, and so am invited to a number of meetings, but in my judgement attendance at the Combined Meetings in January only is usually adequate.

Women in Math

At the Winter Meeting we were able to release a very well received Women in Mathematics poster. Co-sponsored by Waterloo Maple, the poster celebrates the achievements of Canadian women mathematicians. It is being mailed to all Canadian high schools.

Advancement of Mathematics

One of the task-force recommendations, in the review brought to completion by my predecessors, was to establish a Promotion of Mathematics Committee. We are now thinking of building a *Committee for the Advancement of Mathematics*, with fund raising overseen by a sub-committee of this new committee. This would seem to appropriately reflect the constant need to raise funds with the primary goal of working to advance mathematics. In this setting, CMS has just received \$68,100 over three years from NSERC's new PromScience program to assist with its outreach and public awareness activities. National Science Organization

The Secretary of State for Science convened a two day meeting in Aylmer, Quebec (Oct 4-5, 2000) to discuss the desirability of establishing a free standing Canadian Academy. Keith Taylor, who represented the CMS at this meeting, and I jointly responded to an online questionnaire prior to the meeting. The initiative seems serious and fairly advanced. Given the recent election results we might well see the emergence of such an organization, and of significant funding for a more vigorous Royal Society of Canada.

IMU: ICM and CEIC

The elaborate process of preparing for next International Congress of Mathematicians in Beijing in 2002 is underway and we are intent to arrange a Canadian reception at the Congress, hopefully at the Embassy. This will be jointly sponsored by the MITACS research network and the three institutes.

More substantively, I sit, as deputy chair, on the IMU's Committee on Electronic Information and Communication. The CEIC (www.math.ceic.ca) continues to make slow, but hopefully steady, progress on its charter, on issues of meta-data, digital publishing, copyright and intellectual property. We met in Vienna, from October 5-7. The CMS co-sponsored the previous meeting in Berkeley in December 1999. In addition to writing a detailed report for the IMU Executive in Beijing, the principal goal is the development of a worldwide MathNet that allows one to obtain information about mathematicians and mathematics. The two primary steps are the installation of "secondary home pages" (institutional, departmental, and individual) and the integration of preprint services.

In Conclusion

As will be clear from my report, the Executive Director's and all the committee reports, the Society is for the most part thriving. In addition to the activities mentioned above, I finish by observing that 2001 will see an increased emphasis on fund raising, on membership recruitment, and on joint initiatives with other societies and groups. Finally I should add my personal thanks to my predecessor, Richard Kane, who completes four years of truly distinguished service to the CMS in June of 2001.

AWARDS / PRIX

PIMS Awards Prizes for 2000

The first annual PIMS Prizes in Education, Research and Industrial Outreach were awarded on December 10 at a Banquet held at the UBC University Centre. The prizes, valued at \$3000 each, were donated by the Toronto Dominion Bank Financial Group and TD Securities.

The **PIMS Education Prize** rewards individuals who have played a major role in encouraging activities which have enhanced public awareness and appreciation of mathematics, as well as fostering communication among various groups and organizations concerned with mathematical training at all levels. It was awarded to **George Bluman**, who is the chair of the UBC Math Department. George Bluman's lifetime commitment to mathematics education in British Columbia, both in the public school system and at the University of British Columbia, make him an outstanding recipient for the PIMS Education Prize. Many aspects of his activities were highlighted by his nominees, including: providing stimulating mathematics experiences for students, through the Euclid contest and various school workshops; supporting math teachers in the schools; working to raise and maintain high standards in the school system; developing a healthy dialogue with the BC Ministry of Education; encouraging math students at UBC to pursue careers in teaching; and encouraging a strong commitment to teaching at UBC.

Typical of his activities and impact is his over-twenty-year involvement with the Euclid contest as the BC and Territories organizer for this high school enrichment contest in mathematics. George supports the idea that the Euclid contest is an event every Math 12 student should be able to enter and, in doing so, feel a sense of accomplishment. Beyond organizing the contest, he has developed three levels of School Workshop programs which give students (elementary, junior high, and senior high) the opportunity to participate in problem solving workshops with university faculty and students. BC enjoys the highest level of participation, per capita, in the Euclid contest and its universities benefit from the excellent preparation these students receive through the program. In the words of the nominators, much of the BC success in Euclid can be directly attributed to George's efforts.

George personally knows most of the mathematics teachers from around the province and uses this network to provide a dialogue between the BC secondary school system and the universities. He has been tracking high school students' performance at university for over twenty year, and often makes personal phone calls or writes to high schools to give suggestions on how to improve their students' performance. Again, his nominators attest to the positive impact his work has had on the designs, and successes, of their mathematics program. The scope and magnitude of his service to mathematical ed-

ucation over the past twenty years is phenomenal.

The **PIMS Research Prize** is given for a particular outstanding contribution to the mathematical sciences, disseminated during the past five years. It was awarded to **Terry Gannon** of the Dept. of Mathematical Sciences, University of Alberta. Terry's accomplishments cover two separate directions, both of which have won him international recognition. The first accomplishment is his work on the "Moonshine Conjectures", which concern a fantastic connection between the representations of the Monster Group and certain classes of modular forms. Richard Borcherds was awarded the Fields Medal in 1998 for his proof of these conjectures. However, Borcherds' proof contained one part that was non-conceptual and had to be shown by brute force computation. Terry provided a conceptual argument to replace this computation. The second and more extensive of Terry's accomplishments concerns the classification of two-dimensional conformal field theories. The problem involves determining all modular invariants which can be constructed from characters of the representations of the underlying affine Kac-Moody Lie algebras. The first success in classifying two-dimensional conformal field theories was the A-D-E classification of Capelli, Itzykson and Zuber for affine- $SU(2)$. In 1994, Terry discovered a solution to the affine- $SU(3)$ problem and has since made enormous advances towards a solution of the general problem.

In describing his research, Terry states, "My bias as a mathematician is toward breadth. Most mathematicians, it seems, try to strike oil by drilling deep wells. This strategy makes a lot of sense. But actually I'm more drawn towards half-completed bridges and wobbling fences. The theory in those places is relatively undeveloped, so there's a lot of basic results still open. And I get a little restless staying too long in one place."

"Some of my work which attracted a little attention was in an area called Monstrous Moonshine. It was noticed that $196\,884$ –the first interesting coefficient of a function (the j -function) important to classical number theory– equals $1 + 196\,883$, the sum of the first two dimensions of representations of a very special symmetry (the Monster group). The second, third,... coefficients of that function were likewise related to the higher dimensions. The challenge was to explain what that classical number theory had to do with this newly discovered symmetry. A bridge had to be built! Borcherds did most of the work, and for this was awarded a Fields Medal in 1998. He showed that there's a new and very complicated algebraic structure (a vertex operator algebra) whose symmetry is that Monster group, and whose 'graded dimension' is the j -function. If we twist the graded dimension by various elements of the Monster, we get other special functions (Hauptmoduls) of classical number theory. The best known way to show this is by a theorem I found with Chris Cum-

mins.”

“But much of my work thus far has occurred near a certain wobbling fence separating math from physics. String theory, or more precisely, conformal field theory (CFT), was created by physicists for their own shady purposes, but its impact has been far greater in math. Five of the twelve Fields medals awarded in the 1990s were to men whose work directly concerned CFT (namely, Drinfeld, Jones, Witten, Borchers, Kontsevich). I’ve tried to clarify some of the algebra and number theory in CFT, but mostly I’ve been working towards the classification of all CFTs related to a class of infinite symmetries called Kac-Moody algebras. These CFTs seem to be the fundamental ones, and their classification is uncovering unexpected (and unexplained!) links with other areas of math. I hope to complete this classification within the next couple years.”

The **PIMS Industrial Outreach Prize** recognizes indi-

viduals who have employed mathematical analysis in the resolution of problems with direct industrial, economic or social impact. The prize was awarded to Dr. Huaxiong Huang (York), John Stockie (University of New Brunswick), Keith Promislow (SFU) and Brian Wetton (UBC). This team of researchers are part of the PIMS-affiliated Mathematical Modeling and Scientific Computation Group in MITACS. They are working with Ballard Systems, the world leader in hydrogen fuel cell design, to develop models to help Ballard improve the efficiency and durability of fuel cells.

Using parabolic poles, they modeled the reactant gas flow through the Gas Diffusion Electrode (GDE), a layer of porous, conducting material on either side of the catalyst and membrane in the fuel cell. Mathematical analysis of the models highlighted the sensitivity of fuel cell performance to certain GDE parameters, giving insight into the performance of various possible GDE materials.

FROM THE INSTITUTES

Industrial Mathematics Month at PIMS

The Pacific Institute for the Mathematical Science (PIMS) invites researchers, graduate students and senior undergraduates to participate in the following succession of scientific events in Industrial Mathematics:

June 4-8: PIMS-MITACS Workshop on Modeling of Fuel Cells, PIMS at Simon Fraser University:

Organized by the MMSC-MITACS team led by Brian Wetton (UBC) and Keith Promislow (SFU) in conjunction with the “PIMS Center for Scientific Computing” led by Bob Russell (SFU)

June 9-10: PIMS-MITACS Workshop on Inverse Problems and Imaging, PIMS at the University of British Columbia:

Organized by the POTSI-MITACS team led by Michael Lamoureaux and Gary Margrave (U. Calgary) in conjunction with the “PIMS Center for Inverse Imaging and applications” led by Gunther Uhlman (U. Washington)

June 11-15: 4th PIMS Graduate Mathematics Modelling Camp, University of Victoria

June 18-22: 5th PIMS Industrial Problem Solving Workshop, University of Washington:

Organized by Chris Bose (U. Victoria), Randy LeVeque (U. Washington), Huaxiong Huang (York U.), Mark Paulhus (U. Calgary), Keith Promislow (SFU) Ian Frigaard (UBC).

For details please consult the webpage

<http://www.pims.math.ca/industrial>

PIMS Nonlinear PDE Mini-courses

Mini-courses to be offered during the thematic program on nonlinear pde, 2 July–18 Aug 2001, are as follows:

1. Takis Souganidis (Austin): 5 lectures on “Fully nonlinear stochastic PDEs”.

2. Craig Evans (Berkeley): 2 lectures on “Hamilton-Jacobi equations and dynamical systems”.

3. T. Zariphopolu (Austin): 2 lectures on “Viscosity Solutions in Finance”.

4. Andrzej Swiech (Georgia Tech): 5 lectures on “Viscosity solutions in infinite dimensional spaces and optimal control of PDEs”.

5. Pierre-Louis Lions (Paris): 3 lectures “TBA”.

6. Henri Berestycki (Paris): 4 lectures on “Propagation of fronts in excitable media”

7. David Kinderlehrer (Carnegie-Mellon): 4 lectures on: “TBA”.

8. Michael Struwe (ETH): 4 lectures on “Concentration problems in two dimensions”.

9. Wei-Ming Ni (Minnesota): 4 lectures on “Diffusions, cross-diffusions and their steady states”.

10. Fang-Hua Lin (Courant Institute): 4 lectures on “Vortex Dynamics of Ginsburg-Landau and related equations”.

11. Yann Brenier (Paris): 4 lectures on “Variational problems related to fluid and plasma modelling”

12. Eric Sere (Paris): 3 lectures on “Variational problems in relativistic quantum mechanics: Dirac-Maxwell equations”

13. Maria Esteban (Paris): 3 lectures on “Variational problems in relativistic quantum mechanics: Dirac-Fock equations”

14. Cliff Taubes (Harvard): 4 lectures on “Pseudoholomorphic geometry as a tool to study smooth 4-dimensional manifolds”.

15. Gang Tian (MIT): 4 lectures on “Recent progress in Complex Geometry”

16. Rick Schoen (Stanford): 4 lectures on “TBA”.

For more details please consult www.pims.math.ca/pde/

Arithmetic, Geometry and Physics around Calabi–Yau Varieties and Mirror Symmetry

A Workshop at the Fields Institute for Mathematical Sciences

Toronto, Canada
July 23–29, 2001

The organizing and scientific committee of the workshop consists of:

Victor Batyrev (University of Tübingen),
Shinobu Hosono (University of Tokyo),
James D. Lewis (University of Alberta),
Bong H. Lian (Brandeis University),
Noriko Yui (Queen’s University), and
S. T. Yau (Harvard University) (will serve as a scientific advisor to the committee).

The goal of the Workshop is to bring together to the Fields Institute experts, recent Ph.D.’s and graduate students, working (studying) in physics, geometry and arithmetic around Calabi–Yau varieties and mirror symmetry, and to exchange ideas and learn the subjects first-hand mingling with researchers with different expertise. We expect these interactions to lead to progress in solving open problems in mathematics and physics as well as to pave way to new developments.

