CMS NOTES de la SMC

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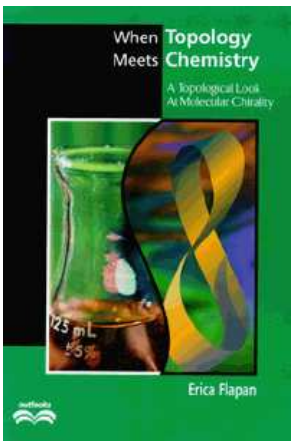
In this issue / Dans ce numéro

A Wonderful Interaction

Book Review by Dale Rolfsen, University of British Columbia

When Topology Meets Chemistry
Erica Flapan
Outlooks Series
Cambridge University Press and the Mathematical Association of America
xiii + 241 pages, 2000



There have been some wonderful interactions between so-called abstract mathematics and real-world science in recent years. Indeed, the old distinctions between "pure" and "applied" mathematics have faded considerably, if indeed they ever had real validity. A good example of this is the application of topological ideas to chemistry and molecular biology.

About forty years ago, Frisch and Wasserman synthesized the first catenane, a molecule which was topologically bonded, linked like the rings in an iron chain. The rings each contained 34 carbon atoms. Since that pioneering work, there have been many interesting syntheses of knotted and linked molecules. For long stringy polymers, such as DNA, the topological effects are perhaps much more important. Knotted and linked DNA actually occurs in nature, and mathematical knot theory has contributed significantly to our theoretical understanding of, for example, how strands of DNA can recombine or pass through each other, utilizing specific enzymes. Our understanding of protein folding is in its infancy and clearly will rely heavily on topological and geometric considerations. Such understanding may well have very practical medical consequences.

The book under review is a brave attempt to explain the current state of the art of the interplay between topology and chemistry, with a bit of molecular biology thrown in at the end. It is intended for an audience of either undergraduate mathematics students (or professional mathematicians, for that matter) or workers in the chemical or biological sciences. It largely succeeds, though I would say it is easier going for a mathematician than for a lay person or scientist who is not comfortable with mathematical jargon.

continued on page 13

CMS NOTES
NOTES DE LA SMC

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EDITORIAL

Peter Fillmore

Are you excited by recent developments in your area of mathematics? by a conference or meeting you attended this summer? by a book you read? by a book you wrote? by a lecture you heard? by a project you were part of?

Mathematics in Canada, in all its many aspects, is flourishing these days, and our job at the *CMS Notes* is to put it all (or as much as we can) on record. But there's a little problem: we don't have any reporters. Or to put it another way, all of you, our readers, are our reporters.

So if you answered yes to any of these questions, why not fire up your word-processor and tell us all about it? This could take the form of an article or a review, or be as simple as a letter to the editors. It is impossible for a small group to know about everything that is going on, so even if you just let us know about something that we ought to be covering, that would be a big step in the right direction.

In this issue we report on new Canada Research Chair appointments, which includes nice descriptions of their work, presumably written by the chairholders themselves. We're also carrying the second instalment of the Mathematics Steering Committee report, as well as an article about William Burnside, reprinted from the Newsletter of the *EMS Newsletter*. All three are attempts to communicate mathematics to a larger audience. Perhaps one of them can serve as a model or inspiration for you. Please help us to tell our story!

Êtes-vous emballés par les nouveaux développements dans votre domaine de spécialisation? Par un congrès ou un colloque auquel vous avez assisté cet été? Par une de vos lectures estivales? Par votre dernière publication? Par une conférence à laquelle vous avez assisté? Par un projet auquel vous avez participé?

Dans leurs formes les plus diverses, les mathématiques sont florissantes au Canada ces temps-ci, et notre travail, comme rédacteurs des *Notes de la SMC*, est de vous tenir au courant de tout ce qui se passe, dans la mesure de nos moyens, bien sur. Seulement, il y a un petit hic : nous n'avons aucun journaliste... Autrement dit, c'est vous, nos lecteurs, qui êtes nos journalistes.

Alors, si vous avez répondu <oui>à l'une des questions du premier paragraphe, pourquoi ne pas ouvrir votre traitement de texte et nous faire part de vos coups de coeur sous la forme d'un article, d'un compte rendu ou simplement d'une lettre à la rédaction? Comme un petit groupe ne peut se tenir au courant de tout ce qui passe, il nous serait déjà fort utile de recevoir un mot de votre part où vous nous diriez ce dont nous devrions parler.

Dans le présent numéro, nous vous présentons des nouveaux titulaires de Chaires de recherche du Canada ainsi qu'une bonne description des travaux de ces chercheurs, vraisemblablement par eux-mêmes. Vous pourrez également lire la deuxième partie du rapport du Comité de direction en mathématiques pures et appliquées ainsi qu'un article sur William Burnside, tiré du *bulletin de la SME*. Ces trois articles se veulent une tentative de transmettre des nouvelles de la communauté mathématique à un vaste public. Qui sait? Peut-être qu'un de ces textes vous inspirera? Aidez-nous à nous faire connaître!

Report of the Steering Committee for Pure and Applied Mathematics

PART 3: REPORT ON THE CANADIAN COMMUNITY

The CMS Notes is publishing this report in instalments, beginning with Parts 1 and 2 in the September issue, and continuing with Part 3 this month.

This section presents a selected overview of recent Canadian mathematical research in the areas of Fundamental Mathematics, Applied and Industrial Mathematics, and Computational Mathematics. In each case, the presentation will focus on significant researchers by sub-discipline, who were selected with a view to verifying key assertions surrounding our funding proposals. Among our goals are to highlight:

- The very striking interdisciplinary trend in Canadian mathematics. Every area demonstrates major research activity based on interactions with other disciplines.
- The large number of excellent younger researchers in Canadian mathematics. These researchers are identified by the asterisk symbol (*) in this text.
- The presence of a number of active structured groups in Canadian mathematics, focused on training and larger scale research. Many younger researchers are part of these groups.

Awards: A Canadian mathematician can be recognized for excellence in a number of ways. Being invited to speak at the International Congress of Mathematicians (ICM) or the International Congress on Industrial and Applied Mathematics (ICIAM), held every 4 years, is a very high honour. Within Canada, a Steacie Fellowship is a notable distinction similar to a US Sloan Fellowship; other important Canadian recognitions are Killam Fellowships and election as a Fellow of the Royal Society of Canada (FRSC). In the past decade, mathematicians have been awarded 4 Steacie Fellowships, 11 Sloan Fellowships, and 8 Killam Fellowships. Recent major recognition includes 4 mathematicians who have received membership in the Order of Canada, and one who has been both elected to the Royal Society and awarded the NSERC Canada Gold Medal for Science & Engineering. The affiliation and recognition of individuals is noted below; the bulleted texts indicate specific, notable examples.

Fundamental Mathematics

(a) Number Theory: Number theory is one of Canada's strongest mathematical areas. It has intimate connections with algebra, analysis and geometry and much of its modern development has arisen out of exploring these connections. The subject has been undergoing a remarkable synthesis whereby analytic and algebraic aspects are now understood to reflect a deeper underlying theory.

The theory of automorphic representations and their associated L-functions, the analytic properties of which encode profound arithmetic information, is central to these new developments. The Canadian mathematician R. Langlands (IAS Princeton) outlined a visionary program for understanding these representations that has shaped the development of the discipline for the past 20 years. J. Arthur (Toronto; FRS, FRSC, Steacie, Killam, Guggenheim, ICM '82, ICM '98, Tory Medal, NSERC Gold Medal) is a world leader in the Langlands program. His work involves harmonic analysis, Lie theory, automorphic forms, algebraic geometry, and number theory. He has achieved a vast generalization of the Selberg trace formula and, with Clozel, has proved the cyclic base change, a fundamental step in the effort to establish the Langlands program. The Langlands program also played a crucial role in Wiles's solution of the Fermat problem. H. Darmon (McGill; Sloan) and his collaborators have applied these methods to obtain new results on a wide class of Fermat-like equations and, more recently, have introduced very novel p-adic methods to prove cases of the main conjecture for elliptic curves.

In analytic number theory, J. Friedlander (Toronto; FRSC, ICM '94), in a series of papers with Iwaniec and Duke, broke through the convexity bounds for L-functions associated to GL(2) modular forms. Major technical novelties they presented have led to a final resolution of Hilbert's eleventh problem and also to a startlingly low bound on the size of Dirichlet L-functions on the half-line. Friedlander and Iwaniec also achieved a spectacular advance on the asymptotic sieve, allowing them to prove that there are infinitely many primes that are the sum of a square and a 4th power. R. Murty (Queens; FRSC, Steacie, Killam), well known for his work on L-functions of elliptic curves and Artin's primitive root conjecture, heads a number theory group that includes E. Kani, N. Yui and 4 PDFs. Other younger researchers in number theory include H. Kim* and C. Consani* at Toronto.

H. Darmon heads a number theory group in Montreal, including E. Goren* at McGill, and C. David, H. Kisilevsky, and F. Thaine at Concordia. The group has associated members from Laval, Ottawa (D. Roy), Queens and Vermont. Training of HQP is a major focus and 13 Masters, 9 PhDs and 19 PDFs have been trained in the past 4 years.

D. Boyd (UBC; FRSC, Steacie) and P. Borwein (SFU; Chauvenet Prize) lead an emerging Vancouver number theory group of striking po-

tential. Besides W. Casselman (UBC; FRSC), the group includes many talented younger researchers such as M. Bennett*, G. Martin*, and V. Vastal* at UBC and S. Choi*, I. Chen*, and P. Lisonek* at SFU. The group makes extensive and sophisticated use of computation.

(b) Algebra: In the twentieth century, algebra was dominated by a drive towards abstraction and formalization. A significant reversal of this trend is now occurring: algebraists are typically involved in, and motivated by, problems from other areas of mathematics or theoretical physics. Lie theory pervades many subjects, including analysis, differential geometry, particle physics, string theories, conformal field theories, representation theory, and, increasingly, number theory. Canada is particularly active in the development of infinite dimensional Lie algebras. The research of R.V. Moody (Alberta; Order of Canada, FRSC, Wigner medal, Kaplan award), from his early work establishing the foundations of affine Kac-Moody algebras to his current work studying quasi-crystals and aperiodic order, demonstrates this linkage to theoretical physics. T. Gannon* (Alberta) filled the gap in the conceptual proof of the moonshine conjectures for which Borcherds was awarded a Fields Medal. The discoverer and chief exponent of the deep and fascinating subject of moonshine is J. McKay (Concordia; FRSC). S. Berman (Saskatchewan) has energized a whole community of Lie algebraists whose work links almost all important non-associative algebras. Younger members of this community include Y. Billig* (Carleton) and Y. Gao* (York). The large interactive algebra group at Alberta also includes A. Weiss (FRSC) who, using algebraic K-theory and Iwasawa theoretic methods, has contributed to recent work on the equivariant Stark conjectures.

(c) Geometry/Topology: The subjects of geometry and topology permeate almost all branches of mathematics, and have diverse and far-reaching interactions with biology, chemistry, computer graphics, and physics. The strong interaction of theoretical physics with geometry and topology is probably the most exciting recent development gauge theory has revolutionized low dimensional topology, and there has been explosive growth in symplectic geometry inspired by problems originating in physics.

There has been a vigorous development of these areas in Canada. The work of F. Lalonde (Montreal; FRSC, Killam, CRC) has been crucial in the understanding of symplectic invariants. His work with D. McDuff (SUNY Stony Brook; FRS, ICM '98) examines the stability and rigidity of Hamiltonian systems. There is an impressive young group at Toronto in the area of symplectic geometry. L. Jeffrey* (Toronto; Sloan, ICM '02), with collaborator F. Kirwan (Oxford; FRS), has given proofs of the famous Witten formulas. She and E. Meinrenken* (Toronto; ICM '02) have each made fundamental contributions to the relation between quantization and symplectic reduction. B. Khesin* (Toronto; Sloan) is a major figure in infinite dimensional symplectic geometry and Lie groups.