Workshop schedule: We plan to have invited speakers deliver introductory lectures which will be scheduled in the mornings. The afternoon lectures will be mostly allotted for contributed talks on recent developments. These lectures will roughly be classified into five groups:

- I. Toric Geometry and Mirror Symmetry (chaired by V. Batyrev)
- II. Periods, GKZ Hypergeometric Systems and Mirror Symmetry in Calabi–Yau Manifolds (chaired by S. Hosono and B. Lian)
- III. Regulators of Algebraic Cycles on Calabi–Yau Manifolds and Mirror Symmetry (chaired by J. D. Lewis)
- IV. L -series of Calabi–Yau Varieties and Mirror Symmetry (chaired by N. Yui)
- V. Mirror Principle (S.-T. Yau)

Expected participants: Mathematicians and physicists in Canadian institutions who are interested in the workshop are all welcome.

From outside Canada, the following mathematicians and theoretical physicists have confirmed their participation in the workshop, as of February 28, 2001: P. L del Angel (Mexico), A. Collino (Torino), I. Dolgachev (Michigan), B. van Geemen (Pavia), S. Mueller-Stach (Essen), X. de la Ossa (Oxford), M.-H. Saito (Kobe), J. Stienstra (Utrecht).

Recent Ph.D.’s expected at the workshop include: P. Brosnan (UC Irvine), K. Consani (Toronto), C. Doran (Columbia), Y. Goto (Hokkaido U. Education), K. Kimura (Chicago), P. Owen (Duke), J. Scholten (Nijmegen), H. Verrill (Copenhagen).

Proceedings: The scientific committee is hoping to publish the Proceedings of the workshop.

Further details can be found
<http://www.fields.utoronto/programs/scientific/01-02/cyms>

DU BUREAU DU PRÉSIDENT

(see page 1 for the English version)

Reprise générale

L'an 2000 a été une année très occupée et généralement très réussie à la Société, tant au niveau organisationnel, intellectuel que financier. À titre de président, j'ai constaté, par la force des choses, mais avec grand plaisir, l'ardeur au travail et l'efficacité du personnel de notre bureau administratif, ainsi que le grand nombre d'activités auxquelles participe la Société.

Je ne pourrai suffisamment insister sur la qualité des services que la Société reçoit d'un si grand nombre de bénévoles. Leur participation à l'examen auquel nous venons de nous livrer est un parfait exemple de cette contribution. Que nous nous comparions à d'autres associations canadiennes ou à des sociétés mathématiques étrangères, nous pouvons être très fiers du nombre et de la qualité de nos activités : Réunions et remises de prix annuelles, programme dynamique de publication, concours commandités pour élèves du secondaire et camps de mathématiques (il y en a eu huit cette année dans six provinces), concours de bourses du fonds de dotation (qui finance, pour la deuxième année, toute une gamme de projets très intéressants) et plus encore. Pour de plus amples renseignements sur le concours, visitez le site de Camel au www.smc.math.ca/Grants/.

Le congrès conjoint Math 2000, qui a connu un franc succès, est certes l'une des activités qui ont le plus marqué la dernière année. Ce congrès (www.cms.math.ca/Events/summer00/), tenu à l'Université McMaster, qui avait partagé l'organisation avec l'Université de Waterloo, fut certainement l'un de nos plus importants jamais tenus au Canada. Il a en effet attiré plus de 500 participants (dont 497 inscrits) et offert une douzaine de conférences principales sur des sujets variés. Quantité d'autres activités tout aussi réussies ont donné lieu à une semaine mathématique sans précédent au Canada.»

Comme le montre la liste des sociétés participantes et des conférences présentées à ce congrès (dans des domaines aussi variés que la génomique – un conférencier de Celera nous a décrit le génome de drosophile –, la théorie du contrôle, l'imagerie, la biostatistique, le chiffrement, la logique, la géométrie symplétique et l'histoire des mathématiques) et à nos autres réunions, nous sommes réellement en mesure de jouer un rôle clé dans le milieu des sciences mathématiques en général.

Ce congrès a été suivi d'une Réunion d'hiver tout aussi diversifiée et stimulante (www.cms.math.ca/Events/-winter00/), qui a terminé en beauté notre série d'activités dans le cadre de l'année internationale des mathématiques. Notre hôte, l'Université de la Colombie-Britannique (UBC), avait déjà accueilli avec brio plusieurs Réunions de la SMC et autres congrès ou rencontres mathématiques. À l'instar

de toutes nos activités, le succès de nos Réunions dépend en grande partie du travail de l'équipe locale, que je remercie sincèrement au nom de la Société. Je tiens également à souligner le généreux appui du Comité du programme national des trois instituts de recherche (Fields, CRM et PIMS) et du Réseau de centres d'excellence MITACS à nos deux congrès annuels.

Quelques points particuliers

Voici maintenant certaines de autres activités récentes de la Société. J'essaierai, dans la mesure du possible, de ne pas répéter les éléments déjà mentionnés dans d'autres rapports.

Olympiades et Putnam

En juin, à l'occasion de notre Réunion d'été, j'ai eu la chance d'assister aux retrouvailles soulignant le 20^e anniversaire de la participation du Canada à l'Olympiade internationale de mathématiques (OIM), à Toronto. Plus de 60 anciens participants sur 86 étaient de la partie, ce qui illustre bien l'importance que revêt une participation à l'OIM pour la plupart des membres. Le 4 juillet, j'ai aussi assisté à la réception annuelle tenue à l'Université Simon Fraser pour souligner le départ de l'équipe vers l'OIM. Les six élèves qui ont représenté le Canada à Séoul (Corée du Sud) du 16 au 25 juillet derniers, ont rapporté une médaille d'or, deux d'argent et une de bronze, et ont terminé au 17^e rang sur 82 pays en lice. Le médaillé d'or, David Arthur (collège Upper Canada), s'est classé 7^e sur 461 participants.

Je tiens à souligner à nouveau les résultats exceptionnels de nos représentants au concours *Putnam* 1999. En effet, trois des dix meilleures équipes et trois des six meilleurs concurrents (7 sur 25) étaient canadiens. Dans un bulletin mensuel de la MAA publié récemment, on lisait qu'au cours des dix dernières années, huit étudiants canadiens ont reçu une bourse Putnam contre seulement deux étudiants d'universités publiques américaines. Au moment où j'écrivais ces lignes, nous attendions avec impatience les résultats du concours 2000. Il n'est pas très étonnant que les anciens membres de l'équipe de l'OIM aient très bien réussi. Comme je l'ai dit aux membres des médias et aux administrateurs présents à la réception organisée en l'honneur du départ des participants pour l'OIM, les résultats obtenus par des Canadiens aux divers concours témoignent admirablement bien de la qualité de l'enseignement des mathématiques au premier cycle dans les universités du pays.

Publications et documents électroniques

Nos publications continuent de faire bonne figure à une époque d'incertitude où le numérique gagne toujours en popularité. Toutes les revues de la Société sont désormais entièrement en ligne. Nous devons prendre d'importantes décisions cette année. Par exemple : Comment intégrer au mieux nos publications électroniques et imprimées? Faut-il élargir ou réduire la gamme de nos activités de publication actuelles?

En octobre, un sous-comité spécial (sous la présidence de Tom Salisbury) a été chargé du dossier. Nous réexaminerons ces questions et d'autres dans le courant de l'année 2001 dans ces pages. Je note une petite amélioration technologique dans la conduite de nos délibérations. En effet, le comité exécutif s'est réuni pour la première fois en conférence téléphonique le 30 novembre 2000. La séance dura deux heures et s'avéra fort productive, prélude à une rencontre beaucoup plus courte que d'habitude à la Réunion d'hiver de la SMC. Nous tâcherons de répéter l'expérience plus souvent.

Dans le dossier des projets de copublication, nous examinons différentes façons d'appuyer le nouvel éditeur European Mathematics Press ou de collaborer avec lui dans le codéveloppement, la production, l'hébergement et la distribution de ses revues électroniques. J'ai aussi eu quelques occasions de discuter de projets conjoints avec le projet Euclid (basé à Cornell et bénéficiaire d'un appui substantiel de la fondation Sloane pour aider les revues mathématiques à se mettre au numérique) et avec les presses du CNRC-ICIST.

La SMC a maintenant terminé le transfert de la collection *Ouvrages de mathématiques de la SMC* de Wiley and Sons à Springer New York. Les dix premiers volumes sont déjà publiés ou en voie de l'être. Quatre titres étaient en vente (succès intéressant) à la Réunion d'hiver, où Springer a donné une réception. J'ai bon espoir que l'on continuera d'en lire les critiques dans ces pages.

En juin 2000, la SMC a lancé une collection parallèle d'ouvrages plus courts, les *Traité de mathématiques de la SMC*, qui seront publiés par l'American Mathematical Society, sous la direction de Ken Davidson et de Cam Stewart, de l'Université de Waterloo. Ces deux collections voient grand, et nous devrions inviter les membres d'autres sociétés mathématiques canadiennes à y publier leurs travaux. Le bureau TeX achève la préparation des fichiers de style et des guides de l'auteur. En s'y conformant d'office, les auteurs allégeront considérablement le fardeau de la production de leurs ouvrages, tant pour eux-mêmes que pour l'éditeur.

Nos nombreuses autres publications continuent à faire bonne figure, mais elles ont toutes besoin d'un grand coup de marketing et d'un réseau de distribution (peut-être des tierces parties). Cette constatation est particulièrement vraie dans le cas de notre collection de livrets destinés aux élèves du secondaire : «Aime-t-on les mathématiques» (ATOM). Il s'agit en effet d'une excellente collection qui a un très grand marché potentiel en dehors de notre auditoire habituel.

Répertoire combiné des membres

Le Conseil a résolu en décembre d'intégrer ou d'annexer son répertoire des membres au répertoire combiné AMS/MAA/SIAM. Cette pratique pourrait commencer en 2002 si l'on parvient à résoudre toutes les questions techniques. Évidemment, la SMC continuera de tenir son propre répertoire des membres. Je souligne au passage que, en ma qualité de président de la SMC, je siège comme observateur

au conseil de l'AMS, ce qui me vaut des invitations à de nombreuses réunions. En règle générale, cependant, il me semble convenable de n'assister qu'à la réunion mixte de janvier.

Les femmes en mathématiques

À la Réunion d'hiver, nous avons enfin dévoilé une affiche intitulée «Les femmes en mathématiques», qui a été très bien reçue. Cofinancée par Waterloo Maple, elle souligne l'apport des mathématiciennes canadiennes et sera distribuée dans toutes les écoles secondaires du pays.

L'avancement des mathématiques

L'une des recommandations du groupe de travail portait sur la création d'un comité de promotion des mathématiques. Nous songeons à présent à établir un Comité pour l'avancement des mathématiques. La recherche de financement serait prise en charge par un sous-comité de ce nouveau comité. À cet égard, la SMC vient de recevoir pour ses activités de sensibilisation un financement triennal de 68 100 \$ du nouveau fonds du CRSNG pour la promotion de la science.

Vers un organisme scientifique national?

Le secrétaire d'État à la science a convoqué une assemblée de deux jours à Aylmer (Québec) les 4-5 octobre 2000 pour discuter de la création éventuelle d'une académie autonome des sciences au Canada. Keith Taylor, qui a représenté la SMC à cette occasion, et moi-même avons répondu à un questionnaire en ligne en prévision de cette assemblée. L'initiative paraît sérieuse et relativement avancée. L'issue des récentes élections rend plus vraisemblable la création prochaine d'un tel organisme et la mise à disposition d'un financement substantiel pour dynamiser la Société royale du Canada.

UIM: ICM et CEIC

La grande «machine organisationnelle» du prochain congrès de l'UMI, qui aura lieu à Beijing en 2002, s'est mise en branle. Le Canada espère tenir une réception dans le cadre du congrès, possiblement à l'ambassade, en collaboration avec le réseau MITACS et les trois instituts.

J'assume en outre la vice-présidence d'un comité de l'information et des communications électroniques de l'UMI. Ce comité (www.math.ceic.ca) progresse lentement, mais sûrement (du moins nous l'espérons) en ce qui concerne la rédaction de sa charte, les questions liées aux métadonnées, la publication électronique, les droits d'auteur et la propriété intellectuelle. Le comité s'est réuni à Vienne, du 5 au 7 octobre. La SMC a commandité la réunion précédente, qui a eu lieu en décembre 1999 à Berkeley. En plus de rédiger un rapport détaillé qui sera présenté au Comité exécutif de l'UMI à Beijing, le principal objectif du comité consiste à développer un réseau mondial, *MathNet*, où l'on pourrait trouver de l'information sur les mathématiciens et les mathématiciennes. Les deux premières étapes sont la création de «pages d'accueil secondaires» (pour établissements, départements et individus) et l'intégration de services de prétrirage.

Conclusion

Comme il ressort clairement de mon rapport, de celui du

directeur administratif et de ceux des comités, la Société est généralement en excellente santé. En plus des activités susmentionnées, j'aimerais également mentionner qu'on verra, en l'an 2001, une intensification des efforts de financement, de recrutement de membres et des projets en collaboration

avec d'autres groupes et sociétés. J'aimerais enfin remercier personnellement mon prédécesseur, Richard Kane, qui a terminé, en juin 2001, quatre années vraiment remarquables à la tête de la SMC.

Canadians Shine in Putnam Contest

The University of Toronto team, consisting of Jimmy Chui, Pavel T. Gyrya and Pompiliu Manuel Zamfir, took fifth place in the Putnam Competition written on December 2, 2000, thus qualifying for a team prize of \$5000 and individual prizes of \$200. Pavel Gyrya was the only Canadian student to rank among the top twenty-five. Other Toronto students also performed well, including David P. Varodayan who received honorable mention, and Karol Gregor.

The University of Waterloo team, consisting of Sabin Cautis, Richard M. Hoshino and Joel Kamnitzer, placed among the second five teams and gained honorable mention. Richard Hoshino and David Nicholson both received honorable mention; Keon Choi University of Waterloo also received

a high standing.

Pierre Levan of the University of Ottawa and Michael Ludkovski of Simon Fraser University also received recognition for fine performances. In all 29 students from 12 Canadian universities placed in the top 200 or so places. The first-ranking school overall was Duke University, followed by Massachusetts Institute of Technology, Harvard University and California Institute of Technology. There are two Putnam fellows each from Harvard and MIT and one from the University of California, Berkeley. Students needed to place among the top sixty to obtain honourable mention.

The Society extends its congratulations to all of these students for their achievement.

Réunion d'hiver 2001 de la SMC du 8 au 10 décembre

Toronto Colony Hotel Toronto (Ontario)

Voici le programme provisoire de la Réunion d'hiver 2001 de la Société mathématique du Canada. La première annonce paraîtra dans le numéro de septembre 2001 des *Notes de la SMC* et sur notre site Web: <http://www.cms.math.ca/Events/winter01>.

HÔTE : Département de mathématiques et statistiques, Université York.

PRIX : Conférence Coxeter-James, **Kai Behrend** (UBC), Prix Adrien-Pouliot, Prix de Doctorat.

SYMPOSIUMS : **Systèmes dynamiques**, Org: Bill Langford (Guelph) et Jianhong Wu (York) ; **Probabilités libres** Org: Andu Nica (Waterloo) ; **Algèbres de Kac-Moody**, Org: Yun Gao (York) et Nantel Bergeron (York) ; **Analyse non-linéaire**, Org: Robert McCann (Toronto) ; **Enseignement des mathématiques**, Org: Pat Rogers (York).

DIRECTEUR DE RÉUNION : Tom Salisbury (York).

LOGISTIQUE LOCALE : Stanley Kochman (York).

2001 ENDOWMENT GRANTS COMPETITION

CONCOURS DE BOURSES DU FONDS DE DOTATION 2001

CALL FOR PROPOSALS / APPEL DE PROPOSITIONS

The Canadian Mathematical Society is pleased to announce a new grants competition to fund projects that contribute to the broader good of the mathematical community. A portion of the annual income from the CMS Endowment Fund will be used to fund such projects and an Endowment Grants Committee (EGC) will administer the distribution of the grants and will adjudicate proposals for projects.

Proposals must address the goal and statement of purpose of the Canadian Mathematical Society:

The goal of the Canadian Mathematical Society is to support the promotion and advancement of the discovery, learning, and application of mathematics. The CMS Statement of Purpose is:

1. To unify and support Canadian mathematicians through effective communication, broad membership, sponsorship of diverse activities, and partnerships with like professional societies.
2. To support mathematics research through the communication of current research to both the specialist and non-specialist, public recognition of research accomplishments and collaboration with the research institutes and granting agencies.
3. To support the advancement of mathematics education through joint projects with mathematics educators at all levels, promotion of educational advancements, and partnerships with provincial ministries of education and organizations supporting mathematics education.
4. To champion mathematics through initiatives that explain, promote and increase the general understanding of mathematics, provide extra-curricula opportunities for students, and encourage partnerships with corporate, government and not-for-profit agencies.

An applicant may be involved in only one proposal per competition as a principal applicant. Proposals must come from CMS members, or, if joint, at least one principal applicant must be a CMS member.

The EGC will consider funding proposals for a maximum of three years. However, multi-year proposals must be funded from the funds available to the EGC in the year of application. The EGC will consider funding proposals to a maximum of \$5,000 per year.

The EGC committee intends to favour proposals where CMS funds can be leveraged or where proposals have no other natural funding body to which to apply.

If it is anticipated that a proposal will generate something of lasting financial value, proposers must indicate that this is the case and declare their intent with respect to that value.

An application form, advice and directions are available at the CMS website www.cms.math.ca/Grants/. Proposers will have ample opportunity to sell their ideas to the EGC.

We hope to be able to have an applicant fill out the application on an HTML form and submit it electronically. If that does not work, we will accept a hard copy as an e-mail attachment using either the Microsoft Word template or the \LaTeX template available for downloading from the CMS web site given above. Send the proposal as an attachment to the e-mail address chair-egc@cms.math.ca. We would also accept a proposal in these templates sent as hard copy to the CMS Executive Office. If you have any immediate questions on the program or the application process please e-mail the Chair of the EGC, J. G. Timourian, at chair-egc@cms.math.ca. If you plan on applying, the committee would find it extremely useful if you sent the Chair an e-mail expressing your interest as soon as possible.

Proposals must be received at the CMS Executive Office or electronically by the EGC committee no later than **September 30, 2001**.

Proposals should be sent to the following address:
 2001 CMS Endowment Grants Competition
 Canadian Mathematical Society
 577 King Edward, Suite 109
 P.O. Box 450, Station A
 Ottawa, Ontario
 K1N 6N5

Again, the relevant electronic addresses are www.cms.math.ca/Grants/ for directions, forms, advice and electronic form submission; chair-egc@cms.math.ca for e-mail contact with the Chair of the EGC and for submission of a proposal as an attached file to an e-mail.

La Société mathématique du Canada (SMC) est heureuse d'annoncer la tenue d'un nouveau concours de bourses pour le financement d'activités qui contribuent à l'essor global de la communauté mathématique. Une partie des recettes annuelles tirées du Fonds de dotation de la SMC servira à financer de telles activités. Le Comité d'attribution des bourses

du fonds de dotation (CABFD) se chargera d'évaluer les propositions et d'attribuer les bourses.

Les propositions doivent être conformes à l'objectif et à l'énoncé d'intention de la SMC :

La Société mathématique du Canada s'est donnée pour objectif de promouvoir et de favoriser la découverte et l'apprentissage des mathématiques, et les applications qui en découlent. Son énoncé d'intention est le suivant :

1. Regrouper et appuyer les mathématiciens canadiens en favorisant la communication et l'adhésion à grande échelle, en commanditant diverses activités et en établissant des partenariats avec des associations professionnelles semblables à la nôtre.
2. Encourager la recherche mathématique en diffusant les résultats de recherches en cours aux spécialistes et aux non-spécialistes, en faisant reconnaître publiquement les travaux de chercheurs et en collaborant avec les instituts de recherche et les organismes subventionnaires.
3. Favoriser l'apprentissage des mathématiques en réalisant des projets avec des professeurs de mathématiques de tous les niveaux, en faisant connaître les progrès dans l'enseignement et en établissant des partenariats avec les ministères de l'éducation provinciaux et les organismes voués à l'apprentissage des mathématiques.
4. Défendre les mathématiques en créant des initiatives visant à expliquer, à promouvoir et à mieux faire connaître la discipline, en organisant des activités parascolaires et en encourageant les partenariats avec les sociétés privées, les gouvernements et les organismes à but non lucratif.

Un demandeur ne peut présenter qu'une proposition par concours en tant que demandeur principal. Les propositions doivent venir de membres de la SMC. S'il s'agit d'un projet conjoint, au moins un des demandeurs principaux doit être membre de la SMC.

Le CABFD évaluera les projets qui s'étalent sur un maximum de trois ans. Les projets s'échelonnant sur plusieurs années seront toutefois financés en fonction des fonds dont

disposera le Comité l'année de la demande. Le Comité se limitera aux propositions dont le financement demandé n'excède pas 5 000 \$ par année.

Le CABFD désire privilégier les propositions où les fonds de la SMC peuvent être équilibrés ou les propositions qui ne disposent d'aucun organisme de financement naturel où postuler.

Si les demandeurs prévoient tirer une valeur financière durable du projet, ils doivent l'indiquer et expliquer ce qu'ils ont l'intention d'en faire.

Le formulaire de demande, les instructions pertinentes et des conseils est disponible au site de la SMC www.smc.math.ca/Grants/. Ainsi, les proposants auront tout le temps voulu pour vendre leurs idées au CABFD.

Nous espérons qu'il sera possible de remplir la demande en format HTML et de la soumettre électroniquement mais sinon, nous accepterons les fichiers annexés à un message de courriel réalisés à l'aide des documents types de format Microsoft Word ou \LaTeX téléchargeables à partir du site Web de la SMC, à l'adresse suivante : pres-egc@smc.math.ca. Nous accepterons aussi les copies imprimées de ces documents types au bureau administratif de la SMC. Pour toute question sur le programme ou sur le processus de demande, prière d'envoyer un message par courriel au président du CABFD, J. G. Timourian, à l'adresse suivante : pres-egc@smc.math.ca. Si vous prévoyez faire une demande, le Comité vous saurait gré de lui faire part de votre intérêt le plus tôt possible en faisant parvenir un message par courriel à son président.

Les propositions doivent parvenir au bureau administratif de la SMC au plus tard **le 30 septembre 2001**.

Envoyer les propositions à l'adresse suivante :
Concours de bourses du fonds de dotation 2001
Société mathématique du Canada
577, avenue King-Edward, bureau 109
C. P. 450, succursale A
Ottawa (Ontario) K1N 6N5

Rappel - liste des adresses pertinentes :
www.smc.math.ca/Grants/ : instructions, formulaires, conseils, envoi du formulaire électronique; pres-egc@smc.math.ca : pour communiquer avec le président du CABFD et envoyer vos demandes en annexe à un message de courriel.

NOTICE

The Executive Office will be closed for two weeks this summer from **August 4th to the 19th inclusive**.

AVIS

Le Bureau d'administration sera fermé pour deux semaines cette été du **4 au 19 août**.

CALL FOR NOMINATIONS / APPEL DE CANDIDATURES

Nominating Committee / Comité des mises en candidatures

The term of office of the Chair and three members of the Nominating Committee ends on December 31, 2001. The positions to be filled are as follows:

One vacancy: Chair

One vacancy: Representative for the Quebec region

One vacancy: Representative for the Ontario region

One vacancy: Representative for the West region

The term of office of the Chair is two years plus an additional two years as a member of the committee for the appropriate region. The term for the other members is four years.

The continuing members will be:

B. Monson (UNB) - Atlantic

J. Borwein (Simon Fraser) - President (Ex-Officio)

C. Rousseau (Montréal) - President-Elect (Ex-Officio)

The deadline for the submission of candidates is **October 15, 2001**. Names, together with the candidate's agreement to serve, should be sent to the address below.

Dr. Graham P. Wright / Secretary / Secrétaire
Canadian Mathematical Society / Société mathématique du Canada
 577 King Edward, Suite 109
 C.P. / P.O. 450, Succursale / Station A
 Ottawa (Ontario) Canada
 K1N 6N5

Les mandats du président et pour trois membres du comité des mises en candidatures prennent fin le 31 décembre 2001. Les positions à combler sont les suivantes :

Une position: Président

Une position: Représentant pour la région du Qu

Une position: Représentant pour la région de l'Ontario

Une position: Représentant pour la région de l'ouest

Le mandat du président est de deux ans plus deux années supplémentaires comme membre du comité pour la région appropriée. Pour les autres membres le mandat est de quatre ans.

Les membres qui continuent sont :

B. Monson (UNB) - Atlantique

J. Borwein (Simon Fraser) - Présidente (Ex-Officio)

C. Rousseau (Western) - Président-élu (Ex-Officio)

L'échéance pour nommer des candidats est **le 15 octobre 2001**. Les noms, avec consentement du candidat, devraient être acheminés à l'adresse ci-dessous:

Editor-in-Chief - CRUX with MAYHEM / Rédacteur-en-chef - CRUX avec MAYHEM

The term of office of the present Editor-in-Chief of the Crux Mathematicorum with Mathematical Mayhem will end December 31, 2002.