J. Hurtubise (McGill; AMS Centennial Fellowship) and his collaborators have provided fundamental insights on various moduli spaces of maps, notably proving a long standing gauge theoretic conjecture of M. Atiyah (Fields Medal) and J. Jones. At McMaster, I. Hambleton (Britton Professor) leads an active geometry group, including 6 PDFs and the newly hired H. Boden*, specializing in gauge theory and Riemannian geometry. Toronto also has a high profile group in algebraic geometry, including. E. Bierstone (FRSC) and P. Milman (FRSC, Killam), who have given a constructive proof for one of the most famous theorems in modern mathematics, Hironoka's desingularization result (for which he was awarded a Fields Medal). M. Kapronov (Toronto) is noted for his introduction of deep and fundamental structures into mathematical physics and algebraic geometry. UBC houses a young group in algebraic geometry, comprised of K. Behrend*, J. Bryan* (Sloan) and Z. Reichstein*, who study algebraic stacks, enumerative geometry, and invariant theory, respectively.

Montreal has a well-established geometry/topology group (CIRGET) organized by S. Boyer (UQAM), N. Kamran (McGill) and F. Lalonde. The 12 members working at the 4 Montreal universities include J. Hurtubise and A. Joyal (UQAM; FRSC, Killam) and the 3 junior researchers, V. Apostolov* and O. Collin* at UQAM and D. Wise* at McGill. Since 1998, this group has trained 26 Masters students, 17 PhDs and 24 PDFs.

(d) Functional Analysis: This is an area of international importance and Canadian researchers have contributed some of the best work in the field. The subject area of Operator Algebras is a blend of algebraic, analytic, and topological techniques and has extensive applications in quantum mechanics and computation, physics, and electrical engineering. G. Elliott (Toronto; FRSC, ICM '94, Killam, CRC) created and leads an exciting and ambitious program to classify all C*-algebras through K-theoretic invariants. K. Davidson (Waterloo; FRSC, Steacie, Killam) is widely known for his fundamental work in nonselfadjoint operator algebras, and structural theorems for triangular algebras. D. Handelmann (Ottawa; FRSC, Steacie, Killam) and I. Putnam (Victoria; FRSC) have discovered new and important interactions between C*-algebras and topological dynamics. All of these mathematicians are leaders of highly active analysis groups at their home universities.

continued on page 17

AWARDS / PRIZES

ROYAL SOCIETY OF CANADA FELLOWS 2002

Two mathematicians, Niky Kamran (McGill University) and Neil Madras (York University), are among the 58 new Fellows, four Specially Elected Fellows and two Foreign Fellows elected to the Royal Society of Canada. They will be inducted at Rideau Hall in November.

Niky Kamran is a leading researcher in the geometric study of differential equations. He has recently established, in a series of joint papers with Finster, Smoller and S.T. Yau, sharp estimates for the long-time behavior of Dirac fields in axisymmetric black hole geometries. His work on differential invariants and conservation laws for differential equations has led to an in-depth understanding of the property of geometric integrability for hyperbolic equations. He is also a founder of the rapidly expanding field of quasi-exactly solvable spectral problems in quantum mechanics. The growth of this field is due to a significant extent to his foundational papers. He was the recipient of the André Aisenstadt Prize in 1992, and is a Laureate of the Royal Academy of Sciences of Belgium. He won that academy's prize in mathematics in 1988 for his research monograph *Contributions to the study of the equivalence problem of Elie Cartan and its applications to partial and ordinary differential equations*.

Neil Madras is well known in the international mathematical and mathematical-physics community for his leading edge contributions to the rigorous theory of self-avoiding walks. He is one of the world leaders in this field. His book with Gordon Slade, *The Self-Avoiding Walk*, is a major contribution that is of fundamental interest to physicists, chemists

and mathematicians alike. It is recognized as the definitive reference work on the subject. Madras is also one of the leading contributors to the development and applications of more efficient Monte Carlo methods for the numerical simulation of self-avoiding walks, and has made significant contributions to the general mathematical theory of self-avoiding geometrical objects, such as trees and animals. He is also one of the influential contributors to the general theory of Monte Carlo methods and randomized algorithms. Madras is also well known for his contributions to probability theory and stochastic processes, as well as for his excursions into mathematical biology.

2002 SLOAN FELLOWS

The Alfred P. Sloan Foundation has announced the names of 104 young scientists and economists who have been selected to receive Sloan Research Fellowships. Among the recipients are 20 mathematicians, including **Vinayak Vatsal** (UBC) and **James F. Geelen** (Waterloo).

2002 GUGGENHEIM FELLOWSHIPS

The John Simon Guggenheim Memorial Foundation has selected 184 artists, scholars and scientists as Guggenheim Fellows for 2002. This includes five mathematicians, one of whom is **Mikhail Lyubich**, recently appointed to a Canada Research Chair at the University of Toronto. His research is concerned with geometric structures in holomorphic dynamics.

EDUCATION NOTES

Ed Barbeau and Harry White, Column Editors

APICS REPORT ON THE ATLANTIC MATHEMATICS CURRICULUM

During the past decade, the four Atlantic Provinces have jointly developed a new high school curriculum. This represents a shift in approach towards an investigative approach to foster understanding. Classroom time will be devoted to activities rather than note-taking and working of examples. Students headed for university calculus will have four, rather than three, courses from Grade 10 to Grade 12 inclusive, although the details of the courses and the pace of implementation vary somewhat with the province. The time of arrival of the first university cohort ranges from the autumn of 2002 (NS), through 2003 (NF, PE) to 2004 (NB), although some pilot schools graduated students earlier than these expected dates.

A group of 53 of the pilot students attracted the concern of the mathematics department at Memorial University. During the academic year, 2001-2002, close to sixty per cent of them either failed or withdrew from the first semester calculus course. At the University of Prince Edward Island, the dean of science also was worried about the curricular changes and asked the Atlantic Provinces Council on the Sciences (APICS) to advise on an appropriate response. A committee was struck to examine how the curriculum was being implemented, what universities have studied its effects and how APICS can ameliorate its impact on matriculating students; its report, dated April 5, 2002, was signed by Maxim Burke (UPEI), Robert Dawson (St. Mary's University), Edgar G. Goodaire (Memorial University), Paul Gosse (Prince of Wales Collegiate, St. John's) and Maureen Tingley (UNB), and endorsed by APICS Council on April 13, 2002.

It is made clear that the smooth introduction of the new curriculum is confounded by its new approach, the lack of timely appearance of appropriate resources and insufficient professional development of teachers. Critics point to the lack of precision and mistakes in support materials, the failure to buttress mastery of skills and misplaced reliance on computers and calculators. New topics have been included at the expense of a solid foundation in algebra, trigonometry and functions and a broader, shallower syllabus has resulted.

The committee made eight recommendations:

1. All universities of Atlantic Canada should require completion of all advanced courses, including the top level precalculus course, for admission to a tertiary calculus course.

2. Each university should administer a placement test and should ban from calculus students likely to fail.

3. Universities should share their placement tests and work towards a single test that would serve all.

4. Universities should track the performance of students graduating from the new curriculum and share the result with schools and universities in the region.

5. Universities should report annually to schools and their districts on the tertiary performance of their students.

6. School and university personnel should promote the APICS calculus booklet through the web (visit `www.math.mun.ca/ãpics/`), and hard copies should be given to school counsellors and teachers.

7. Departments of education should ensure that secondary mathematics courses be taught by suitably qualified people, and that seniority not be a primary criterion for filling positions.

8. Teacher education programs should provide additional workshops and training sessions to encourage familiarity with the new curriculum, mathodology and technologies.

The brief report has some particularly useful features. It emphasizes how the responsibility for success has to be shared among parents (who must become involved and hold students and teachers accountable), teachers (who need to ensure that they are properly prepared) and students (who need to take advantage of their opportunities). Paul Gosse, head of mathematics at Prince of Wales Collegiate, provides an astute and fair-minded appreciation of the new curriculum in an appendix. A further appendix gives a province-by-province summary of the syllabus.

INNOVATIONS IN MAINSTREAM COURSES

In the September issue of these *Notes*, there was a brief review of a volume in the series designated *MAA Notes*. Since 1982, about 60 publications devoted to the teaching of undergraduate mathematics have appeared, each costing around US$30. This month, I draw attention to three recent arrivals, each dealing with new ideas for key first courses in the undergraduate curriculum, calculus, linear algebra and modern algebra.

Changing calculus: A report on evaluation efforts and national impact for 1988-1998

Susan L. Ganter
xi + 78 pages, MAA, 2001
ISBN 0-88385-167-9
Catalogue code: NTE-56

For the better part of two decades, there have been many projects involved in changing the teaching of (mainly) tertiary calculus, with increased emphasis on such factors as the use of graphing calculators and computers, applications, innovations in teaching such as group work, expository work and alternative modes of evaluation. This volume takes stock. NSF (US National Science Foundation) files for 127 projects funded between 1988 and 1994, articles in the literature and responses to a letter mailed to over 600 individuals were used to get a grip on the results of reform efforts. Separate chapters deal with NSF-funded projects, student achievement, student attitudes and faculty reactions. There is more detailed discussion on five influential initiatives: the Harvard Consortium; the Calculus, Concepts, Computers and Cooperative Learning project at Perdue University; Calculus and *Mathematica* at the University of Illinois (Urbana-Champaign); Project *CALC* at Duke University; and Calculators in the Calculus Curriculum at Oregon State University. While not completely consistent, studies seem to indicate higher retention rates, increased student confidence and a tendency for students view calculus more holistically, although their technical proficiency may be weaker. The students who resist reform tend to be those at the top of their classes or have taken calculus previously. It is embraced by those less successful with traditional teaching, poor at taking tests, not well motivated and belonging to disadvantaged groups. Within a mathematics department, the adoption of reform efforts has led to increased awareness of, conversation about, and participation in educational activities. The report urges researchers to address a number of questions more systematically concerning the nature of undergraduate learning, mathematical contributions to science and technology, appropriate education for students and the nature of future changes. This is a useful document for the table of your common room.

Linear algebra gems: assets for undergraduate mathematics

David Carlson, Charles R. Johnson, David C. Lay, A.Duane Porter (editors)
xvi + 328 pages, MAA, 2002
ISBN 0-88385-170-9
Catalogue code: NTE-59

Although linear algebra has been a staple of the undergraduate curriculum for about forty years, it has not been easy in general to either teach or learn. The elegance of the subject lies largely in its formulation and its sophistication goes over the heads of many students. It is easy to get bogged down in tedious detail, and the temptation to retreat to standard matrix routines is strong.

However, many teachers have been able to find illustrative results that are both beautiful and accessible, and to show how a linear algebra method can illuminate other parts of mathematics. This volume, compiled on behalf of the Linear Algebra Curriculum Study Group of the Mathematical Association of America, collects together over 70 short articles along with 123 class problems sorted into nine areas (partitioned matrix multiplication; determinants; eigenanalysis; geometry; matrix forms; polynomials and matrices; linear systems, inverses and rank; applications; other topics). Many have been previously published in MAA journals, while others were submitted in response to an appeal in the *College Mathematics Journal*.

There is quite a variety. Some articles look at standard topics in new perspectives, while others provide examples for the classroom or new proofs of results. Most occupy a couple of pages. Here are a few samples. A quick proof of Cramer's Rule is given through replacing the equation $A\mathbf{x} = \mathbf{b}$ by the matrix equation

$$A[I \leftarrow^i \mathbf{x}] = [A \leftarrow^i \mathbf{b}] \,,$$

(where, for example, $[A \leftarrow^i \mathbf{b}]$ is the square matrix obtained from A by replacing its ith column by the column vector $\mathbf{b}$) and taking determinants of the two sides. A condensation technique of C.L. Dodgson (Lewis Carroll) is revived, whereby a sequential calculation of 2×2 determinants will lead to an evaluation of an $n \times n$ determinant. Anatol Fekete at Memorial University contributes a nice result on the calculation of determinants whose entries are values of polynomials evaluated at consecutive integers. There is a result on how to construct integer matrices with integer eigenvalues. A number of ideas for student projects are presented.

Innovations in teaching abstract algebra

Allen C. Hibbard, Ellen J. Maycock (editors)
x + 152 pages, MAA, 2002
ISBN 0-88385-171-7
Catalogue code: NTE-60

This volume follows a 1996 workshop at DePauw University and contributed paper sessions at the 1997 and 1999 Joint MAA-AMS meetings. Participants in these events and other individuals were invited to write articles on new approaches to teaching abstract algebra. Their papers fall into three categories, according as they treat course design that will engage students, the use of technology as an exploratory tool and the role of applications and problem solving. The theme of the first section is how students can can learn to handle abstract and generalized settings. In the second, a number of software packages are exploited to allow the exploration of structures, particularly groups: *Exploring Small Groups* (ESG) developed by Ladnor Geissinger; an augmentation

of this entitled *First Group Behaviour* (FGB) by Ellen M. Parker; *Interactive SET Language* ($ISETL$); *Groups, Algorithms and Programming* (GAP); $MATLAB$; *Maple*; and *Mathematica*. All of these give a hands-on experience without the tedious details. Pascal's triangle, puzzles and change-ringing of bells are vehicles described in the final section for motivating students.

HELP FOR NEW FACULTY MEMBERS

The modern academic treads a perilous road, achieving a permanent position after an investment of many years of study and probably several temporary appointments. Once ensconced, this person has to handle many obligations of scholarship and teaching that are being continually evaluated. Fortunately, there is an increasing recognition within the profession of the stresses that this engenders, so that there are workshops (such as *NExTMAC* under the auspices of the Mathematical Association of America, a session of which occurred at the recent CMS meeting in Laval) and books directed to both new doctorates and departments. The older generation began their careers in an atmosphere in which administrators were loath to intervene, and found its way by a mixture of instinct, learning from experience and good luck. This atmosphere is being replaced by an openness where difficulties can be acknowledged and tackled. Two recent books, one directed at novices and the other at their departments, give a good example of the advice that is available.

Advice for new faculty members: *Nihil nimus*

Robert Boice
Allyn and Bacon, 2000
xiv + 313 pages
ISBN 0-205-28159-1

Learning to teach and teaching to learn mathematics: Resources for professional development

Matt DeLong and Dale Winter
MAA Notes Series #57
Mathematical Association of America, 2002
xiv + 270 pages
ISBN 0-88385-168-7
US$34.95 Catalogue code: NTE-57

Boice, a professor of psychology, directs his advice directly to the new academic. While not specific to mathematics, most of what he says will be of value. Espousing the motto, *Nihil nimus* ("Nothing in excess"), he counsels them to balance their many obligations, efficiently and moderately. Contrary to the opinion of some, he finds that new hires have a genuine concern to enjoy and succeed in their teaching. It is just that they do not know the ropes and how to draw on the support of colleagues. And their difficulties are correctible.

The easy style of a self-improvement manual should not hide from the reader that the advice is practical, sensible, based on experience and backed by psychological insights and research. Some titles of the chapters in the first section on teaching are "Wait", "Begin before feeling ready", "Stop", "Let others do some of the work". They deal with such matters as negative thinking and classroom management. A similar measured approach informs the second section on writing while in the third he discusses the academic culture. Faculty members who start well know how to network, respect and enjoy their colleagues, are accepted by students and are getting invitations to review and travel, while those headed for disillusionment are beset by feelings of isolation, self-doubt and victimization. The empathy of the author is stamped on every page. This book was given to each participant in the *NeXTMAC* session at Laval.

DeLong and Winter are concerned with the creation of a supportive enviroment for new faculty members as they embark on their first teaching assignments and need to "develop and enhance their instructional skills". Drawing on "seven years of collective experience in professional development at the University of Michigan, Duke University, Taylor University and Harvard University", the book describes a "semester-long program of professional development". Directed to departmental administrators, it provides a detailed prescription for a daylong orientation session followed by a succession of workshops during the teaching term that deal with matters of teaching, discipline, assessment and administration. This includes the opportunity to discuss thorny issues that will be all-too-familiar to most of us. The authors provide handouts that might be used, schedules that might be followed and references to books and papers that might be read and discussed. Of course, the book is not neutral about instructional values. It presumes that instructors will try to foster a student-centered environment where students will often work collaboratively, be coached in how to use resources (particularly how to read the textbook productively), and have their opinions and goals respected. A concluding chapter treats observation of lectures by colleagues. There are three types of regime. A senior colleague observes a lecture and then has a private critical session with the lecturer. Alternatively, after a visit to the lecture, the observer would have a discussion with the students in the absence of the lecturer. Finally, peer visits might be exchanged for the benefit of mutual advice and support. Like the Boice book, this volume is imbued with practicality, anticipates what can go wrong and makes suggestions to put them right.

Canada Research Chair Appointments

Five mathematicians were among 95 appointments to Canada Research Chairs announced in June: Ian Putnam (Victoria), David Sankoff (Ottawa), Mikhail Lyubich (Toronto), Alexei Miasnikov (McGill) and Andrew Granville (Montreal).

Ian F. Putnam is the Canada Research Chair in Operator Algebras and Dynamical Systems (Tier 1). His achievements include election as a Fellow of the Royal Society of Canada (1999), NSERC University Research Fellow (1987-1996), the André Aisenstadt Prize (1992) and the Israel Halperin Prize (1990). His area of research is described as follows:

The field of dynamical systems is the study of mathematical models for the evolution of physical systems. Although the mathematical foundations are very old, the field has become one of increasing importance in the last twenty years. Part of this can be traced to advances in computational technology, but of equal importance is the discovery of the phenomenon now known as chaos and its pervasive role in nature. The study of dynamical systems has also played an important role in information theory and its application to information technology.

Operator algebras were developed as a model for quantum mechanics in the early part of the last century. The seminal work of Murray and von Neumann demonstrated the close connections between this subject and dynamical systems.

Dr. Ian F. Putnam, Canada Research Chair in Operator Algebras and Dynamical Systems, is recognized worldwide as a top expert on the interrelation of these two subjects. He is the leader of an international group of researchers who bring the powerful tools of modern operator algebra theory to the study of operator algebras associated to topological dynamical systems.

Dr. Putnam will continue his explorations using the tools of Alain Connes's program of noncommutative geometry. The goal of Dr. Putnam's research is two-fold: to construct from dynamical systems new examples of C*-algebras and to apply the tools of non-commutative geometry to these C*-algebras to obtain new information about the dynamics. Some specific immediate areas of interest are the study of aperiodic order, topological orbit equivalence and Smale's program for hyperbolic (i.e. chaotic) dynamics from smooth systems.

Dr. Putnam will be working closely with collaborators at the university and at the Pacific Institute for the Mathematical Sciences (PIMS), and plans to form a group of collaborators from among these and other institutions. With Dr. Putnam's appointment to this Chair, this group could soon become one of the strongest mathematical centres in Canada.

David Sankoff is the Canada Research Chair in Mathematical Genomics (Tier 1). He is a leader in applying mathematical approaches to the study of genes and genomes. His early work on sequence comparison, multiple alignment and RNA secondary structure is at the forefront of modern computational biology and bioinformatics. In recent years he has elaborated a program for the mathematical study of genome evolution and his ideas on the subject form the basis for much of the advanced work in the area. The projects he will undertake as Canada Research Chair in Mathematical Genomics will seek to expand this field on several fronts including: the probabilistic modelling of the evolution of bacteria, protists and higher organisms; and the consequences of mechanisms like gene duplication, hybridization and lateral transfer for gene order evolution.

The development of models will allow statistical analysis and tests for a variety of questions pertaining to functional, historical and random proximities of genes. Comparing models with empirical data also promises to contribute to understanding phenomena as diverse as speciation, infertility due to chromosomal rearrangement, and chromosomal aberrations in neoplasms.

As in some of his earlier work, Dr. Sankoff will also focus on the design and analysis of algorithms for genome comparison, particularly to solve the difficult problems raised by the incorporation of multigene families into existing methods. He plans to integrate the empirical knowledge gained in his statistical projects into the algorithms in the form of parameters for the type, size, location and frequency of gene rearrangement events.

As part of his project, Dr. Sankoff will also establish a research centre for innovation in bioinformatics that will contribute to the development of a genomic research cluster at the University of Ottawa.

Mikhail Lyubich, Canada Research Chair in Mathematics (Tier 1), has numerous publications and has given many international lectures on the theory of real and complex dynamical systems. His honours include a Sloan Research Fellowship and a Guggenheim Memorial Fellowship. His research involves theoretical work on low-dimensional models of chaotic dynamics.

The theory of dynamical systems provides a basis for understanding the long-term evolution of complex systems, with practical applications that span fields as diverse as the motion of celestial bodies, fluid and atmospheric dynamics, neurology and population modelling. All of these fields demand a fundamental understanding of chaotic dynamical systems, particularly the structure of strange attrac-

tors and fractal bifurcation diagrams, the nature of universality laws, and the interplay between real systems and their extensions to the complex domain. Advances in theoretical understanding can help specialists in different branches of science learn how to deal with intrinsic chaotic and fractal features of nature.

The past twenty-five years have brought many breakthrough discoveries in the field of real and complex low-dimensional dynamics, including discovery of the universality and rigidity phenomena and proving deep theorems which ultimately lead to proof of the Universality Conjecture and a complete description of the measure-theoretic picture of dynamics in the real quadratic family.

Dr. Mikhail Lyubich has contributed a number of key discoveries in these areas, gaining a reputation as one of the leaders in the area of holomorphic dynamical systems. He plans to extend his work toward the following four goals: proof of the rigidity conjecture in one-dimensional holomorphic dynamics; full understanding of dynamics in generic one-parameter families of unimodal maps; exploration of the universality and deformation phenomena in families of dissipative two-dimensional dynamical systems; and further study of the interplay between holomorphic dynamics, hyperbolic geometry and laminations. Dr. Lyubich's work will assist the University of Toronto to become one of the world's leading centres in dynamical systems, forming an important bridge between existing strengths in theoretical and applied mathematics.

Alexei Miasnikov is Canada Research Chair of Combinatorial Algebra (Tier 1). He is the author of more than sixty articles and forty lectures, and was Director of Cryptography at the City University of New York.

Dr. Miasnikov vaulted into the ranks of the world's leading mathematicians with his proof–co-published with Olga Kharlampovich of McGill–that the elementary theory of free non-abelian groups, posed by Alfred Tarski in 1945, is decidable. This problem was viewed as one of the last remaining unsolved questions in group theory, which abounds in notoriously difficult decision problems involving combinatorial relationships between words. One of Dr. Masnikov's goals is to pursue the unexplored directions in the field of group theory that have been opened up by the new methods he developed for the resolution of Tarski's problem. One significant aim is to generalize his ideas to a more geometric framework that would illustrate the theory of word-hyperbolic groups presented by Mikhail Gromov in the mid-1980s.

A second focus of Dr. Misnikov's program is to find a counterexample to the Andrews-Curtis Conjecture, which holds that every balanced presentation of a trivial group can be transformed into the standard presentation by a finite sequence of elementary transformations. He proposes to find a counterexample in a finite quotient using computational methods.

The overarching goal is to identify a number of group theory decision problems that have high-average case complexity and would require an extremely long time to solve. These decision problems hold enormous potential for application in cryptography.