The Publications Committee of the CMS now invites nominations for the next Editor-in-Chief to serve a five year term.

Applications should consist of a formal letter of application and include the following:

- A curriculum vitae
- An expression of views of the publication indicating if any changes in direction or policy are contemplated
- Since editorial responsibilities often necessitate a lessening of responsibilities in an individual's normal work, applicants should indicate that they have the support of their university department and, in particular of their head of department.

The Publications Committee will communicate its recommendation to the Executive Committee of the CMS in April

2002. Any input from the mathematical community concerning this important selection process is welcome.

Applications (with supporting material) and/or comments should be sent to the address below:

The deadline for the receipt of applications is **November 15, 2001**.

Le mandat des rédacteur-en-chef actuels du Crux Mathematicorum with Mathematical Mayhem prendra fin le 31 décembre 2002.

Le Comité des publications de la SMC sollicite des mises en candidatures pour les prochains rédacteur-en-chef pour un mandat de cinq ans.

Les mises en candidature doivent inclure une lettre formelle et les éléments suivants:

- Un curriculum vitae
- L'expression de votre opinion sur la publication indiquant si des changements de directions ou de politiques sont envisagés

- Puisque les responsabilités de rédaction nécessitent souvent une réduction dans la charge normale de travail, les candidats devraient indiquer qu'ils(elles) ont l'appui de leur département et en particulier, de leur chef de département.

Le Comité des publications transmettra ses recommandations au Comité exécutif de la SMC en avril 2002. Les

commentaires de la communauté mathématique au sujet de cette importante sélection sont bienvenus.

Les mises en candidatures (avec matériel à l'appui) et/ou commentaires devraient être acheminés à l'adresse qui suit:

L'échéance pour la réception des mises en candidature est le **15 novembre 2001**.

Address for Nominations / Adresse de mise en candidatures:

James A. Mingo, Chair / Président
 CMS Publications Committee / Comité des publications de la SMC
 Department of Mathematics and Statistics
 Queen's University
 Kingston, Ontario K7L 3N6
 chair-pub@cms.math.ca

Editors-in-Chief - CMS Notes / Rédacteurs-en-chef - Notes de la SMC

The term of office of the present Editors-in-Chief of the *CMS Notes*, P.A. Fillmore and S. Swaminathan will end December 31, 2002.

The Publication Committee of the CMS invites applications for the next Editor(s)-in-Chief to serve for a five year term.

Applications should consist of a formal letter of application and a curriculum vitae.

The Publication Committee will communicate its recommendation to the Executive Committee of the CMS in April 2002.

Applications and/or comments should be sent, by **November 15, 2001** to the address below:

Le mandat du rédacteurs-en-chef actuels des *Notes de la SMC*, P. A. Fillmore et S. Swaminathan, prendra fin le 31 décembre 2002.

Le Comité des publications de la SMC sollicite les mises en candidature pour le prochain rédacteurs-en-chef pour un mandat de cinq ans..

Les mises en candidature doivent inclure une lettre formelle et un curriculum vitae.

Le Comité des publications transmettra ses recommandation au Comité exécutif de la SMC en avril 2002.

Les candidatures et/ou commentaires devraient être acheminés, avant le **15 Novembre 2001** à:

Address for Nominations / Adresse de mise en candidatures:

James A. Mingo, Chair / Président
 CMS Publications Committee / Comité des publications de la SMC
 Department of Mathematics and Statistics
 Queen's University
 Kingston, Ontario K7L 3N6
 chair-pub@cms.math.ca

Coxeter-James / Jeffery-Williams / Krieger-Nelson Prize Lectureships

Prix de conférence Coxeter-James / Jeffery-Williams / Krieger-Nelson

The CMS Research Committee is inviting nominations for three prize lectureships.

The Coxeter-James Prize Lectureship recognizes outstanding young research mathematicians in Canada. The selected candidate will deliver the prize lecture at the Winter 2001 Meeting in Toronto, Ontario. Nomination letters should include at least three names of suggested referees.

The Jeffery-Williams Prize Lectureship recognizes out-

standing leaders in mathematics in a Canadian context. The prize lecture will be delivered at the Summer 2002 Meeting in Québec City, Québec. Nomination letters should include three names of suggested referees.

The Krieger-Nelson Prize Lectureship recognizes outstanding female mathematicians. The prize lecture will be delivered at the Summer 2002 Meeting in Québec City, Québec. Nomination letters should include three names of suggested

referees.

The deadline for nominations is **September 1, 2001**. Letters of nomination should be sent to the address below:

Le Comité de recherche de la SMC invite les mises en candidatures pour les trois prix de conférence de la Société, la Conférence Coxeter-James, la Conférence Jeffery-Williams et la Conférence Krieger-Nelson.

Le prix Coxeter-James rend hommage à l'apport exceptionnel des jeunes mathématiciens au Canada. Le candidat choisi présentera sa conférence lors de la réunion d'hiver 2001 à Toronto (Ontario). Les lettres de mises en candidatures devraient inclure les noms d'au moins trois répondants possibles.

Le prix Jeffery-Williams rend hommage à l'apport exceptionnel des mathématiciens d'expérience au Canada. La Conférence sera présentée lors de la réunion d'été 2002 au Québec, (Québec). Les lettres de mises en candidature devraient inclure les noms d'au moins trois répondants possibles.

Le prix Krieger-Nelson rend hommage à l'apport exceptionnel des mathématiciennes au Canada. La Conférence sera présentée lors de la réunion d'été 2002 au Québec, (Québec). Les lettres de mises en candidatures devraient inclure les noms d'au moins trois répondants possibles.

La date limite pour les mises en candidatures est le **1 septembre 2001**. Les lettres de mises en candidatures devraient être envoyées à :

Douglas Stinson, CMS Research Committee / Comité de recherche de la SMC
Department of Pure Mathematics,
University of Waterloo
200 University Ave West, Waterloo ON
Canada N2L 3G1

CMS ANNUAL REPORTS FROM COMMITTEES

Editorial Note: The following were edited from the 2000 Annual Reports of the Society's Standing Committees. The Treasurer's Report will appear in the September issue of the Notes.

Education

Ed Barbeau (Toronto) Chair

Jacques Bélair (Montréal)

Afton Cayford (UBC)

John Grant McLoughlin (Memorial)

Jennifer Hyndman (UNBC)

Jacqueline Klasa (Dawson College)

Andy Liu (Alberta)

Morris Orzech (Queen's)

Abraham Punnen (UNBSJ)

Keith Taylor (Saskatchewan)

A principal function of the Education Committee is to ensure that a significant portion of each professional meeting of the Society is devoted to educational matters. The Committee selects, for each meeting, a session organizer and possibly nominates a plenary speaker. While given information about areas of emphasis at past meetings, the organizer has a great deal of discretion and can count on financial support together with whatever extra funding can be raised.

At both the meetings in 2000, we were fortunate to have rich and informative sessions. In Hamilton, in June, Robert Corless and Eric Muller organized sessions on the education of future school teachers and new approaches to the use of technology. The guest speaker was Lawrence Shampine of

Southern Methodist University. At Vancouver, in December, George Bluman and Klaus Hoechsmann organized a session on the knowledge of teachers, with a focus on the book of Liping Ma, with Liping Ma herself present to participate in the discussion. The public address was delivered by Roger Howe of Yale University. Ravi Vakil, of MIT, not only gave an hour talk but also had a problems session for local high school students. It was gratifying that several regional school teachers attended this meeting, and that Kanwal Neel, President of the British Columbia Association of Mathematics Teachers was one of the contributors to the session.

The Committee nominated Bernard Courteau, emeritus professor at the Université de Sherbrooke to receive the 2000 Adrien Pouliot Award in recognition of his significant contribution in the popularization of mathematics, leadership among the teachers in Quebec and efforts to bring about positive change in the curriculum in that province. The Award was presented to him at the banquet at the December meeting.

Financial support for provincial contests in several provinces was allocated by the committee. In addition, the Society provided a grant towards the cost of a 32-page insert on the Mathematical Sciences in Quebec, for the journal "Québec Science".

Each year, the Canada-Wide Science Fair is held at a different Canadian Centre. In May, 2000, it was held in London,

Ontario, and the Society participated by awarding prizes of \$300, \$200 and \$100 to the most meritorious exhibits that involved mathematics; these were judged by David Borwein and Peter Cass of the University of Western Ontario, along with Ole Nielsen of Queen's University. There will be CMS prizes also at the 2001 Science Fair in Kingston, Ontario.

The Committee recommended to the Executive that graduate students in mathematics education be offered membership in the Society on terms similar to those for mathematics graduate students.

At the moment, the Society's main role in education in Canada is a supportive one, collaborating with other organizations on particular ventures. In particular, we would like to provide grants to professional teachers' organizations to defray the costs of having good mathematical expositors at their meetings and public functions.

The CMS faces a number of challenges in the educational sphere:

(a) Since a majority of members of the Society teach at a college or a university, an important activity of the Society should be to support this. Part of this can come through an exchange of information in the CMS Notes and at our regular meetings, but we need to be able to wrestle more deeply with the implications of recent developments in educational research and changes that might be needed in the curriculum.

(b) We need to consider how we can act most productively in education at the primary and secondary level, partly through informed criticism of the curriculum and partly through the formation of teachers. The Committee has been urged to come up with an official statement, but this seems to be premature. There needs to be a further exchange of opinion among the membership, and we probably should be in contact with other professional organizations in the mathematical sciences.

(c) We need to have a more extensive presence on the web. Currently, school students can find problems on the CMS web-site, along with solutions, and can subscribe to CRUX with MAYHEM and Olymon. It would be nice to make available more resources, particularly for teachers and students at the tertiary level. For students who are not competition oriented, we should be providing mathematical fare that might encourage individual research or delving into the literature.

(d) The Society is often approached for information about careers in the mathematical sciences, which, at the moment, we have no systemic way of providing. If we are to encourage students into the study of mathematics, we need to be able to provide them with up to date information about where a degree in mathematics can take them and what the prospects are for a productive and satisfying career.

(e) There is clearly increasing interest in mathematics among the general public, fuelled in part by some recent films and plays. We need to be cognizant of what the public understands by mathematics and support enterprises that convey an authentic sense of our discipline.

Electronic Services

Edgar Goodaire (Memorial) Chair

François Bergeron (UQAM)

Jason Brown (Dalhousie)

Robert Corless (Western)

L.W. Marcoux (Alberta)

David Rodgers (Argus Associates)

Gail Wolkowicz (McMaster)

The Electronic Services Committee oversees the Society's electronic operations and serves as an advisory board to the Director of Electronic Products and Services. It monitors the CMS web site and recommends changes when and as necessary. Its responsibilities are considerable because almost every area of concern to the CMS is affected by and makes use of modern technology, from the Executive Office to publications, research, education and outreach.

At the start of the year, in response to a major review of the Society's electronic services operations, the committee was reduced to a hard-working group of six people. The hope was that the small size (less than half its previous composition) would permit more internal focus, that it would encourage the discussion of broader issues and that it would enable the committee to respond more quickly and effectively to the developments and requirements of the enormous and vital aspect of the organization which CMS electronic services has become. The experience of just one year suggests that the restructuring of the Committee was a very positive move.

We devoted a good deal of time to the possible introduction of "The Camel Club", an addition to the CMS web site that would keep subscribers up to date on the latest, most interesting mathematical content available on the world wide web, complete with links to mathematical software tools, a hyperlinked archive for research and education, and interactive articles introducing research-level topics.

We entertained a major proposal from APuRL, a digital publishing research group in Vancouver, which would integrate all aspects of the CMS publishing enterprise into a single "vortal". We saw and were most favourably impressed by the mock-up of a new look to the CMS web site, created by a student working for the Camel Manager in Ottawa.

The CMS web site, popularly known as Camel - the Canadian Mathematics Electronic Service (Les Services Mathématiques Electroniques Canadiens)—was created in 1994 as an experimental project of the Centre for Experimental and Constructive Mathematics of Simon Fraser University. It now receives hundreds of thousands of "hits" each month and has become an enormous repository of information and resources for mathematicians, teachers and lay people.

All CMS publications are on-line and during the past year, preprint areas were established whereby manuscripts ready

for publication in the Canadian Journal of Mathematics and the Canadian Mathematical Bulletin, but not yet assigned an issue, are posted and freely available.

Endowment Grants

James Timourian (Alberta) Chair

George Bluman (UBC)

Lisa Jeffrey (Toronto)

Thomas Ransford (Laval)

Richard Wood (Dalhousie)

The Committee created documents to publicize the program, prepared an application form and review procedure, conducted the 2000 Endowment Grants Competition and made the awards. In this competition we offered two means of applying, either by using an online HTML form or by submitting an MS Word form document as an e-mail attachment.