Andrew J. Granville is Canada Research Chair in Number Theory (Tier 1). He has authored some 100 influential papers addressing problems in many mathematical areas. Among his honours are the U.S. Presidential Faculty Fellowship, the Hasse Prize of the Mathematical Association of America and the Ribenboim Prize of the Canadian Number Theory Association; he was an invited lecturer at the Zurich International Congress of Mathematicians.

First developed by the ancient Greeks and Hindus, number theory holds the answer to any number of contemporary, real-world problems, including: public key cryptography to protect information transmitted on the Internet; CDs that can withstand minor scratches without harm to the digital information they hold; and satellite positioning systems that allow shipments to be tracked. Number theory also has increasingly important applications in the areas of theoretical physics and computer science.

Dr. Granville's research as Canada Research Chair in Number Theory is aimed at better understanding basic questions in number theory: the distribution of prime numbers and other important number-theoretic sets; multiplicative functions; values of character sums; values of L-functions at the edge of the critical strip; and the abc-conjecture and its consequences. He has done important work in all of these areas, and is working on some of the outstanding questions that have arisen on these topics.

A key part of Dr. Granville's program will be collaborative work wth fellow professors, postdoctoral fellows and graduate students. To date, Dr. Granville has formed more than fifty professorial collaborations to assist him with his extensive writings, and he has acted as advisor to about two dozen postdoctoral fellows and graduate students. He believes that mathematics should be a collaborative effort and that important ideas often stem from such interactions. Dr. Granville intends to bring this perspective to his work at the Université de Montréal, leading students and junior faculty in research, inviting participation from leading international researchers, and helping to develop an extremely positive learning and research environment.

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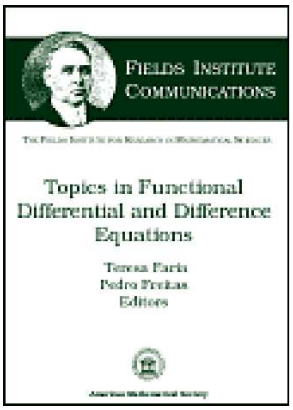
The Problem With Conference Proceedings

Book Review by Michael C. Mackey, McGill University

Topics in Functional Differential and Difference Equations
Teresa Faria and Pedro Freitas, Editors
Fields Institute Communications 29
AMS, 2001
378 pp



In physics and engineering problems, applied mathematicians are used to dealing with situations described by ordinary differential equations or partial differential equations. It may come as something of a surprise for them to discover that there are many areas of application where dynamics are explicitly dependent on the value of some state variable at a time in the past. In such cases the dynamics may be described by differential delay equations or functional differential equations. Examples of such situations with delayed dynamics are found in many areas of applied science and are especially abundant in the biological sciences. For example, neural feedback systems have delays due to the neural conduction delays, blood cell production must take into account the maturation delays dependent on the time required for transcription and translation at the molecular level.

Delay, or functional, differential equations are notoriously difficult to study and deal with, and there have been a number of books written dealing with the subject. The ones written for the professional mathematician are excellent but virtually impossible for the non-specialist to use with any degree of facility to deal with a practical problem. The ones written by non-specialists can be more useful, but often suffer from mathematical defects. One might therefore hope that a contribution in a conference proceedings might start to fill this gap.

This volume, published by the American Mathematical Society under the Fields Institute Communications, is the outcome of the Conference on Functional Differential and Difference Equations held at the Department of Mathematics of the Instituto Superior Técnico, Lisbon from 26 to 30 July, 1999. The conference was at least partially focused on celebrating the seminal influence of the work of Jack Hale in this field, and in that sense it succeeded admirably. However, the written record under review here suffers from the all too common ills of almost all conference proceedings. Namely, no matter how interesting and delightful the conference (and this conference was both), the proceedings inevitably have a certain schizophrenic quality since the talks are often totally disconnected from each other. The only way that this can be overcome is for the editors to give some coherence to the papers through selective grouping with some explanatory introductory material for each section. This takes real work and I have rarely seen this done successfully. Regrettably this was not even attempted in this volume. Either the editors elected not to, or found it too daunting a task. The contributions are so varied in subject and variable in substance I would have had trouble doing it, and I think the charitable conclusion is that they did too and opted for a presentation of papers arranged alphabetically by authors surname. A ho-hum choice not designed to aid the uninitiated reader.

The papers presented in this proceedings are so diverse that a mindless recounting of the merits of each would be numbingly boring. What catches a reviewer's fancy is quite variable, but the ones I noted in particular started with the feast of a review ("Some Problems in FDE") by Hale. An der Heiden (page 223) offers an interesting and illuminating treatment of a spectrum of problems. There are a number of papers dealing with potentially interesting applied problems such as the dynamics of feline leukemia virus (Fitzgibbon et al., page 133) and neural dynamics. (Giannakopoulos et al., page 147 and Huang and Wu, page 235). Several authors dealt with aspects of delayed dynamics in systems described by partial differential equations. (Amraoui and Rhali, page 1; Bátkai and Piazzera, page 51; and Bouzahir and Ezzinbi, page 63). Problems modeled by systems such as these are becoming progressively more important in considerations of intracellular molecular dynamics.

Would I recommend this volume to anyone for purchase? No. The price is far too high relative to what I suspect anyone will glean from it. There may be a handful of specialists who would like to own this book, but I suspect that they will be very few and far between.

The Sesquicentenary of William Burnside

by Tony Mann, University of Greenwich, UK

This article originally appeared in the June 2002 issue of the Newsletter of the European Mathematical Society.

This year marks the sesquicentenary of the birth in London on 2nd July 1852 of William Burnside, who today is known principally for his contributions to group theory. (He is sometimes confused with his contemporary, the Irish mathematician William Snow Burnside (1839-1920), author with A.W. Panton of a *Theory of Equations*: our Burnside was of Scottish descent.) The death of his father in 1858 left the family in straitened circumstances. William was educated at Christ's Hospital, the "Bluecoat School", where he was top pupil in the mathematical school, and in 1871 he was awarded a mathematical scholarship to St. John's College, Cambridge.

In his first year at Cambridge, Burnside was a member of the St. John's Boat Club which was Head of the River. For reasons which are unclear, during his second year he moved to Pembroke College, where he contributed to the Boat Club as coach and oar (usually Seven) for the rest of his time in Cambridge: it is not considered entirely coincidental that in this time the Pembroke boat rose from 25th to fourth in the May races.

Burnside was joint second wrangler in 1875, and came first in the Smith's Prize Examination. He was then awarded a fellowship at Pembroke, where he remained until the summer of 1885, when he became Professor of Mathematics at the Royal Naval College at Greenwich. He resigned his Pembroke fellowship on his marriage in 1886.

At Greenwich, Burnside taught mathematics to seamen and naval architects. He was well paid —the Professors' salary was £600 per annum— and had time to pursue his own mathematical interests. He seems to have maintained his links with Cambridge, sometimes attending Henry Frederick Baker's Saturday seminar or "tea party", and he remained highly regarded at Pembroke, where he became an Honorary Fellow in 1900. On the death of Sir George Gabriel Stokes in 1903 he was offered the Mastership of Pembroke, which he declined, either for financial reasons or because he wished to avoid the concomitant administrative responsibilities. He took an active part in the London Mathematical Society, serving on Council for many years and being President 1906-1908, and he was elected Fellow of the Royal Society in 1893.

Burnside remained at the Royal Naval College until his retirement in 1919. He lived in south-east London and on his retirement moved to West Wickham, where his house Cotleigh in High Street is now the HSBC Bank. His wife Alexandrina Urquhart came from Poolewe in Ross-shire (north west Scotland) and they regularly visited the family croft there, where William could indulge his love for fishing. Their five children (there were no grandchildren) are still remembered in Poolewe. There are hints that Burnside could present a rather stern personality when people did not come up to the high standards he set for himself and others, but he was held in affection by his naval students, who on his retirement presented him with a handsome illuminated address (now in Pembroke College Library).

Initially an applied mathematician, Burnside published his first paper on group theory in 1893. His *Theory of Groups of Finite Order* (1897) was the first book in English on group theory: a considerably revised second edition appeared in 1911. Burnside wrote in the first edition, "No simple group of odd order is at present known to exist. An investigation would undoubtedly lead to results of importance." It was almost seventy years before Feit and Thompson would show that indeed all groups of odd order are soluble. This was typical of Burnside's ability to identify fruitful problems: another example was "the Burnside Problem" (the question of whether a finitely-generated group of finite exponent is necessarily finite) which he proposed in 1902 and which also led to significant areas of twentieth century mathematics. Towards the end of his life, Burnside became interested in probability theory, writing a book, *Theory of Probability*, which was published posthumously in 1928.

William Burnside died on 21st August 1927 and is buried in West Wickham Parish Church, where his grave is marked by a Celtic cross. His collected papers, edited by Peter M. Neumann, A.J.S. Mann and Julia Tompson and including a number of essays about Burnside's mathematics by distinguished scholars, will shortly be published by Oxford University Press.

(A Wonderful Interaction–continued from page 1)
The author does go to admirable lengths to define mathematical concepts from scratch. She also explains chemical terms and presents a rather fascinating account of the chemical background needed to understand the work at hand.

I asked a friend, who has a PhD in chemistry and teaches the subject, to have a look at the book, in an attempt to get the perspective of a non-mathematician. Although he has some background in mathematics, my friend found some of the math definitions and jargon rather hard going. On the positive side, he said he learned some new things in chemistry. For example, the drug Thalidomide has both a right- and left-handed version. The left-handed one helps treat morning sickness while the other one causes the birth defects for which the drug became notorious.

The thalidomide example is a dramatic illustration of the importance of handedness, or chirality, which is the *leitmotif* of much of the book. It is rather astonishing that some heavy machinery from the topology of 3-dimensional manifolds comes into play in the study of chirality of molecular structures. A molecule may be modelled by a graph whose vertices represent atoms and edges are the bond between the atoms. For example if you take a Möbius band and just consider the boundary curve, together with some bonds going across the band (perpendicular to the centerline) to vertices on the boundary, the resulting graph is called a Möbius ladder. The fact that Möbius ladders are intrinsically chiral was first proved by Simon, using a delicate argument involving 2-fold branched coverings of the 3-dimensional sphere and linking numbers to establish the nonexistence of an orientation-reversing involution.

Perhaps even more spectacular is the use of a 1987 theorem of Culler, Gordon, Leucke and Shalen called the cyclic surgery theorem. It is a fundamental result in the application of knot theory to 3-dimensional manifolds and their fundamental groups. This theorem turns out to be a key ingredient in an argument by Ernst and Sumners analyzing how certain tangles can be combined in the modelling of DNA recombination. This is presented in the very last chapter of the book, on the "Topology of DNA."

Besides a quite detailed study of chirality, which has many aspects, the book covers certain ideas of knot theory, such as knot polynomials and the Arf invariant, which have applications to the theory of embedding of graphs. A rather lengthy chapter deals with symmetries of graphs embedded in space. A typical result is that if G is a nonplanar graph embedded in R^3, then no orientation-reversing automorphism of (R^3, G) can induce the identity automorphism on the vertices of G. This is then used to show that certain molecules – for example ferrocenophan – are intrinsically chiral.

The book is quite rich in illustrations, which enhance its readability and visual appeal. Unfortunately, there are several errors even in the pictures. The figure 8 knot on page 67 is drawn wrong, and on page 213 three of the four figures presented as outcomes of TN3 Resolvase experiments are actually incorrect.

The writing style is pleasantly informal, though rigorous where necessary. As already mentioned, the author does a good job of defining terms and also takes some pains to motivate definitions and theory. Some definitions, I think, are inadvertently omitted, such as the bipartite graph $K_{p,q}$. It would have been very useful to have a detailed glossary of terms, say at the end of the book, for ready reference. Also if there is a subsequent edition, I would recommend a more detailed index.