We received 7 applications for the 2000 competition. Six used the electronic HTML form while one was submitted as an attachment to an e-mail. The total amount requested was \$78,000. In December 2000 the Committee approved full or partial funding for 5 applicants, for a total of \$32,000 out of a budget of \$40,000 that had been authorized by the CMS Finance Committee.

Applicants were quickly and informally told the results of the competition by e-mail and were formally notified in early January, 2001 of the decisions. The successful applications for the 1999 and 2000 competitions are available on line at the CMS web site, at <http://www.cms.math.ca/Grants/EGC/>

We have received all the reports required for the projects supported in the 1999 competition and we are generally pleased with the results. These appeared in the CMS Notes (March 2001) and are available on the web site. Materials for the 2001 competition will be available on line early in the New Year and they will not be substantially different from the ones for the 2000 grants. Potential applicants should find it useful to look at the successful 1999 and 2000 proposal applications.

We welcome any comments about projects that should be funded, the procedures created, the decisions made, and the information in the reports from projects that have been supported. In the 2001 competition we hope to start earlier with more publicity so that the number of applicants increases.

Finance

Ian Goulden (Waterloo) Chair

Timothy Appelt (Structured Analytics)

David Bates (Maritime Life)

Jonathan Borwein (SFU)

Alan Dow (York)

Richard Kane (Western)

Michael Lamoureux (Calgary)

Gordon Mason (UNB)

F. Arthur Sherk (Toronto)

Graham P. Wright (Ottawa)

The Finance Committee is responsible for the overall financial activities of the Society, including the annual budget and the restricted investments funds (the Endowment Fund, the Mathematical Olympiad Fund and, now, the Designated Activities Fund).

The Treasurer's Report provides details on the 2000 Financial Year and the 2001 Budget.

This is the second year after the transfer of the management of the Society's Restricted Investments to the Toronto Dominion Quantitative Capital Division. The Committee is delighted with the "passive" approach to the Society's endowment funds that has been implemented at Toronto Dominion, with all investments in indexed funds.

The Finance Committee is also very pleased with the addition of Mr. Roch MacLean to the staff of the Executive Office this year, as the Manager of Finances and Accounting, and looks forward to working with him in future years.

Fund Raising

Jonathan Borwein (Simon Fraser) Chair

Richard Kane (Western)

Georg Schmidt (McGill)

F. Arthur Sherk (Toronto)

Jon Thompson (UNB)

Joan Wick Pelletier (York)

Robert Woodrow (Calgary)

Graham P. Wright (Ottawa)

Fundraising was not as successful in 2000 as had been anticipated, in part because of unexpected calls on the Executive Director's time. This is expected to change in 2001 in which a fund raising drive has already started.

That said, in addition to roughly the usual level of support from Provincial Ministries amounting to just over \$25,000, we received major funding from the Imperial Oil Charitable Foundation, Sun Life of Canada and Waterloo Maple. We were also successful in being funded by NSERC's new Public Awareness of Science Committee for the next three years totalling \$68,800. Support from corporations, foundations and institutes for our educational activities increased by almost \$19,000 over 1999. In addition, just over 100 individual members donated nearly \$10,800. Thanks go to all those who helped support our various activities in 2000.

The Committee is developing a package suitable for use in marketing Camel web services to potential clients. It is re-drafting a letter to send to potential advertisers, indicating what we think Camel offers and where we wish to have advertising directed (such as job placement in insurance and finance, publishers and software vendors).

The other major initiative has been to consider the relationship between fundraising, publicity and related activities. After much thought, the Committee recommended the establishment of an Advancement of Mathematics Committee (AMC) within which would sit a Fund Raising Subcommittee whose members would be largely ex-officio. Moreover, a written report from the AMC would form a standing item for discussion annually with the Development Group. It might be sensible for funding of public lectures and like activities to be taken over by the AMC. The AMC would have broad obligations to monitor activities within and without the CMS and to seek out opportunities for coordination, outreach, publicity, fund raising and other promotional activities. Terms of reference are in preparation.

Human Rights

Paul Gauthier (Montréal) Chair

Margaret Beattie (Mt. Allison)

Zhiguo Hu (Windsor)

David Poole (Trent)

Robert van Den Hoogen (St. Francis Xavier)

In 1999 the Society adopted a position statement on the employment situation for young mathematicians in Canada. This statement was prepared by the Human Rights Committee at the request of the Executive. In principal, the Human Rights Committee feels responsible to monitor the ongoing situation. However, we felt that the employment situation had improved sufficiently that there was no need to make a detailed study of hiring practices in 2000.

In the fall of 1999, there was good news in the form of a news report that the South Korean mathematician Ahn Jae-Ku had been released from prison following a change of government in that country. Professor Ahn had been jailed in 1994 for allegedly pro-North Korean activities. The Committee and the Society had been monitoring the case and, along with other international organizations, had lobbied for Ahn's release. Several Canadian mathematicians visited South Korea in 2000 and the Human Rights Committee attempted to obtain confirmation through them of Ahn's well-being, but without success. Finally, with the help of one of our Korean students, we were able to speak with Ahn's family and learn that Ahn is indeed no longer in prison, but he is under surveillance.

International Affairs

Peter Fillmore (Dalhousie) Chair

Henri Darmon (McGill)

Mohammad Hamdan (UNB)

Robert Miura (UBC)

Thomas Salisbury (York)

Catherine Sulem (Toronto)

Nicole Tomczak-Jaegermann (Alberta)

During the report year the Committee took the following actions:

It wrote to the International Mathematical Union (IMU) Executive suggesting that: the IMU be more active in ICSU; inquiring about mathematics representation at the congress "Science for the Twenty-first Century", since the word "mathematics" did not appear in the draft documents; and suggesting that more items about mathematics should appear in the ICSU newsletter, Science International.

In consultation with the CMS Research Committee, an ad-hoc committee was formed to prepare a submission to the IMU providing information about potential Canadian speakers at the next International Congress of Mathematicians, ICM 2002 in Beijing. A report was submitted to the ICM 2002 Program Committee in December. The Committee also provided advice to the CMS Executive on the subject of hosting a reception with the Canadian Embassy at ICM 2002.

We recommended to NRC (the adhering agency for Canada) that Canada vote affirmatively on the three IMU postal ballots of the year, namely: that Holland move to Group IV; that Peru be admitted in Group I; and that Estonia be admitted in Group I. The Committee was unhappy that these ballots were not supported by more—in some cases any—supporting information. For the ballot on Estonia MathSciNet was used to obtain data on numbers of research papers published.

Mathematical Competitions

Daryl Tingley (UNB) Chair

Edward Barbeau (Toronto)

Margaret Beattie (Mt. Allison)

Peter Crippin (Waterloo)

Luis Goddyn (Simon Fraser)

Richard Nowakowski (Dalhousie)

Bill Sands (Calgary)

Christopher Small (Waterloo)

Jean Turgeon (Montréal)

Graham P. Wright (Ottawa)

The Mathematical Competitions Committee (MCC) is responsible for overseeing activities associated with the Society's involvement in mathematics contests. Two contests, the Canadian Open Mathematics Challenge (COMC) and the Canadian Mathematical Olympiad (CMO) are sponsored and run by the Society. The MCC is also responsible for Canada's participation in the Asian Pacific Mathematics Olympiad (APMO) and the International Mathematical Olympiad (IMO). Other activities of MCC include the Mathematical Olympiads' Correspondence Program, and Math Camps.

Much of the work of the MCC is done by its three subcommittees, namely the Canadian Open Mathematics Challenge Committee, the Canadian Mathematical Olympiad Committee and the International Mathematical Olympiad Committee.

Further information, including press releases, on most of the topics in this report can be found through the CMS Competitions web page: www.math.ca/CMS/Competitions/

The 32nd Canadian Mathematical Olympiad (CMO) took place on April 5, 2000. The top three students were Daniel Brox, Sentinel Secondary School, West Vancouver; David Arthur, Upper Canada College, Toronto; and David Pritchard, Woburn Collegiate Institute, Scarborough. Prizes of \$2000, \$1500 and \$1000 were presented at the CMS Awards Banquet, held at Renison College, University of Waterloo. In addition, the Sun Life Cup was presented to Daniel Brox and all winners received book prizes, donated by John Wiley Sons and Nelson Thomson Learning.

The 2000 Asian Pacific Mathematics Olympiad (APMO) was written in March by 39 Canadian students, selected either because they had been invited to the CMS 2000 Winter IMO Training Camp in January, or because they had placed well in the 1999 COMC. The Canadian students performed very well, receiving 7 medals and three honourable mentions. Canada placed 6th amongst the 19 participating countries. David Arthur received a gold medal, Daniel Brox and Denise Cheung silver medals, and, Stephen Fung, Chris Cappadocia, Lino Demasi and Mark MacDonald, bronze medals. David Pritchard, Shu Niu, and Edmond Choi earned honourable mentions.

To mark the twentieth anniversary of Canada's participation in the IMO, a reunion of IMO alumni was held in Toronto on Sunday June 11. About 60 alumni attended, as well as others who have been involved with Canada's IMO efforts over the years (including several who participated in the 1995 IMO, held at York University). Thanks goes to the CMS office for organizing the event, as well as to Ravi Vakil and Bruce Shawyer for their interesting speeches.

At the reunion, Canada's 2000 IMO team was introduced. The team consisted of David Arthur, Upper Canada College, Toronto and David Pritchard, Woburn Collegiate Institute, Scarborough, Ont., both of whom were on Canada's 1999 IMO team, as well as Daniel Brox, Sentinel Secondary School, Vancouver; Denise Cheung Albert Campbell Collegiate Institute Toronto; Keon Choi, A.Y.Jackson Secondary School, Toronto; and David Goodman, Kelvin High School, Winnipeg. The Team Leader was Dr. Andy Liu (University of Alberta), the Deputy Team Leader was Dr. Christopher Small, (University of Waterloo) and the Deputy Team Leader - Observer was Ms. Viktoria Mineva (Alberta International College).

The 41st IMO was held in Seoul, Republic of Korea, July 13-25, 2000, with 81 countries and 461 students participating. At the Awards Ceremony (July 24, 2000) a Gold Medal was awarded to David Arthur, Silver Medals to Daniel Brox and David Pritchard and a Bronze Medal to Keon Choi. Denise Cheung received an Honourable Mention. More information is available from the CMS web site and from the article written

by Andy Liu in the December 2000 issue of the CMS Notes.

Two training camps are held each year to prepare students for the IMO, the winter camp to begin the training for the IMO and the summer for intensive training of the actual IMO team. The 2000 Winter IMO Training camp took place at Trent University from January 5 to January 9. Students were selected for the camp on the basis of their work in the Mathematical Olympiads Correspondence Program (below) and their performance on a time limit examination (TLE) organized by Richard Nowakowski (intended to provide some indication of performance in a competition-like setting). There were 15 students from across Canada in attendance, as well as a team of trainers and support people: Andy Liu, Christopher Small, Viktoria Mineva (the team leaders); David Poole (the local organizer); Bill Sands (Chair of the IMO Committee); Richard Hoshino and Byung Chun (IMO alumni); and Daryl Tingley (Chair of the MCC).

The 2000 Summer IMO Training Camp was held at Simon Fraser University from June 30 to July 15. The trainers were: Andy Liu, Christopher Small, and Viktoria Mineva. The local organizer for the camp was Deanne Verones, of SFU. Five local students attended the camp at which the Korean Consulate General presented the team with some Korean coins.

The Mathematical Olympiads' Correspondence Program (MOCP) is a problems based correspondence program. It is intended for Canadian (or permanent resident) high school students with exceptional mathematical ability who wish to pursue mathematical problem solving at a high level and/or have ambitions to compete in Mathematical Olympiads. Dr. Edward Barbeau has been the Coordinator of this program for many years. This year, he was assisted by Dr. Dragos Hrimiuc at the University of Alberta and Dr. Valeria Pandelieva of Ottawa. Problem sets are sent each month to the students and they have six weeks to return solutions. These are then marked and returned (with copious comments) to the students. Currently, 25 students are actively participating in the program.

The Imperial Oil Charitable Foundation generously agreed to be the Title Sponsor of a series of "Esso Math Camps". During June 17-23, 2000 the third annual CMS National Math Camp took place at Huron College (on the Campus of the University of Western Ontario). Twenty-four students from across the country attended. The camp was organized and run by Tom and Marlene Griffiths, Richard Hoshino, Jean Collins, Wai Ling Yee, and John Grant McLoughlin.