A student of mathematics, particularly one interested in topology, will find this a useful and informative – even exciting – book. A student of chemistry might find it considerably more challenging, especially in the middle parts, and would be advised, if seriously interested in the subject, to take a course in topology in conjunction with reading this book.

OBITUARY / AVIS DE DÉCÈS

W. T. Tutte 1917-2002

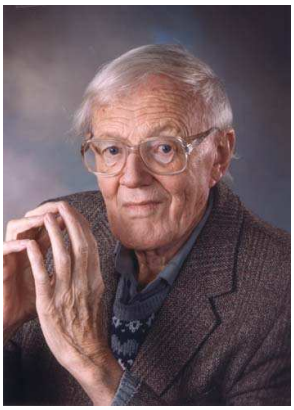


Photo courtesy of Peter Dennis

William T. Tutte, Distinguished Professor Emeritus at the University of Waterloo, died May 2, 2002. The cause was congestive heart failure, complicated by lymphoma of the spleen, both diagnosed within six weeks of his death.

It was just a year ago, October 2001, that he was inducted as an Officer in the Order of Canada, in a ceremony held at Rideau Hall in Ottawa. The citation began "He is internationally renowned for his seminal work in the area of graph theory. As a young mathematician and codebreaker, he deciphered a series of German military encryption codes known as Fish". These two sentences speak to his place in history. His wartime codebreaking work, much emphasized in newspaper obituaries, was a secret by order of British security until 1995 and, indeed, is only described with detail in recent articles.

Beginnings

Bill Tutte was born May 14, 1917 at Fitzroy House in Newmarket, England. His father was the House gardener, his mother the caretaker. How he rose from this background to graduate from Trinity College, Cambridge, is as remarkable a chapter of his life as those that followed.

Fitzroy House is now, and was perhaps then, a horseracing stable. In Bill's first years, the family moved about with the vagaries of domestic employment until, when he was about three, they came to live in a house called Moorend, located high on the Yorkshire moor, in Aislaby, overlooking the Esk river, about three miles from Whitby and the east coast of England. His parents were the caretakers at Moorend. This is the place of first remembrances, where he first went to school. Then, only a few months after his beginning school, the family moved once again, back to the Newmarket area, to a little village Cheveley, three miles east of Newmarket centre. It so happens that the city of Cambridge lies fifteen miles to the west of Newmarket.

The family lived in a flint cottage, one half of a duplex, reached by a footpath adjacent to the 600 year old Anglican Church that dominates Cheveley. His father soon obtained the position of gardener at the Rutland Arms Hotel in Newmarket. This finally gave stability to family life: they lived in that cottage until his father's death in 1944.

Bill went to the village school, run by the Anglicans, from age six until eleven. He has spoken of the school as enlightened in its religious education and the possessor of a fine children's encyclopedia, which he frequently consulted. Aided by its contents, Bill developed a keen interest in astronomy.

He was a successful student: at age ten he took the scholarship examinations for secondary school. The schools in England were organized on a county basis and, through an ancient oddity of district boundaries, Cheveley lies in Cambridgeshire, even though Newmarket, in Suffolk, lies between Cheveley and the city of Cambridge. So when Tutte won a scholarship, it was to the distant school in Cambridge. Too distant, his parents judged, and he was kept at home. A year later he again took the examinations, with the same success. This time, at eleven, his parents took the headmaster's advice to enroll him at the Cambridge and County High School for Boys. It was to be for Bill a long daily commute, taking his bike into Newmarket and, if the weather was fair, on the further fifteen miles into Cambridge. Or, if it was foul, then take the train from Newmarket, with another mile's walk from the station at the far end.

In this school he further excelled in studies. A testament to this is a little shelf of books left in his office, each imprinted in gold on the cover with the school motto "Virtute et Fide" and with a plate inside inscribed by the headmaster. "Prize for Mathematics, Form VI", reads the inscription of "Shakespeare's Complete Works"; for "The Plays of John Galsworthy", it is "Prize for Chemistry, Form VI."

Trinity College

In 1935, he entered Trinity College, Cambridge. For his studies there he was, in his words, "adequately supported financially by a State Scholarship, a College Scholarship, and a grant from the County." As an undergraduate, Bill majored in chemistry. Indeed, he achieved First Class Honours therein, and went on to graduate study in that field. His first two publications describe experimental work in chemistry. But the evidence is clear that his primary interest, dating at least from his high school days, was in mathematics, though not perhaps in the fields most in vogue. From his first days at Cambridge, he participated regularly in the meetings of the Trinity Mathematical Society. There he met Cedric Smith, and then Leonard Brooks and Arthur Stone, like-minded undergraduates with whom he conducted researches in mathematics. They were

mathematics majors; Bill formed a bond with these three that would remain close throughout their lives.

Not the first that they studied, but the one most remembered by history, was the problem of determining whether or not a square can be partitioned into smaller squares, all unequal in size. It arises from puzzle #40, Lady Isabel's Casket, in H.E. Dewdney's book "The Canterbury Puzzles".

It is, of course, not the puzzle but what they made of it that is remarkable. To begin they translated the problem to the language of electrical networks. In the 1940 paper that later described their work are formulas for electrical network functions, not just those found earlier by Kirchoff, but new ones for transfer functions. This paper became a standard reference for electrical network practitioners. The question of squaring the square, in electrical terms, became a study of rotational symmetry of a part of the network, and how reflection of the symmetric part can alter its currents without affecting potentials. The level at which they conceived the problem is remarkably deep. Their method did succeed in finding partitions of squares into smaller unequal squares.

This was not the only memorable study that Tutte undertook in his initial period at Trinity, but the others were published later. For Tutte's academic career was put on hold by World War II.

Bletchley

In January 1941, upon invitation of his Tutor, Tutte went to Bletchley Park, the now legendary organization of code-breakers of Britain. It was later that year, in October, that Tutte encountered TUNNY, the first of a set of machine-ciphers named Fish. Now Fish is not Enigma. The Bletchley code-breakers, among whom Alan Turing was prominent, had had success in deciphering Enigma codes. But that success was with the naval and air force versions; the army version of Enigma proved to be resistant to analysis. That Bletchley could not read Army Enigma gave them incentive to attack Fish, which was used only by the Army. Moreover, Fish was used for high level communications between Berlin and the field commanders.

Tutte's great contribution was to uncover, from samples of the messages alone, the structure of the machines which generated these codes. This came about as follows. In August 1941, a German operator sent a Fish-enciphered teleprinter message of some 4000 letters from Athens to Berlin. For some reason, the message was not received properly and so it was resent. Against all guidelines, it was sent with the same setting. It was identical in content, but it differed slightly, in word spacing and punctuation. John Tiltman of Bletchley was able to use this blunder to find both the message and the obscuring string that was added to make up the enciphered message. But that seemed to be all that could be found, when Tutte was presented with the case in October.

Tutte began by observing the machine generated obscuring string carefully. Splitting it up into various lengths, he noticed signs of periodicity. For the first of the five teleprinter tape positions, the regularity he supposed arose from a wheel of 41 sprockets. And then at the last position, one of 23 sprockets. Over the next months, Tutte and colleagues worked out the complete internal structure, that it had twelve wheels, two for each of the five teleprinter positions, and two with an executive function. They determined the number of sprockets on each wheel, and how the advancement of the wheels was interrelated. They had completely recreated the machine without ever having seen one. Tony Sale, who first described this work in a 1997 article in New Scientist, characterized it as the "greatest intellectual feat of the whole war."

Knowing the structure of the enciphering machine is a necessity for code-breaking, but it is only the first step. Tutte then put himself to creating an algorithm to find from the enciphered messages the initial settings of the machine wheels. The algorithm that he created, the "Statistical Method", looked for certain types of resonances, but it had to consider far too many possibilities to be carried out by hand. So it was that, in 1943, the electronic computer COLOSSUS was designed and built by the British Post Office. It was to run the algorithms that Tutte—and his collaborators Max Newman and Ralph Tester—developed, that COLOSSUS was created. This man-machine combination was used to break Fish codes on a regular basis throughout the remainder of the War.

Resuming Academic Life

In late 1945, Tutte resumed his studies at Cambridge, now as a graduate student in mathematics. He published some work begun earlier, one a now famous paper that characterizes which graphs have a perfect matching, and another that constructs a non-Hamiltonian graph. He went on to create a ground-breaking Ph.D. thesis, "An algebraic theory of graphs", in which he forges the subject now known as matroid theory.

Coming to Canada

Upon completing his degree, Tutte was invited by H.S.M. Coxeter to come to Canada, to join the Faculty of the University of Toronto. In his fourteen years at Toronto, beginning in 1948, he rose to preeminence in the field of combinatorics. One form of recognition in that period was his election as Fellow of the Royal Society of Canada.

It is difficult to describe in a summary way the many branches of research that Tutte pursued. Fortunately, Tutte has himself given such a summary, in his comments in the "Selected Papers of W.T. Tutte", published in 1979, and "Graph Theory as I have known it", in 1998. It is notable the degree to which these researches have

their point of origin in squaring the square and matroids.

In 1962, Tutte joined the Faculty of the University of Waterloo. This was just five years after its creation. Tutte made a major contribution to establishing the identity and reputation of the University. His presence was a magnet for combinatorialists from all over the world. It was not only recognized stars of the field that came to Waterloo, but those of future prominence. Tutte was an important ingredient in the recipe that produced the Faculty of Mathematics in 1967, becoming one of the first members of the Department of Combinatorics and Optimization. He retired in 1985, but continued to be a significant member of the Faculty as Professor Emeritus. Until his retirement, he was Editor in Chief of the Journal of Combinatorial Theory.

Bill Tutte enjoyed hiking, and soon after his arrival in Canada, became a member of the Canadian Youth Hostels Association. It was through the Hostel movement that he met Dorothea Mitchell, from Oakville: they were married in October 1949. Dorothea was lively and chatty, Bill more reserved in manner: they formed a lovely couple. When they moved to Waterloo, they lived out in the little village of West Montrose, just adjacent to the wooden covered bridge that is the signature of the region. Here the Tuttes managed an extensive garden, of mostly wild flora, on the banks of the Grand River. The neighbourhood is a pleasant place for hikes. Dorothea was an avid and skilled potter, well-known for her pivotal role in the founding of the Waterloo Potters workshop. For the Waterloo Combinatorics Conference of 1968, she made a personalized mug for each of the invited speakers, some thirty five in all. Dorothea died of cancer in 1994; they had no children.

Professor Tutte is presented the medallion of the Order of Canada by Her Excellency the Right Honourable Adrienne Clarkson, Governor General of Canada, 2001

Here is an assessment of Tutte's impact by two leading combinatorialists.

Paul Seymour of Princeton University writes: "Professor Tutte has been for many years the dominant figure in graph theory, and his contributions to the subject outweigh those of any other individual (in every sense except perhaps quantity). There are numerous instances when Tutte has found a beautiful result in a hitherto unexplored branch of graph theory, and in several cases this has been a 'breakthrough', leading to the development of a major new subject."

László Lovász of Microsoft writes: "Few theorems in mathematics are honored by the general public by naming them after the mathematician who proved them. In Tutte's case, however, there are several such results: for somebody working in matching theory, Tutte's theorem is his characterization of graphs having a perfect matching; for a matroid theorist, it means his characterization of regular matroids; for somebody studying Hamiltonian cycles it means his result that 4-connected planar graphs have a Hamilton cycle. And there is also the Tutte polynomial of a graph (and a matroid), which is again a household word for many combinatorialists."