In 2000, in addition to the National Math Camp, nine Regional ESSO Math Camps were held at Dalhousie University, the University of New Brunswick, Brebeuf College, Brock University, the University of Western Ontario, the University of Ottawa (two camps, one French one English), the University of Regina, and the University of Alberta. The format and length of these camps varied considerably: from 2

day non-residential to 6 day residential camps. The considerable success of these camps is evident from the desire of each university to continue to offer a camp as well Memorial University and Simon Fraser University will be part of the program. Further information on the Math Camps can be found at <http://www.cms.math.ca/MathCamps/>.

The Canadian Open Mathematics Challenge (COMC) is a math contest written in November of each year. It provides mathematical enrichment for a large number of students and serves as a qualifying paper for the Canadian Mathematical Olympiad (CMO). The results are also used in the selection process for students to the IMO winter training camp. Plaques are awarded to both the students and schools for being a provincial or regional winner and Gold Medals are awarded to up to 9 other students in each province or region. The Fifth COMC was held on November 29, 2000. Over 5000 students participated. This was a small increase from last year and very encouraging since the Ontario school system was experiencing significant labour difficulties. A list of the regional and provincial winners can be found at: www.cms.math.ca/CMS/Competitions/COMC/ As the increasing number of students shows, the COMC is going well. Schools and provincial governments seem to like the opportunity to see how their top students fare on a national basis. The Society's increased interest in students (including the COMC and Math Camps) is reaping numerous rewards.

Nominating

Catharine Baker (Mount Allison) Chair

Jonathan Borwein (Simon Fraser)

Steven Boyer (UQAM)

Eddy Campbell (Queen's)

Kenneth Davidson (Waterloo)

Richard Kane (Western)

Anthony Lau (Alberta)

Barry Monson (UNB)

The Nominating Committee approved two amendments to the terms of reference of the Finance Committee: that the Past-President or President-Elect be a member; and that the Manager, Finances and Accounting, be invited to attend each meeting of the Finance Committee as an observer.

Nominations were sought for 13 committee positions and the appointments were approved at the December 2000 meeting of the Board of Directors. Subsequently nominations were made for the remaining committee vacancies, which will be submitted to the Board for approval in June 2001.

We recommended a two-year extension (01/01-12/02) to the term of David Bates (Maritime Life) as a private sector member on the Board and nominated Daniel Piche (Manitoba) and Deidre Mahar (Dalhousie) as a student delegate to the Board and as an alternate, respectively, from 01/01-12/02.

These appointments were also approved at the December 2000 meeting of the Board.

Catharine Baker (Mount Allison) became Chair of the Committee on July 1, 2000, succeeding Eddy Campbell.

We have proposed a slate of nominees for the 2001 CMS elections to the Executive Committee and Board of Director positions. These names appeared in the February issue of the Notes along with a call for other nominations.

Publications

James Mingo (Queen's) Chair

Bradd Hart (McMaster)

Anthony Pierce (UBC)

Thomas Salisbury (York)

Christine Soteros (Saskatchewan)

Anthony Thompson (Dalhousie)

The Publications Committee oversees the publishing activities of the Society. The publications of the Society together with the respective editors-in-chief are:

Canadian Journal of Mathematics (J. Carrell and N. Ghoussoub), Canadian Mathematical Bulletin (M. Min-Oo and A. Nicas), Crux Mathematicorum with Mathematical Mayhem (Bruce Shawyer), CMS Book Series (J. Borwein and P. Borwein), CMS Tracts in Mathematics (K. Davidson and N. Kamran), CMS Notes (P. Fillmore and S. Swaminathan), A Taste of Mathematics (R. Nowakowski).

The G. de B. Robinson Prize is awarded each year for an outstanding article published in one of the Society's two research journals; in even numbered years the prize is awarded for an article published in the Journal and in odd numbered years for an article published in the Bulletin. The 2000 Prize for was awarded to Dr. Ravi Vakil of the Massachusetts Institute of Technology, for his article 'Characteristic numbers of quartic plane curves' which appeared in the Canadian Journal of Mathematics, volume 51, no. 5, pp.1089-1120 (1999).

The following editorial appointments were recommended by the Committee and, where necessary, approved by the Board of Directors:

Canadian Journal of Mathematics: Editors-in-Chief Henri Darmon and Niky Kamran (07/01 - 12/06) Canadian Mathematical Bulletin: Editors-in-Chief James Lewis, Arturo Pizarola and Noriko Yui (01/01 - 12/05) Scientific Editorial Board for the CJM and CMB: George Elliott and Freydoon Shahidi, (01/01 - 12/05) CMS Notes: Editors-in-Chief Peter Fillmore and S. Swaminathan (01/01 - 21/02); Ian Putnam - Contributing Editor for Research (01/01 - 12/02); E. Barbeau & H. White - Contributing Editors for Education (01/01 - 12/02); Paul Milnes - Photo Editor (01/01 - 12/02) Digital Editor: Loki Jørgensen (01/01 - 12/01) TeX Editor: Michael Doob (01/02 - 12/02) Crux Mathematicorum with Mathematical Mayhem: Edward Wang - Problems Editor (01/01 - 12/05); Robert Woodrow - Olympiad Editor (01/01 - 12/05)

The Society launched a new publication to be called the CMS Tracts in Mathematics and with Editors-in-Chief K. Davidson and C. Stewart (07/00 - 12/04). Tracts will consist of original monographs of about 150 to 200 pages giving an exposition of a research topic of current interest or lecture notes for an advanced graduate level course. The series will be co-published with the American Mathematical Society.

The Task Force on Publications was asked to review the status of all CMS publications considering their quality, success, full cost, electronic viability, operating efficiency, and ability to generate revenue, and the to develop a strategy to address the concerns identified and to ensure long-term viability of the Society's publications. It was also asked to consider the feasibility of additional publications; perhaps jointly with other organizations. The Task Force made the seven recommendations below. Following each is the Committee's response.

1. That the Publications Committee appoint a sub-committee or, perhaps better, an individual member who will continuously monitor the relevant literature on the future of scholarly publication and report back to the committee on a regular basis. Response: The Committee endorsed the idea of having a member responsible for advising the rest of the Committee on the future of digital publishing. This might be incorporated into the Digital Editor's duties.

2. That the Publications Committee approach the editors of the Canadian Applied Mathematics Quarterly to discuss possibilities of supporting the journal that are of mutual benefit to the CMS and CAIMS. Response: The Chair will appoint someone to approach the Quarterly.

3. That the Publications, Research and Electronic Services Committees strike a joint sub-committee to determine the feasibility of purely electronic journals being offered that would become part of packages with the electronic versions of CJM and CMB. Response: The Committee endorsed this proposal. There are some technical and financial issues to be discussed; however the proposal appears feasible.

4. If an encouraging report comes from the above recommendation, the Research Committee should be responsible for announcing the Society's willingness to assist in the establishment of electronic journals and should receive and vet any proposals. Response: Agreed as in 3.

5. That the Executive and the Publications Committee consider, in consultation with the TeX Editor, the creation of an Associate TeX Editor position. It is envisaged that such a person as being an experienced mathematician, committed to the CMS, and skilled at both TeX and forms of on-line communication of mathematics. Response: The Committee endorsed this proposal and will seek to implement it.

6. That any member of the CMS who loves their specialty and has a flair for explaining it to young people, submit a proposal to the editors of ATOM. Response: The Committee agrees with this sentiment.

7. That the Publication and Electronic Services Committees form an ad-hoc sub-committee to investigate the scholarly merit and financial implications of reviving the CMS Conference Proceedings Series in a purely electronic format. Response: The Committee thought that this was a good idea and will look into re-establishing the Conference Proceedings Series as an electronic publication.

Research

Niky Kamran (McGill) Chair

Martin Barlow (UBC)

François Bergeron (UQAM)

Hermann Brunner (Memorial)

Ian Putnam (Victoria)

Doug Stinson (Waterloo)

Catherine Sulem (Toronto)

The 2000 Summer Meeting (Math 2000) was held jointly with CAIMS, CORS, the Canadian Undergraduate Mathematics Conference, and the 14th Canadian Symposium on Fluid Dynamics, in Hamilton, Ontario. The meeting was hosted by McMaster University. There were the following research sessions: Algebraic Groups, organized by Carl Riehm (McMaster); Biofluid Dynamics and Medical Science, organized by Siv Sivalogonathan (Waterloo); Control Theory, organized by Kirsten Morris (Waterloo); Cryptography and Number Theory, organized by Hugh Williams (Manitoba) and Gary Walsh (Ottawa); Financial Mathematics, organized by Luis Seco (Toronto); Geophysical Fluid Dynamics, organized by Kevin Lamb (Waterloo) and Richard Greatbatch (Dalhousie); Group Theory, organized by Olga Kharlampovich (McGill); History of Mathematics and the Dawn of a New Millennium, organized by Tom Archibald (Acadia); Imaging and Vision, organized by Ed Vrscay and Alan Law (Waterloo); Industrial Statistics, organized by N. Balakrishnan (McMaster); Logic, organized by Bradd Hart (McMaster) and Claude Laflamme (Calgary); Mathematical Biology, organized by Robert Miura (UBC); Math on the Internet, organized by June Lester (Simon Fraser); Operations Research, presented by CORS and organized by Rick Caron (Windsor); Partial Differential Equations, organized by Pengfei Guan (McMaster); Symplectic Geometry, organized by Lisa Jeffrey (Toronto); and Topology of Manifolds, organized by Ronnie Lee (Yale) and Ian Hambleton (McMaster).

At Math 2000, the 2000 Krieger-Nelson Prize Lecturer was Kanta Gupta (Manitoba) and the research plenary lectures were given by James Arthur (Toronto), Francis Clarke (Lyon), Dusa McDuff (Stony Brook), Gene Myers (Celera Genomics), Raymond Pierrehumbert (Chicago), Carl Pomerance (Georgia), Maurice Queyranne (UBC), Lawrence Shampine (Southern Methodist), Lou Van Den Dries (Urbana), Shing Tung Yau (Harvard), and Efim Zelmanov (Yale).

The Research Committee met in Hamilton and selected the four core CMS sessions for the Summer 2002 meeting, to be held in Quebec City. This was done in consultation with the Meeting Director, Claude Levesque (Laval).

The 2000 Winter Meeting of the CMS was held in Vancouver, and hosted by the University of British Columbia. This meeting featured research sessions in the following areas: Algebraic Geometry, organized by Peter Russell (McGill); Classical and Computational Analysis, organized by Peter Borwein (Simon Fraser); Financial Mathematics, organized by Abel Cadenillas (Alberta) and co-sponsored by MITACS and PIMS; History of Mathematics, organized by Len Berggren (SFU), in collaboration with the Canadian Society for the History and Philosophy of Mathematics; Number Theory, organized by Rajiv Gupta and Nike Vatsal (UBC); Operator Algebras, organized by Michael Lamoureux (Calgary) and Ian Putnam (Victoria); Ordered Groups, organized by Akbar Rhemtulla (Alberta); Partial Differential Equations, organized by Richard Froese, Nassif Ghousseb and Izabella Laba (UBC), and sponsored by PIMS; Probability and Applications, organized by Martin Barlow (UBC), Richard Durrett (Cornell), Claudia Nehauser (Minnesota) and Edwin Perkins (UBC), and sponsored by the National Program Committee (CRM, Fields, PIMS).

The 2000 Coxeter-James Prize Lecture was given by Damien Roy (Ottawa) and the 2000 Doctoral Prize Lecture was given by Steve Astels (Waterloo). The research plenary lectures were given by Patrick Dehornoy (Caen), Richard Durrett (Cornell), Roger Howe (Yale), Izabella Laba (UBC), Stanley Pliska (UI Chicago), Paul Roberts (Utah) and Peter Sarnak (Princeton).

The Research Committee met in Vancouver together with the Meeting Director, Daniel Daigle (Ottawa) and selected the four core sessions for the Winter 2002 meeting to be held in Ottawa.

The next four meetings of the CMS will be held in Saskatoon in the Summer of 2001, Toronto in the Winter of 2001, Quebec City in the Summer of 2002 and Ottawa in the Winter of 2002.

Students

Daniel Piché (Waterloo) Chair

Jean-Phillippe Boulet (Laval)

Benoit Charbonneau (MIT)

Susan Cooper (Queen's)

Gabriella Couto (McMaster)

Tullia Dymarz (Alberta)

Alexandre Girouard (Montréal)

Andrew Irwin (Rutgers)

Robert Juricevic (Concordia)

Dave Morgan (Memorial)

Lindsey Shorser (Toronto)

Robert Woodrow (Calgary)

Graham P. Wright (Ottawa)

This is the second annual report of the Student Committee, and describes our first full year of operation. The Committee is responsible for all aspects of mathematics student affairs. Information on the goals of the Committee and its membership can be found on the student website: www.cms.math.ca/Students

At its first meeting in December 1999, the Committee identified a number of initiatives it wished to undertake. The activities of the Committee in 2000 were the following:

1. Maintaining a student website. The site contains a calendar of events, local activities, grant applications, information on the annual Canadian Undergraduate Mathematics Conference (CUMC), and a number of other items of interest to mathematics students. Our Web master continues to update the site on a regular basis to maintain relevant information. Contributions from the community are appreciated.

2. Publishing a national student newsletter. This initiative was started by Student Editor, Robert Juricevic and his predecessor Alexandre Girouard. Since M. Girouard's departure last summer, M. Juricevic has spearheaded the project. The newsletter will contain articles, profiles, Web links, jokes, and other information of interest to mathematics students. The goal of the Committee is to have several issues each year, with primary distribution through the student website. Each issue would have content from a different region. The first issue, which has received positive feedback from many individuals in the community, will be published in early 2001 and sent to the various mathematics departments at that time.

3. Sponsoring the CUMC The 2000 CUMC was held at McMaster University during the Math 2000 meeting in Hamilton. A number of the Committee's members attended the conference and did some last minute recruiting of students for the CUMC from the CMS-MITACS job fair in Toronto. The Committee is also assisting the CUMC in planning its future and enabling its continuity through the development of an operations manual for its organisers. The CMS Endowment Grant, the Committee and the CUMC are providing funding for this initiative. It is the goal of the Committee that the development of the manual will be completed in 2001.

4. Providing funding to various regional student events. Three events were funded in 2000: the Industrial Problem Solving Workshop, the Graduate Industrial Math Modelling Camp, and the APICS annual meeting. A total of \$500 was provided.

5. Sponsoring talks on mathematics. The Committee sponsored a talk by Ravi Vakil at the CMS Winter Meeting in Vancouver. This talk was actually a topology problem solving session involving many students in the Vancouver and Victoria regions. It received a lot of excellent feedback. Related to this talk was also a talk by Ravi in the Education Session about the importance of mathematicians speaking to a general

audience.

6. Responding to the Task Forces on the Future of the CMS. The Committee prepared a 10-page response to the various task force recommendations on student related issues. It is hoped that this response will be of assistance to the Executive Committee in preparing its final recommendations.

Although a number of initiatives have been started successfully, the Committee has identified others that are still proving a challenge. For example, the CUMC holds its conference annually, with 30 to 40 students giving talks at each. However, during the seven years it has been held, only two of the conferences have proceedings. A number of factors make it difficult to prepare proceedings, including the fact that few students have given talks before attending a CUMC, fewer are familiar with LaTeX, and even fewer still have edited such a document. Helping start initiatives like the CUMC proceedings and providing a framework for their continuity will be one of the goals of the Committee as its role continues to evolve.

Women in Mathematics

Malgorzata Dubiel (Simon Fraser) Chair

Rob Corless (Western)

Jennifer Hyndman (UNBC)

June Lester (UNB)

Neal Madras (York)

Keith Taylor (Saskatchewan)

Shelly Wismath (Lethbridge)

Frank Zorzitto (Waterloo)

The Committee on Women in Mathematics is charged with monitoring the status of women within the Canadian mathematical community and the Society, recommending and initiating actions which will ensure equitable treatment of women, and with encouraging the participation of women in mathematics at all levels.

The year 2000 saw the completion of our major project: a poster to celebrate distinguished Canadian women of mathematics, amongst them six winners of the CMS Krieger-Nelson prize. The project was supported by the Canadian Mathematical Society and Waterloo Maple. Copies of the poster are being distributed to all high schools, universities and colleges in Canada, to present these women as role models for female students.

The Committee continues to maintain the Directory of Canadian Women in the Mathematical Sciences: a collection of web pages of Canadian women who are actively involved in research or studies in mathematics, or any other aspects of mathematical sciences. The directory is a valuable source for information about Canadian women mathematicians.

UPCOMING CONFERENCES

BEN-GURION UNIVERSITY OF THE NEGEV, FACULTY OF NATURAL SCIENCES

The Center for Advanced Studies in Mathematics

Workshop and Conference in Mathematics in honor of Professor Saharon Shelah, winner of Bolyai prize 2000 and Wolf prize 2001

Beer-Sheva, May 20 - May 25, 2001

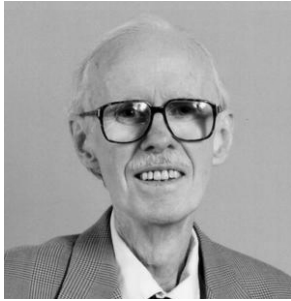
The workshop is devoted to recent progress in some of the areas of mathematics on which Saharon Shelah has left an imprint: Set Theory, Model Theory, Algebra, Topology and Combinatorics. The morning sessions will be devoted to mini-courses on recent developments in these areas. Afternoon sessions will be devoted to contributed talks.

On Monday, May 21, there will be a one-day conference with 6 invited plenary talks by A. Blass, R. Göbel, A. Hajnal, E. Hrushovski, M. Kojman, and A. Shalev.

Topics of mini-courses will include Ordered Groups, Exponential Fields, Infinite Abelian Groups, Forcing and new Iteration Techniques, PCF theory, Reconstruction of Topological Spaces from groups of Autohomeomorphisms, and more. Students can apply for a free accommodation at the students dormitories. The number of beds is limited. There are no conference or workshop fees.

For more detail check the workshop site:
www.math.bgu.ac.il/~bguconf

OBITUARIES / AVIS DE DÉCÈS



**George F. D. Duff
(1926-2001)**

George Francis Denton Duff, FRSC, passed away early in the morning of Friday, March 2.

Professor Duff was an undergraduate at the University of Toronto, obtaining his B.A. there in 1948 and his M.A. in 1949. He completed his Ph.D. at Princeton in 1951 under Lefschetz and joined the Department of Mathematics at Toronto in 1952 after one year as a Moore instructor. He served as Chair of the Department from 1968 to 1975 and retired in 1992, but stayed actively involved in the Department until quite recently. One highlight of his mathematical life was his address to the International Congress of Mathematicians at Vancouver in 1974, where he talked about “Mathematical Problems of Tidal Energy.”

In his long and active career he served the University, the Province of Ontario, the Department of External Affairs, as well the worldwide mathematical community in many roles. He was editor of the *Canadian Journal of Mathematics* and of the *Mathematical Reports of the Academy of Sciences, Royal Society of Canada*. He was the tenth President of the CMS and Honorary President of the Ontario Association of Mathematics Teachers. He became a Fellow of the Royal Society of Canada in 1959 and was awarded an honorary LLD from Dalhousie University in 1994.

There will be a memorial service for Professor Duff on Friday, September 21, 2001, accompanied by a memorial conference on the same day. For details consult the September *Notes* or pat@math.utoronto.ca.

Reminiscences of George Duff

My first contact with George was in early 1955, when I was a graduate student at McMaster and George was an invited speaker at a colloquium. I remember being impressed both by the clarity of his talk and the natural courtesy and enthusiasm in which it was given. It helped to solidify my plans to be a graduate student at Toronto.

A few months later, in August, another graduate student and I travelled to Winnipeg with Tim Rooney and George in George’s car, to attend the CMC Summer Seminar at U of M. To this day, I’m sure that I learned more about the CMS and about how mathematicians tick from Tim and George than I did in any other two and a half days’ time. Again, I was impressed with George’s natural courtesy, and his sharp mind.

George’s term as Editor in Chief of the CJM and mine as Managing Editor overlapped. He always dealt with matters in an efficient – sometimes almost brusque – manner and was not afraid to face tough moments. Some of the same spirit was in his administration of the Math Dept in Toronto over a period of some 6 years. This was not always a pleasant time, and some of George’s actions did not go down well with some members of the Department. But he had some very solid achievements, among them the establishment of a departmental library over stiff opposition from the central library.

One of George’s talents (or drawbacks, depending on your point of view) was finding jobs for others to do. Not that he would shrink from work

himself (he was always a willing and hard worker). In my own case, it was George who recommended me to a position in the School of Graduate Studies, and on a later occasion, to a seat on the Board of Governors. My respect for George was such that I always went along with his suggestions, and it always paid off.

Still later, I served on the committee to establish the Coxeter Scholarship at U of T, which George chaired. It is no exaggeration to say that this scholarship would never have come into existence were it not for George’s efforts. I’m pretty sure also that George made the largest single contribution to the fund to establish the scholarship. He certainly worked harder than anybody else to bring it off.

With all of George’s impressive output of mathematical research, and his interest in editorial and administrative pursuits, he also maintained over the years an active interest in high school education. George co-authored more than one high school math text, and had an active co-operative relationship with many educators.

— Arthur Sherk (*Toronto*)



George Duff c. 1970

Here is one memory of mine, which illustrates George’s sense of humour.

Some years ago, before he was chairman, he and I were driving home together and he was telling me of a

very bitter argument that he had just been having with another member of the department. While this was going on, a young woman dashed across in front of our car. George braked and said "Watch out girlie!", and I said to George, "Yes, you don't want blood on your car." George replied, "Well, not her blood."

— *Tim Rooney (Toronto)*

My first encounter with George was as a student in his two-semester honours course on Partial Differential Equations of Mathematical Physics, Applied Math 4e, at U of T in 1961-62. That course provided my first real insight into the power of mathematics to model really complex phenomena, and it hooked me to the extent that I later asked George to supervise my doctoral thesis when I returned to do graduate school at U. of T. after teaching high school for a year. My wife-to-be, Anne Odell, was also in the course. She was in Honours Physics and Chemistry, then the only group of students who had to take Applied Math 4e. But there were only eight of them and they were lost among the 35-40 4th year Honours Math and Honours Applied Math students who took the course optionally, and who had far deeper mathematical backgrounds than the eight. I don't think George was quite aware of this dichotomy among his students, but explaining the more subtle aspects of the mathematics to Anne in the evenings after lectures was not only salutary for our relationship, but helped my understanding of the course too.

By the way, at the end of the course, George gave each of the students a sheet of Math Department letterhead with his/her name typed on it. We were allowed to write anything we wanted on the sheet and bring it to the exam. This was the first time I had encountered this policy for dealing with a course full of complicated formulas; I have found it useful for some of my classes over the

years. With much planning and a very fine pen, I got the whole course on that sheet, and never once had to look at it during the exam.

During the year or so that I was working on my thesis under George, the single thing that impressed me most about his mathematics was his ability to see a forest where I could only perceive a bunch of trees. Moreover, he did not attempt to predetermine the direction of my investigations. At the beginning he gave me some papers to read and asked me to try and come up with a suitable thesis problem. When I did, he did not try to guide me in its solution, but when I ran into a brick wall he made suggestions about approaches I had not considered. I thought at the time and still do that this is an ideal way to encourage the development of a mathematics student.

Always friendly and helpful, George will be much missed by many of us who knew him as a friend as well as a teacher and colleague.

— *Robert Adams (UBC)*

During my undergraduate education at the University of Hong Kong, I heard many times that Professor George F. D. Duff was an expert in partial differential equations. In fall 1966 I began my study for a PhD degree in mathematics at the University of Toronto. Since I was very interested in having Professor Duff directing my dissertation, I went to his office, shortly after my arrival at Toronto, to ask him whether he would accept me as his student. Without any warning, he gave me an oral examination on various topics in mathematics. I was very happy when he told me that he would be glad to do so when I had satisfied the other degree requirements.

After receiving my Ph.D. degree in 1969, I began my academic career in the US. I invited Professor Duff to visit Florida State University twice, and the University of Louisiana at Lafayette

once. My colleagues and graduate students were extremely impressed by his colloquium talks and research. During these visits he was also my house guest. I got to know him as a friendly, courteous, warm and sincere person.

Professor Duff was a distinguished mathematician. His research work has a lasting impact. The world has lost a great person. Personally, I feel that I have lost not only a wonderful teacher, but also a real friend.

— *Chiu Yeung Chan (Univ. of Louisiana, Lafayette)*

George Duff was my thesis supervisor at U of T in the late 60's. Then, as even now, I was somewhat in awe of his intellect. However, despite being a lowly graduate student, George made me feel welcome and included me at gatherings in his home. And his ever-present courtesy and kindness extended beyond those student days. I remember attending my first big meeting at Wisconsin just after graduating. George was there and made it a point to include me and several other former students in many of the extra social activities. When his old friend Walter Rudin asked George if he would like to come to dinner and see his house (which had been built by Frank Lloyd Wright), George asked if he could bring some of us along. There I was, sitting with Walter Rudin (whose mathematical analysis text I had cut my teeth on) and other mathematicians, just enjoying the diverse and interesting topics of conversation. It was wonderful and made me feel for the first time like I really had become a member of the world community of mathematicians.