Tutte was a master of phrasing: here are some examples. To begin, there is the phrase "squaring the square". Next, the term "wheel" is an apt description of the structure that lies at the heart of his analysis of 3-connected graphs; its nongraphical analog in matroid theory is "whirl". The title of a seminar describing a fatal flaw he had found in a famous mathematician's paper on 3-colouring was "Et tu, Tut-té!" The title of his famous paper on the Reconstruction Conjecture for graphs is "All the king's horses". In his penetrating analysis and reformulation of the Birkhoff-Lewis equations, he declares some of those equations to be "of mysterious provenance." Finally, one of his last public lectures was "Sixty years in the nets."

Tutte was awarded the Tory Medal by the Royal Society of Canada in 1975. He won the Killam Prize in 1982. Last year he was awarded the CRC-Fields Institute Prize; receiving this became the occasion for two of his last public lectures, the one referred to above in Toronto, the other in Montreal.

In 1987 Tutte was named a Fellow of the Royal Society of London.

- D. H. Younger (Waterloo)

Canadians Win Five Medals at the 2002 International Mathematical Olympiad

Competing against students from 83 other countries, Canadian high school students have done extremely well, winning one gold medal, three silver medals, one bronze medal and one honourable mention at the 43rd International Mathematical Olympiad (IMO), Glasgow, UK, July 19-30, 2002.

At an Awards Ceremony held on July 29th, 2002 in Glasgow, a Gold Medal was awarded to Roger Mong. Olena Bormashenko, Alexander Fink and Tianyi (David) Han were awarded Silver Medals. Robert Barrington-Leigh received a Bronze Medal while Ralph Furmaniak was awarded an Honourable Mention.

Although students compete individually, country rankings are obtained by adding the team's scores. The maximum score for each student is 42 and for a team of six students the maximum is 252. The Canadian team placed 12th out of 84 competing countries with a score of 142. "This ranking is the best since Canada started competing at the IMO" said Dr. Graham Wright, Executive Director of the CMS.

The team was accompanied by the Team Leader, Dr. Arthur Baragar (University of Nevada - Las Vegas), the Deputy Team Leader, Mr. Naoki Sato (Canadian Medalist at the 1992 and the 1993 IMO), the Leader Observer, Dr. Bill Sands (University of Calgary), and the Deputy Leader Observer, Mr. Robert Morewood (Burnaby South Secondary School).

"Our team members were excellent ambassadors for Canada in Glasgow," said Dr. Baragar. "The 2002 IMO contest was very difficult and I am immensely proud of their outstanding performance - on the fourth question every Canadian student received a perfect score."

The Leader's Report on the 2002 IMO team will be provided in the November 2002 CMS Notes

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(Steering Committee Report–continued from page 4)

Among younger researchers, A. Nica* (Waterloo) and R. Speicher* (Queens), are making major contributions to noncommutative probability and its connection to mathematical physics, standard probability, and combinatorics. Geometric Functional Analysis focuses on the structure of Banach spaces proper, and has been stimulated by several important problems that have been unsolved for 50 years. The work of N. Tomczak-Jaegermann (Alberta; FRSC, ICM '98, Killam, CRC), involving sophisticated probabilistic and geometric techniques was crucial to the proof that the only Banach space with large self-symmetry is Hilbert space. Younger researchers in functional analysis also include M. Khalkali* (Western) and V. Runde* (Alberta).

G. Elliott (Toronto) is providing strong leadership to a group focused on his classification program. He has a noted record both for training numerous researchers and for attracting international collaboration. In the past 5 years, using a variety of funding sources, he has trained an average of 4 PhD students and 4 PDFs annually.

N. Tomczak-Jaegermann (Alberta) is directing a group that studies high-dimensional convex bodies and their asymptotics, and which involves 3 PhD students and 4 PDFs. Additional funding provided by her CRC position and PIMS has enabled this group to evolve.

(e) PDE/Mathematical Physics: The Canadian PDE community includes many strong researchers with well-established ties to other mathematics disciplines, such as dynamical systems, mathematical physics, differential geometry, probability, applied mathematics, and scientific computation. Canada has several researchers of international calibre in aspects of mathematical physics linked to quantum phenomena and spectral analysis. M. Sigal (Toronto; FRSC, ICM '90, Killam, Synge Prize) is behind some fundamental work on the problem of quantum asymptotic completeness in many-body problems, and is now a contributor to the stability questions in Ginsburg-Landau theory of superconductors. J. Feldman (UBC; FRSC, ICM '90, Synge prize) is a central figure in an international group working on an ambitious program for mathematically rigorous theories of superconductivity and liquid crystals. In a related direction, V. Ivrii (Toronto; FRSC, ICM '78, ICM '86), has done fundamental work on the asymptotic distributions of eigenvalues for the Laplace operator. There is a strong group of younger researchers, including D. Jakobson* (McGill; Sloan), V. Jaksic* (McGill), I. Laba* (UBC) and J. Toth* (McGill; Sloan), working in spectral analysis with an emphasis on both mathematical physics and number theory.

In the area of dynamical systems, O. Bogoyavlenskij (Queens) has discovered a number of striking connections between integrable systems and symplectic geometry. W. Craig (McMaster, CRC) works on Hamiltonian PDEs and their applications to the dynamics of surface water waves. Mathematical modelling of signal propagation in optical fibres involves the nonlinear Schródinger equation, for which C. Sulem (Toronto) is an international authority. Geometry and PDE come together in the work of P. Guan (McMaster), who has recently completed a proof of conjectures due to L. Nirenberg on the geometry intersections of convex bodies. J. Chen* (UBC; Sloan) and collaborators have made fundamental contributions in minimal surface theory, gauge theory and Kahler manifolds, and mirror symmetry. N. Kamran (McGill) is currently collaborating with Finster, Smoller, and Yau on important questions in general relativ-

ity in the presence of quantum Dirac particles. R. McCann* (Toronto; AMS Centennial Fellowship) has been a principal contributor to the recent remarkable progress in understanding the Monge-Kantorovitch transportation problem, posed during Napoleonic times. N. Ghoussoub (UBC; FRSC) and C. Gui (UBC) have made key contributions to phase transition phenomena by settling a conjecture of Gibbons, then another, related one by DeGiorgi, in dimension 2, and its antisymmetric case up to dimension 5. M. Delfour (FRSC; Prix Urgel-Archambault, Killam) has made major contributions to the control and design of PDEs with numerous applications to technology. His work on shapes and geometry has led to a new intrinsic theory of thin and asymptotic shells with complete relaxation of the classical regularity.

Other impressive younger new researchers include R. Almgren* (Toronto), working on pattern formation phenomena; R. Choksi* (SFU), specializing in conservation laws and shock waves; P. Gustafson* (UBC), studying vortex dynamics; J. Colliander* (Toronto), working in harmonic analysis and nonlinear evolution equations; N. Kevlahan* (McMaster), specializing in fluid dynamics and scientific computations; A. Nachman* (Toronto), dealing with fundamental contributions to inverse problems; M. Pugh* (Toronto), a world expert on fluid dynamics; and A. Tourin* (Toronto), working with Hamilton-Jacobi equations and their applications.

(f) Discrete Mathematics: Discrete mathematics is essentially the mathematics of computer science and is an area firmly based in applications to engineering and the mathematical sciences. Experts in the subject are found in industry and in many university departments (mathematics, computer science, business, and engineering science) and are funded by many NSERC GSCs. Within Canada, there are large active groups of GSC 336/337 grantees in many basic areas of discrete mathematics, such as algebraic combinatorics, graph theory, finite geometry, graph algorithms, combinatorial designs, coding theory, and, more recently, cryptography. The achievements of the strong cryptography group at Waterloo (notably R. Mullin and S. Vanstone (FRSC, NSERC Industrial Chair)) are discussed below in the section on Discrete Scientific Computing. This group also includes D. Stinson (NSERC Industrial Chair), who is funded by a computer science GSC.

Canada has significant strength in algebraic combinatorics, centered at UQAM and Waterloo. C. Reutenauer (UQAM; CRC) is working on a wide variety of projects, such as free Lie algebras, combinatorics of words, noncommutative algebras, and descent algebras. D. Jackson (Waterloo) is currently studying ramified coverings of surfaces and Hurwitz numbers. F. Bergeron (UQAM) is studying families of specialized polynomials: Macdonald, harmonic, quasi-symmetric. N. Bergeron* (York; CRC) has a variety of interests, including descent algebras, Schubert polynomials, Hopf algebras, and the geometry of flag manifolds. Canadian mathematicians are making significant contributions to graph theory and combinatorial designs. B. Alspach (Regina) is heading a group of graduate students and PDFs that has completely solved the long-standing cycle-decomposition problem. Notable younger researchers in discrete math include J. Brown* (Dalhousie), P. Haxell* (Waterloo), A. Menezes* (Waterloo), J. Geelan* (Waterloo), J. Morris* (Lethbridge; UFA), B. Stevens* (Carleton), J. Huang* (Victoria), and O. Oellermann* (Winnipeg).

F. Bergeron and C. Reutenauer are principal figures in a Montreal combinatorics and theoretical computing laboratory (LACIM). The total group is very active in HQP training, with 27 Masters, 13 PhDs, and 6 PDFs in the past 4 years.

(g) Probability: Over the past 20 years, new ideas in probability have been driven by interdisciplinary and industrial applications. The subject has been led in many new directions due to its connections with mathematical biology, finance, statistical physics, polymer chemistry, fluid flow models, and telecommunications. Canada has an extremely strong group of researchers in probability who are at the forefront of many of these developments.

E. Perkins (UBC; FRSC, ICM '94, Steacie, CRC) and his colleagues have made superprocesses a central subject of international study, in particular by demonstrating that they arise as scaling limits of models used in population genetics, epidemiology, and mathematical ecology. The Canadian probability and statistical physics communities have been strengthened with the recent appointment of D. Brydges (UBC; CRC), who has had a profound impact via the introduction of ideas from constructive field theory into probability. One of the most powerful methods in statistical mechanics, introduced by Brydges and Spencer in the mid-1980s, is the lace expansion. G. Slade (UBC; FRSC, ICM '94) is internationally renowned for his use of the lace expansion to study polymer models (self-avoiding walk, lattice trees) in chemistry and percolation; his recent work helps establish exciting connections between these models and superprocesses. An outstanding contribution of probability to fluid mechanics was the derivation by J. Quastel* (Toronto; Sloan), together with Yau, of the Navier-Stokes equation as the continuum limit of a many particle stochastic system.

The probability group at UBC is acquiring a new structured presence: it has outstanding core strength with its two CRC holders, Brydges and Perkins, plus Slade, M. Barlow (FRSC, ICM '90), and J. Walsh (FRSC, ICM '74). More faculty hiring and PIMS support is planned, and CFI funding is being sought to provide appropriate space.

CMS 2001 Treasurer's Report

Editorial Note: For other 2001 committee reports, please see the April 2002 issue of the CMS Notes.

Arthur Sherk (Toronto)

A comparison of Operations Fund revenues and expenditures for 2001, against 2000, shows a 3% decrease in total revenue and a 2% increase in total expenses. While this may not be alarming in itself, it is worth some analysis.

There was a modest increase in membership fee revenue, which is encouraging, but a decrease in subscription and publications revenues, which is cause for concern. Income from foreign exchange was up, reflecting the relatively weak position of the Canadian dollar. However, grants and donations were both down, and this fact is a deterrent to the continuing development of important educational and research projects.

On the expenditures side, the largest increase is in salaries and benefits. This reflects the re-organization and the increase in the number of staff at the Executive Office, in response to the substantially increased workloads induced by the new projects. Boards and Committees expenses also continue to increase, in spite of much-appreciated practices of financial restraint on their part.

The reaction to this brief analysis should not be a pessimistic outlook for the future. Rather, it should be (and indeed is) a challenge to work on our strengths. We should continue to develop programs, while aggressively cultivating the revenue sources that we have. We must also continue to seek new sources of revenue.