George made many significant contributions throughout his career, but perhaps a lesser known one was his strong influence upon and support for the development of the graduate program in mathematics at Dalhousie University. In May 1994 he was awarded an honorary LLD from Dalhousie. I remember the day well. In the morning

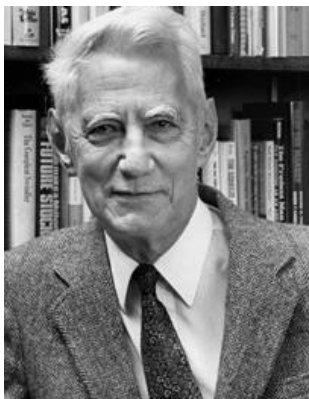
George gave the convocation address. In his quiet way he was an extraordinarily accomplished speaker and quite a master of the English language. In the afternoon he gave an hour-long address at our mathematics department awards ceremonies. It struck just the right note but I knew that George was becoming worn down, having been on his feet and talking since early morn-

ing. However, there was to be no let-up because the university had scheduled a dinner in his honour to immediately follow the awards ceremony. There were a few short introductions and then to our complete surprise, he was asked to give yet another speech. Despite being quite exhausted (as any of us would be), George graciously rose to the occasion and gave a charming, relaxed and

amusing discourse. I felt terrible that this had been sprung on him but I had to admire his good sportsmanship. I was also pretty sure that he would not want to return Dalhousie soon for any more awards.

Throughout his career, George had a wonderful and lasting effect on many of us and he will be missed.

— *John Clements (Dalhousie)*



**Claude Shannon
(1916–2001)**

Claude Elwood Shannon, the mathematician who laid the foundation of modern information theory while working at Bell Labs in the 1940s, died on February 24, 2001. He was 84.

Shannon's theories are as relevant today as they were when he first formulated them. "It was truly visionary thinking," said Arun Netravali, president of Lucent Technologies' Bell Labs. "As if assuming that inexpensive, high-speed processing would come to pass, Shannon figured out the upper limits on communication rates. First in telephone channels, then in optical communications, and now in wireless, Shannon has had the utmost value

in defining the engineering limits we face."

In 1948 Shannon published his landmark *A Mathematical Theory of Communication*. He begins this pioneering paper on information theory by observing that "the fundamental problem of communication is that of reproducing at one point either exactly or approximately a message selected at another point." He then proceeds to so thoroughly establish the foundations of information theory that his framework and terminology remain standard.

Shannon's theory was an immediate success with communications engineers and stimulated the technology which led to today's Information Age.

Shannon published many more provocative and influential articles in a variety of disciplines. His master's thesis, *A Symbolic Analysis of Relay and Switching Circuits*, used Boolean algebra to establish the theoretical underpinnings of digital circuits. This work has broad significance because digital circuits are fundamental to the operation of modern computers and telecommunications systems.

Another example is Shannon's 1949 paper entitled *Communication Theory of Secrecy Systems*. This work is now generally credited with trans-

forming cryptography from an art to a science.

Shannon was born in Petoskey, Michigan, on April 30, 1916. He graduated from the University of Michigan in 1936 with bachelor's degrees in mathematics and electrical engineering. In 1940 he earned both a master's degree in electrical engineering and a Ph.D. in mathematics from the Massachusetts Institute of Technology (MIT).

Shannon joined the mathematics department at Bell Labs in 1941 and remained affiliated with the Labs until 1972. He became a visiting professor at MIT in 1956, a permanent member of the faculty in 1958, and a professor emeritus in 1978.

Shannon was renowned for his eclectic interests and capabilities. A favorite story describes him juggling while riding a unicycle down the halls of Bell Labs.

He designed and built chess-playing, maze-solving, juggling and mind-reading machines. These activities bear out Shannon's claim that he was more motivated by curiosity than usefulness.

In his words "I just wondered how things were put together."

THE UNIVERSITY OF WESTERN ONTARIO – LONDON, ONTARIO
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The Department of Mathematics at The University of Western Ontario invites applications for a Limited Term position at the rank of Assistant Professor for the period July 1, 2001 to June 30, 2002.

Candidates must have a PhD in Mathematics, and have experience teaching undergraduate Mathematics courses. The successful candidate will also have an active research program in the areas of invariant theory and algebraic groups. Duties will include teaching four half courses and contribution to research in the Department.

Those interested in applying for this position should forward a Curriculum Vitae and have three letters of reference sent to:

Prof. J. F. Jardine, Chair
Department of Mathematics
The University of Western Ontario
London, Ontario N6A 5B7
Canada

At least one letter of reference should include a detailed comment on the teaching abilities of the applicant.

We also welcome e-mail inquiries and submissions, to be sent to the address:

math-pos@julian.uwo.ca

Our web address is <http://www.math.uwo.ca>

The deadline for applications is before June 1, 2001. The effective date of the appointment is July 1, 2001.

Positions are subject to budgetary approval. In accordance with Canadian Immigration requirements, Canadian citizens and Permanent Residents will be considered first for this position. The University of Western Ontario is committed to employment equity, welcomes diversity in the workplace, and encourages applications from all qualified individuals including women, members of visible minorities, aboriginal persons, and persons with disabilities.

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The Department of Mathematics and Statistics will be making at least one renewable (tenure-track) appointment in Mathematics and Engineering at the Assistant Professor level to begin January or July 2002. Members of the Mathematics and Engineering group are currently active in the areas of communications and information theory, control, and dynamics and mechanics. The Department also has an interest in expanding into other areas including partial or applied differential equations, large scale scientific computation and statistical data analysis.

Candidates must have a Ph.D. in applied mathematics, electrical, mechanical or chemical engineering, computer science, statistics or a closely related field. Membership or eligibility for membership in a Canadian professional engineering association is required. Normally, this requires an undergraduate engineering degree. Candidates are expected to have a strong research record, develop an independent research programme, and offer evidence of a strong ability and interest in teaching a range of applied mathematics/statistics courses and in supervising graduate students. Salary will be commensurate with qualifications and experience.

Interested candidates should arrange that a curriculum vitae, descriptions of teaching and research interests, at least three letters of recommendation, and copies of their three most significant publications be sent to the address below, preferably **before May 15, 2001**. At least one letter should comment on the candidate's teaching.

Dr. Joan M. Geramita, Associate Head
Department of Mathematics and Statistics
Queen's University, Kingston
Ontario, K7L 3N6, Canada
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CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

MAY 2001

18–20 ISM Graduate Student Conference / Colloque ISM des Etudiants Avancés (McGill University, Montréal)

www.math.uqam.ca/ISM/francais/colloque2001.html

25–26 2001 Seaway Number Theory Conference (Carleton University, Ottawa)

<http://www.math.carleton.ca> (see Upcoming Events)

25–29 Annual Meeting of the Canadian Mathematics Education Study Group (University of Alberta, Edmonton)

<http://cmesg.math.ca>

25–29 Workshop on Groups and 3-Manifolds, (CRM, Univ. de Montréal, Québec)

Organizer: *S. Boyer (UQAM)* boyer@math.uqam.ca

25–27 Annual meeting and special session on French mathematics, Canadian Society for History and Philosophy of Mathematics / Société canadienne d'histoire et de philosophie des mathématiques (Université Laval, Québec)

<http://www.cshpm.org>

28–June 1 Workshop on Groups, Rings, Lie and Hopf Algebras (Memorial University of Newfoundland, St. John's Newfoundland)

<http://www.math.mun.ca/~yurl/GRLHA/default.htm>

JUNE 2001

2–4 CMS Summer Meeting / Réunion d'été de la SMC (University of Saskatchewan, Saskatoon, Saskatchewan)

<http://www.cms.math.ca/CMS/Events/summer01>

2–5 One Hundred Years of Russell's Paradox (Munich)

<http://www.lrz-muenchen.de/godeherd.link/russell1101.html>,
Ulrich.Albert@lrz.uni.muenchen.de

4–8 International Conference on Computational Harmonic Analysis (City University of Hong Kong)

malam@cityu.edu.hk

4–13 Hamiltonian Group Actions and Quantization, in the Symplectic Topology, Geometry, and Gauge Theory Program (Fields Institute, Toronto and CRM, Montréal)

<http://www.fields.utoronto.ca/symplectic.html>

12–17 8th Annual Canadian Undergraduate Mathematics Conference. 8e conférence canadienne des étudiants en mathématiques (Laval University, Québec)

<http://cumc.math.ca> or <http://ccem.math.ca>

JULY 2001

1–14 42nd International Mathematical Olympiad (Washington D.C., USA)

imo2001.usa.unl.edu

9–13 Workshop on Geometric Group Theory, (CRM, Univ. de Montréal, Québec)

MAI 2001

Organizer: *D. Wise (Brandeis & McGill Univ.)* dani-wise@brandeis.edu

9–20 Séminaire de mathématiques supérieures NATO Advanced Study Group (Université de Montréal)

<http://www.dms.umontreal.ca/sms>

16–21 COCOA VII - The Seventh International Conference on Computational Commutative Algebra (Queen's University, Kingston)

A. Geramita (tony@mast.queensu.ca)

<http://cocoa.dima.unige.it/>

17–21 First Joint International Meeting between AMS and Société Math. de France, History of Math. special session, Tom Archibald (Acadia Univ.)

<http://www.ams.org/meetings/>

22–25 International Symposium on Symbolic and Algebraic Computation, (University of Western Ontario, London, Ontario)

<http://www.orcca.on.ca/issac2001/>

23–Aug.3 Combinatorics and Matrix Theory, (Laramie, Wyoming)

sfallat@math.wm.edu, <http://math.uwyo.edu/>

AUGUST 2001

7–9 Nordic Conference on Topology and its applications, NORDTOP 2001 (Sophus Lie Centre at Nordfjordeid, Norway)

nordtop2001@mail.mathatlas.yorku.ca

7–10 The 4th Conference on Information Fusion, (CRM, Univ. de Montréal, Québec)

communications@crm.umontreal.ca

12–18 Thirty-ninth International Symposium on Functional Equations (Sandjberg, Denmark, organized by Aarhus University) *Henrik Stetkaer*: stetkaer@imf.au.dk

<http://www.imf.au.dk/isfe39>

13–15 13th Canadian Conference on Computational Geometry, (University of Waterloo)

<http://compgeo.math.uwaterloo.ca/cccg01>

13–15 Second Gilles Fournier Memorial Conference / Seconde Conférence à la mémoire de Gilles Fournier (Université de Sherbrooke, Sherbrooke, Québec)

<http://www.dmi.usherb.ca/evenements>

15–18 Second Workshop on the Conley Index and related topics / Deuxième atelier sur l'indice de Conley et sujets connexes (Université de Sherbrooke, Sherbrooke, Québec)

<http://www.dmi.usherb.ca/evenements>

JUILLET 2001

20–23 Second Canada-China Mathematics Congress (Vancouver)
<http://www.pims.math.ca/science/2001/canada-china/>

SEPTEMBER 2001

22–26 Applications of Discrete Mathematics, Australian Mathematical Society (Australian National University, Canberra) *Ian Roberts: iroberts@darwin.ntu.edu.au*
 or *Lynn Batten: lmbatten@deakin.edu.au*

DECEMBER 2001

8–10 CMS Winter Meeting / Réunion d'hiver de la SMC (Toronto Colony Hotel, Toronto, Ontario)
<http://www.cms.math.ca/CMS/Events/winter01>

MAY 2002

3–5 AMS Eastern Section Meeting (CRM, Université de Montréal)
<http://www.ams.math.org/meetings/>

JUNE 2002**SEPTEMBRE 2001****DÉCEMBRE 2001****MAI 2002****JUIN 2002**

6–8 CAIMS 2002 (University of Calgary)
Samuel Shen: shen@maildrop.srv.ualberta.ca

15–17 CMS Summer Meeting / Réunion d'été de la SMC (Université Laval, Québec, Québec)

Monique Bouchard: meetings@cms.math.ca

24–28 Special Activity in Analytic Number Theory (Max Planck Institute, Bonn) *moroz@mpim-bonn.mpg.de*

JULY 2002

22–30 44rd International Mathematical Olympiad (University of Strathclyde, Glasgow, UK0)

AUGUST 2002

20–28 International Congress of Mathematicians (Beijing, China) <http://icm2002.org.cn/>

DECEMBER 2002

8–10 CMS Winter Meeting / Réunion d'hiver de la SMC (University of Ottawa / Université d'Ottawa, Ottawa, Ontario)

Monique Bouchard: meetings@cms.math.ca

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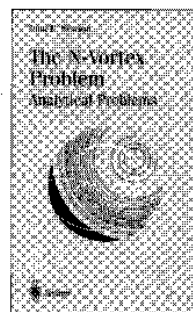
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