Not surprisingly, revenue from investments was also down. In the combined restricted funds, the balance on December 31, 2001 was approximately $115,000 less than it was on December 31, 2000, and $24,000 less than the December 31, 1999 figure. However, there was a net withdrawal of approximately $100,000 in that two year period, to fund World Math 2000 and the Endowment Grants projects. Thus the actual investment performance was better than it appears. Given the state of the world money markets in the last two years, a decrease of $24,000 over that time seems to be quite bearable. We can surely look forward to brighter times ahead.

UNIVERSITY OF WATERLOO – WATERLOO, ONTARIO
DEPARTMENT OF COMBINATORICS AND OPTIMIZATION

Faculty Positions

Applications are being invited for one or more tenure-track faculty positions, in any of the Department's research areas: algebraic combinatorics, combinatorial optimization, continuous optimization, cryptography, graph theory, and quantum computing. While the intention is to make appointments at the rank of Assistant Professor, applications for more senior positions will be considered. Outstanding junior candidates will be considered for a Tier 2 Canada Research Chair. A Ph.D. and significant evidence of excellence in research and the potential for effective teaching are required. Responsibilities will include the supervision of graduate students, as well as teaching at the undergraduate and graduate levels. Salary will depend on the candidate's qualifications. Effective date of appointment: July 1, 2003. These appointments are subject to the availability of funds. Canadians and permanent residents will be considered first for these positions. The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native peoples, and persons with disabilities.

Interested individuals should send curriculum vitae, selected reprints/preprints and the names of three references to:

Prof. W.H. Cunningham, Chair
Department of Combinatorics and Optimization
Faculty of Mathematics, University of Waterloo
Waterloo, Ontario, Canada N2L 3G1
E-mail: combopt@math.uwaterloo.ca
phone: (519) 888-4567 x3482
fax: (519) 725-5441
http://www.math.uwaterloo.ca/CandO_Dept/index.shtml

Closing date for receipt of applications is **December 10, 2002**.

UNIVERSITY OF WATERLOO – WATERLOO, ONTARIO
DEPARTMENT OF COMBINATORICS AND OPTIMIZATION

Faculty Position in Continuous Optimization

Applications are being invited for a tenure-track faculty position in the area of continuous optimization. While the intention is to make an appointment at the rank of Assistant Professor, applications for more senior positions will be considered. Outstanding junior candidates will be considered for a Tier 2 Canada Research Chair. A Ph.D. and significant evidence of excellence in research and the potential for effective teaching are required. Responsibilities will include the supervision of graduate students, as well as teaching at the undergraduate and graduate levels. Salary will depend on the candidate's qualifications. Effective date of appointment: July 1, 2003. This appointment is subject to the availability of funds. Canadians and permanent residents will be considered first for these positions. The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native peoples, and persons with disabilities.

Interested individuals should send curriculum vitae, selected reprints/preprints and the names of three references to:

Prof. W.H. Cunningham, Chair
Department of Combinatorics and Optimization
Faculty of Mathematics, University of Waterloo
Waterloo, Ontario, Canada N2L 3G1
e-mail: combopt@math.uwaterloo.ca
phone: (519) 888-4567 x3482
fax: (519) 725-5441
http://www.math.uwaterloo.ca/CandO_Dept/index.shtml

Closing date for receipt of applications is **December 10, 2002.**

UNIVERSITÉ DE MONTRÉAL–MONTRÉAL, QUÉBEC
FACULTÉ DES ARTS ET DES SCIENCES
DÉPARTEMENT DE MATHÉMATIQUES ET DE STATISTIQUE

Poste en statistique

Le Département de mathématiques et de statistique de la Faculté des arts et des sciences de l'Université de Montréal recherche une professeure ou un professeur à plein temps en statistique, au rang d'adjoint, d'agrégé ou de titulaire. Pour toute information sur le Département et le Centre de recherches mathématiques avec qui le Département entretient des liens étroits, veuillez visiter les sites **www.dms.umontreal.ca** et **www.crm.umontreal.ca.**

Fonctions: Enseignement aux trois cycles, encadrement d'étudiants aux cycles supérieurs, activités de recherche.

Exigences: Détenir un doctorat en statistique. La qualité du dossier en recherche est primordiale. La candidate ou le candidat doit démontrer une excellente aptitude en enseignement. Un intérêt pour la consultation est un avantage. L'enseignement à l'Université de Montréal se fait en français. Une bonne connaissance de la langue française est donc requise. Une personne ne parlant pas français devra en acquérir une connaissance adéquate dans un délai raisonnable après l'engagement.

Traitement: L'Université de Montréal offre un salaire concurrentiel jumelé à une gamme complète d'avantages sociaux.
Date d'entre en fonction: le 1er juin 2003.
Les personnes intéressées doivent faire parvenir un curriculum vitae complet incluant une courte description des intérêts de recherche, au moins trois lettres de recommandation et au maximum trois tirés à part des plus importantes contributions à la recherche, et ce avant **le 15 novembre 2002** (ou jusqu'à ce que le poste soit comblé), à :

Directeur
Département de mathématiques et de statistique
Université de Montréal
C.P. 6128, succursale Centre-ville
Montréal QC Canada H3C 3J7
Téléphone : (514) 343-6743 Télécopieur : (514) 343-5700
Courriel : directeur@dms.umontreal.ca

Conformément aux exigences prescrites en matière d'immigration au Canada, cette annonce s'adresse en priorité aux citoyens canadiens et aux résidents permanents. L'Université de Montréal souscrit à un programme d'accés l'égalité en emploi pour les femmes et au principe d'équité en matière d'emploi.

CMS MEMBERSHIP

The 2003 Membership Notices have been mailed. Please renew your membership now. To renew electronically, please visit our website at www.cms.math.ca

ADHÉSION À LA SMC

Les avis d'adhésion 2003 ont été postés. Veuillez renouveller votre adhésion maintenant. Vous pouvez aussi renouveller au site web www.smc.math.ca

UNIVERSITÉ DE MONTRÉAL–MONTRÉAL, QUÉBEC
DEPARTMENT OF MATHEMATICS AND STATISTICS

Position in Statistics

The Département de mathématiques et de statistique of the Faculté des arts et des sciences of the Université de Montréal invites applications for a tenure-track position in statistics at any rank (assistant, associate or full). For information about the department and the university, the candidates are invited to visit the webpage of the department **(www.dms.umontreal.ca)** as well as that of the Centre de recherches de mathématiques **(www.crm.umontreal.ca)** with which it has close collaborations.

Duties: Undergraduate and graduate teaching, supervision of graduate students, and research.

Requirements: To hold a Ph.D. in Statistics. The research record must be outstanding. The candidate must possess excellent teaching skills. An interest for statistical consulting is an advantage. A good working knowledge of French is required. Candidates who do not speak French must acquire an adequate knowledge of it within a reasonable period after the appointment.

Salary: The Université de Montréal offers competitive salaries and a complete package of social benefits.

Starting Date: June 1, 2003.
The interested candidates must submit a curriculum vitae including a concise statement of their research interests, at least three letters of reference, and copies of at most three of their most important research publications before **November 15, 2002** (or until the position is filled), to:

Chair
Département de mathématiques et de statistique
Université de Montréal
C.P. 6128, succursale Centre-ville
Montréal QC Canada H3C 3J7
Phone : (514) 343-6743 Fax : (514) 343-5700
E-mail : chair@dms.umontreal.ca

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. The Université de Montréal subscribes to an affirmative action program for women and to employment equity.

CONCORDIA UNIVERSITY–MONTRÉAL, QUÉBEC
DEPARTMENT OF MATHEMATICS AND STATISTICS

Tenure-Track Position in Statistics

The Department of Mathematics and Statistics at Concordia University invites applications for one tenure-track position in Statistics. Applicants should have a PhD in Statistics and demonstrated interest in teaching and research at both the undergraduate and graduate levels. Strong candidates in any area of Statistics are encouraged to apply; however, preference will be given to candidates with post-doctoral experience and strong research in the areas of Computational Statistics, Multivariate Analysis, Survival Analysis, Time Series Analysis, Bio-Statistics, Finance or Data Mining. Applicants should send a letter of intent, a curriculum vitae, a statement of teaching and research interests and three letters of reference to:

Dr. Hershy Kisilevsky
7141 Sherbrooke St. West, Office HB-200
Montreal, Quebec, H4B 1R6
Applications may be sent by e-mail to chair@mathstat.concordia.ca.

Review of applications will begin on **November 1, 2002** and continue until the position is filled. Subject to budgetary approval, we anticipate filling this position, normally at the rank of Assistant Professor, for July 1, 2003. All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority. Concordia University is committed to Employment Equity and encourages applications from women, aboriginal peoples, visible minorities and disabled persons.

UNIVERSITY OF OTTAWA– OTTAWA, ONTARIO
DEPARTMENT OF MATHEMATICS AND STATISTICS

Tenure-track position in Statistics

The Department of Mathematics and Statistics of the University of Ottawa invites applications of recent Ph.D.s for a tenure-track position in Statistics starting July 1, 2003. The rank remains open and individuals with an exceptional research record and proof of leadership qualities will be seriously considered.

Applicants should send curriculum vitae, a research plan, and arrange for four confidential letters of recommendations, with one addressing teaching, to be sent to:

Mayer Alvo, Chairman
Department of Mathematics and Statistics
University of Ottawa
Ottawa, ON Canada, K1N 6N5

Applicants are also encouraged to include up to three copies of their most significant publications. The closing date for receipt for applications is **December 15, 2002**.

Conditions of employment are set by a collective agreement. Employment equity is University policy and the University strongly encourages applications from women. Canadian citizens and permanent residents will be considered first for these positions.

Information about the department can be found at **http://www.science.uottawa.ca/mathstat**

McGILL UNIVERSITY–MONTRÉAL, QUÉBEC
DEPARTMENT OF MATHEMATICS AND STATISTICS

Tenure-Track Position in Mathematics

The Department of Mathematics and Statistics expects to fill a tenure-track position in an area of Mathematics with close links to Computer Science (for example: Discrete Mathematics, Computational algebra, Probability or Logic). Candidates should have a broad interest in applications, particularly of an algorithmic nature.

While the appointment is expected to be made at the level of an Assistant Professor, the Department will consider applicants for a senior position. Applicants should have a strong training in Mathematics and should have a doctorate degree by the time of appointment. They are also expected to have demonstrated the capacity for independent research of excellent quality. Besides research accomplishments and teaching credentials, the selection criteria include the potential to develop and teach Mathematics courses to students in the Software Engineering Program.

Applications with a curriculum vitae, a list of publications, a research outline, an account of teaching experience, a statement on teaching and the names, phone numbers and e-mail addresses of at least four references (with one addressing the teaching record) should be sent to:

Professor J.P. Labute, Associate Chair
Department of Mathematics and Statistics
McGill University
805 Sherbrooke Street West, Montréal, Québec, H3A 2K6
Email: labute@math.mcgill.ca

Candidates must arrange to have the letters of recommendation sent directly to the above address. Candidates are encouraged to include copies of up to 3 selected reprints or preprints with their applications.

To ensure full consideration, applications must be received by **November 30, 2002**.

In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. However, all outstanding candidates will be considered. McGill University is committed to equity in employment.

UNIVERSITY OF TORONTO–TORONTO, ONTARIO
DEPARTMENT OF MATHEMATICS

Tenured or tenure-track position in Department of Mathematics

The University of Toronto solicits applications for one or more tenured or tenure-track positions in the Department of Mathematics, to begin July 1, 2003. Rank and salary will be commensurate with qualifications. The main areas of research interest are partial differential equations, geometric analysis, applied and computational mathematics, and algebra/number theory; however, exceptional candidates in any field of pure and applied mathematics are encouraged to apply.

It is intended that the successful applicants will be nominated for a Canada Research Chair. Accordingly, candidates are expected to be outstanding mathematicians, whose research and teaching will make major contributions to the quality and stature of the department.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, all appropriate material about their teaching, and the AMS Standard Cover Sheet. They should also arrange to have at least four letters of reference sent directly to the

Search Committee
Department of Mathematics, University of Toronto
100 St. George Street, Room 4072
Toronto, Ontario, Canada M5S 3G3

Additional information is available at our Web page: **www.math.toronto.edu/jobs.**

Priority will be given to applications received by **November 15, 2002**. Applications after this date will be considered until the positions have been filled.

The University of Toronto is strongly committed to diversity within its community and especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to the further diversification of ideas.

Any inquiries about the application should be sent to **ida@math.toronto.edu.**

UNIVERSITY OF TORONTO–TORONTO, ONTARIO
DEPARTMENT OF MATHEMATICS

Tenured or tenure-track position in Department of Mathematics– area of analysis or algebra

The Department of Mathematics, University of Toronto anticipates openings at the tenure-track or tenure level. Preference will be given to researchers in the area of analysis or algebra. Rank and salary will be commensurate with qualifications.

Candidates are expected to have demonstrated excellence in both teaching and research after the Ph.D.; in particular, a candidate's research and teaching record should show clearly the ability to make major contributions to the quality and stature of the department. The Department also has a limited number of distinguished Canada Research Chairs for which extraordinary candidates may be nominated.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, all appropriate material about their teaching and the AMS Standard Cover Sheet. They should also arrange to have at least four letters of reference sent directly to:

Search Committee
Department of Mathematics, University of Toronto
100 St. George Street, Room 4072
Toronto, Canada M5S 3G3

At least one letter should be primarily concerned with the candidate's teaching.

Additional information is available at our Web page: **http://www.math.toronto.edu/jobs.**

Priority will be given to applications received by **November 15, 2002**. Applications after this date will be considered until the position has been filled.

The University of Toronto is strongly committed to diversity within its community and especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to the further diversification of ideas.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

Any inquiries about the application should be sent to **ida@math.toronto.edu.**

UNIVERSITY OF TORONTO–TORONTO, ONTARIO
DEPARTMENT OF MATHEMATICS

Tenured or tenure-track position in Department of Mathematics–differential/complex geometry

The Department of Mathematics, University of Toronto anticipates an opening at the tenure-track or tenure level. The preferred area of research is differential/complex geometry. Appointment will be made at the rank of Assistant or Associate Professor, to begin July 1, 2003.

Candidates are expected to have demonstrated excellence in both teaching and research after the Ph.D.; in particular, a candidate's research and teaching record should show clearly the ability to make major contributions to the quality and stature of the department. The Department also has a limited number of distinguished junior Canada Research Chairs for which extraordinary candidates may be nominated.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, all appropriate material about their teaching and the AMS Standard Cover Sheet. They should also arrange to have at least four letters of reference sent directly to:

Search Committee
Department of Mathematics, University of Toronto
100 St. George Street, Room 4072
Toronto, Canada M5S 3G3

At least one letter should be primarily concerned with the candidate's teaching.

Additional information is available at our Web page: **http://www.math.toronto.edu/jobs.**

Priority will be given to applications received by **November 15, 2002**. Applications after this date will be considered until the position has been filled.

The University of Toronto is strongly committed to diversity within its community and especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who may contribute to the further versification of ideas.

All qualified candidates are encouraged to apply; however, Canadians and permanent residents will be given priority.

Any inquiries about the application should be sent to **ida@math.toronto.edu.**

UNIVERSITY OF TORONTO–TORONTO, ONTARIO
DEPARTMENT OF MATHEMATICS

Assistant Professorship Position

The Department invites applications for one or more limited term Assistant Professorships which may become available, subject to budgetary approval, for a period of one to three years beginning July 1, 2003. Duties consist of teaching and research, and candidates must demonstrate clear strength in both. Preference will be given to candidates with recent doctoral degrees. Salaries commensurate with qualifications.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, all appropriate material about their teaching and the AMS Standard Cover Sheet. They should also arrange to have at least three letters of reference sent directly to the

Search Committee
Department of Mathematics, University of Toronto
100 St. George Street, Room 4072
Toronto, Canada M5S 3G3

To ensure full consideration, all information should be received by **November 15, 2002**.

Additional information is available at our Web page: **http://www.math.toronto.edu/jobs.**

The University of Toronto is strongly committed to diversity within its community and especially welcomes applications from visible minority group members, women, Aboriginal persons, persons with disabilities, members of sexual minority groups, and others who my contribute to the further diversification of ideas.

All qualified applicants are encouraged to apply; however, Canadians and permanent residents will be given priority.

Any inquiries about the application should be sent to **ida@math.toronto.edu.**

NEWS FROM DEPARTMENTS

Concordia University, Montreal, Québec

Promotions: J. Garrido (Professor, June 2002); D. Korotkin (Associate Professor, June 2002).

Appointments: A. Sen, (Statistics, Assistant Professor, July 2002); A. Iovita (Associate Professor, January 2003).

Research Professors: P. Bracken(Assistant Professor, Applied Mathematics, June 2002-May 2003); L. Hohoueto, (Assistant Professor, Mathematical Physics, May-August 2002); A. Kokotov (Assistant Professor, Applied Mathematics, September 2002-May 2003); P. Olivares (Assistant Professor, Finance Mathematics and Actuarial Science, May-August 2002); A. Pal (Assistant Professor, Arithmetic Algebraic Geometry, June 2002-July 2003); A. Prasad (Assistant Professor, Automorphic Forms, January-May 2003); J. Rasmussen (Assistant Professor, Algebra, June 2002-May 2003); M. Roy (Assistant Professor, Topological Dynamics, June 2002-May 2003); A. Sakia (Assistant Professor, Number Theory, January-May 2003); A. N. Turin (Professor, Mathematical Physics, January-May 2003).

Visitors: K. Bennour (Tunisia, Statistics-Economics, September-January 2003); S. C. Kochar (India, Statistics, November-December 2002); R. Roknizadeh (Iran, Mathematical Physics, September-October 2002

Université du Québec á Trois-Rivières (UQTR)

Prix: Le professeur Harry White s'est mérité le Prix de reconnaissance en enseignement de l'UQTR dans la catégorie 1er cycle, professeur régulier (avril 2002).

Promotion: Les professeurs Sylvain Delisle et Harry White ont été promus au titre de professeurs titulaires (mai 2002).

CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

OCTOBER 2002 **OCTOBRE 2002**

9–20 Axiomatic, Enriched and Motivic Homotopy Theory (NATO Advanced Study Institute) (Issac Newton Institute for Mathematical Sciences, Cambridge, U. K.)
t.andrew@newton.cam.ac.uk,
http://www.newton.cam.ac.uk/programs/NST/nstw01.html

15–21 8th International Conference on General Inequalities (De La Motte Castle, Noszvaj, Hungary)
gi8@riesz.math.klte.hu

23–28 Workshop on Categorical Structures for Descent and Galois Theory, Hopf Algebras and Semiabelian Categories, (The Fields Institute for Research in Mathematical Sciences, Toronto)
tholen@mathstat.yorku.ca

29–Oct 3 18th International CODATA Conference (Hotel Delta Centreville, Montreal, Que)
codata@dial.oleane.com, http://www.codata.org

30–Oct 4 K-theory and Arithmetic (Issac Newton Institute for Mathematical Sciences, Cambridge, U. K.)
t.andrew@newton.cam.ac.uk,
http://www.newton.cam.ac.uk/programs/NST/nstw01.html

OCTOBER 2002 **OCTOBRE 2002**

17–19 NCTM Canadian Regional Conference (Regina, Saskatchewan) Hosted by the Saskatchewan Mathematics Teachers' Society.
http://www.nctm.org/, http://mathcentral.uregina.ca/SMTS/

NOVEMBER 2002 **NOVEMBRE 2002**

2–3 PIMS Cascade Topology Conference (University of British Columbia, Vancouver, BC) **25–28** Fifth International Conference on Monte Carlo and QuasiCarlo methods in Scientific Computing (MCQMC) (Singapore, Republic of Singapore)
http://www.mcqmc2002.math.nus.edu.sg

DECEMBER 2002 **DÉCEMBRE 2002**

8–10 CMS Winter Meeting / Réunion d'hiver de la SMC (Marriott Hotel, Ottawa, Ontario)
http://www.cms.math.ca/Events/winter02/index.html

9–13 Elliptic Cohomology and Chromatic Phenomena (EuroWorkshop, Newton Institute, Cambridge, U.K.)
t.andrew@newton.cam.ac.uk,
http://www:newton.cam.ac.uk/programs/NST/nstw04.html

16–20 Higher Chromatic Phenomena (EuroWorkshop, Newton Institute, Cambridge, U.K.)
t.andrew@newton.cam.ac.uk,
http://www:newton.cam.ac.uk/programs/NST/nstw04.html

JANUARY 2003 **JANVIER 2003**

Jan – Aug Thematic Program on Automorphic Forms, (The Fields Institute for Research in Mathematical Sciences, Toronto)
Automorphic@fields.utoronto.ca

6-19 Pan-American Summer Institute(PASI) on PDE, Inverse Problems and Non-linear Analysis, Centro de Modalamiento Matemático(CMM), Universidad de Chile.
sandy@pims.math.ca

FEBRUARY 2003 **FÉVRIER 2003**

10–15 Mathématiques Appliquées et Applications des Mathématiques (Nice, France)
http://www.acm.emath.fr/amam/

MAY 2003 **MAI 2003**

11–16 International Conference on General Control Problems and Applications (GCP2003) : Dedicated to the 100th anniversary of A. N. Kolmogorov (Tambov Sate University, Tambov, Russia)
www.opu2003.narod.ru/

JUNE 2003 **JUIN 2003**

14–16 CMS Summer Meeting / Réunion d'été de la SMC (University of Alberta, Edmonton, Alberta)
www.cms.math.ca/Events/summer03/index.e

17–21 Fourth Butler Memorial Conference (University of Alberta, Edmonton, Alberta, Canada) *http://conley.math.ualberta.ca/butler.html*

18–21 First Joint Meeting between AMS and Real Sociedad Matematica Espanola (Seville, Spain)
www.us.es/rsme/-ams/

JULY 2003 **JUILLET 2003**

7–11 Fifth International Congress in Industrial and Applied Mathematics (Sydney, Australia)
www.iciam.org

27 - Aug. 9 Banach algebras and their applications (University of Alberta, Edmonton, AB)
http://www.math.ualberta.ca/ ba03/

DECEMBER 2003 **DÉCEMBRE 2003**

6–8 CMS Winter Meeting / Réunion d'hiver de la SMC (Simon Fraser University, Harbour Centre, Vancouver, British Columbia)
Monique Bouchard: meetings@cms.math.ca

SUMMER 2004 **ÉTÉ 2004**

CMS Summer Meeting / Réunion d'été de la SMC (Dalhousie University, Halifax, Nova Scotia)
Monique Bouchard: meetings@cms.math.ca

JULY 2004 **JUILLET 2004**

12–15 Toulouse 2004 Joint Meeting between the CMS, Société Mathématique de France (SMF), Société de Mathématiques Appliquées et Industrielles (SMAI) and the Société Française de Statistiques (SFDS), (Toulouse, France)
http://www.cms.math.ca/Events/Toulouse2004/
http://www.cms.math.ca/Reunions/Toulouse2004/

DECEMBER 2004 **DÉCEMBRE 2004**

CMS Winter Meeting / Réunion d'hiver de la SMC (McGill University, Montréal, Québec)
Monique Bouchard: meetings@cms.math.ca

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