

CMS

NOTES

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## FLT Continues to Stimulate

Book Review by M. Ram Murty, Queen's University

### Fermat's Last Theorem for Amateurs

By Paulo Ribenboim  
Springer-Verlag New York, Inc., 1999  
xiii + 407 pages.



Serge Lang has said that a person can make an important contribution to mathematics simply by asking a pertinent question. That means even an amateur can make a significant advance to a subject. Fermat did and so did Goldbach and a host of lesser known mortals. Our inability to answer such questions may make us view them as impertinent. Yet, they lurk in the background, sometimes as ghosts haunting us or taunting us, but often as muses, inspiring us to higher thoughts.

No branch of mathematics has such a vast assemblage of questions as number theory. No branch other than number theory has the dubious honour of

having vast hordes of amateurs claiming to be circle squarers, angle trisectors or worse still, 'solvers' of Fermat's Last Theorem. Still, we must admit that it is a simple way to initiate the public into the mysteries of mathematics. However, without training in advanced number theory, both algebraic and analytic, the proof of Fermat's Last Theorem arising from the work of Ribet, Taylor and Wiles is still inaccessible to the lay public and perhaps will be for some decades to come.

The book under review by Paulo Ribenboim does little to bring the amateur closer to embarking on the arduous journey of understanding the world of elliptic curves and modular forms, the subtleties of deformation theory and finite flat group schemes, or the galaxy of representation theory, that are the basic prerequisites to comprehend the work of Ribet-Wiles. That would have been a formidable task even for the experts to attempt. Still, the book by Ribenboim has its merits, in that it definitely has an 'amateur' flavour. Apart from 8 pages in the final chapter of the book, there is no indication of the new ingredients of 'The Proof.' As such, the book can be comfortably used as an undergraduate text even at the freshman level to introduce the student into the mysteries of number theory and the nature of mathematical discovery.

Few people realise the importance of mathematical thought in the process of civilization. Few realise the role of

(see FERMAT—page 13)

**CMS NOTES**  
**NOTES DE LA SMC**

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**EDITORIAL**



*Peter Fillmore*

Readers who have missed Graham Wright's bimonthly column in its accustomed cover location should not despair; it will be found on page 8. In its place we are pleased to offer a wide-ranging review of an important Canadian contribution to the literature on Fermat's last theorem. This is followed by an account of a piece of our history, touching on another stubborn problem of mathematics. It relates the story of the summer school for teachers operated by the Canadian Mathematical Congress (CMC, the former name of the CMS) in the Maritimes for more than 20 years. It was started in the 1950's to help school teachers cope with what was then called "the new math", and was wound down when that goal was met.

Or was it? A recent book by Liping Ma (reviewed in the September *Notices of the AMS*) ponders the gap in achievement between American and Chinese school students in the recent Third International Mathematics and Science Study (TIMSS), tracing it to a corresponding gap in teacher comprehension of mathematics. The performance of Canadian students was somewhat better, but still far behind the Chinese.

The ultimate responsibility for that surely rests with the professional mathematicians - you and I. Is it not scandalous that in Canada, as in the US, so little of our effort is devoted to this fundamental problem? We need to follow the example of our CMC forebears and

get involved in teacher education and certification in nontrivial ways.

\*\*\*\*\*

Avis aux lecteurs déçus de ne pas trouver la chronique bimestrielle de Graham Wright en page couverture comme à l'habitude : ne désespérez pas, vous pourrez la lire à la page 8. À la place, il nous fait plaisir de vous présenter un aperçu global d'une importante contribution canadienne aux études sur le dernier théorème de Fermat. Vous pourrez lire ensuite une page de notre histoire portant sur une autre des grandes difficultés des mathématiques. C'est l'histoire des cours d'été pour enseignants organisés par la Société mathématique du Canada dans les Maritimes pendant plus de 20 ans. Donnés pour la première fois en 1950, ces cours visaient à aider les enseignants à comprendre ce qu'on appelait alors les « nouvelles mathématiques ». Le programme a pris fin une fois cet objectif atteint.

Mais l'avons-nous vraiment atteint? Dans un livre publié récemment, Liping Ma (voir critique dans les *Notices of the AMS* de septembre) s'interroge sur l'écart entre les résultats des élèves américains et ceux des élèves chinois dans une récente étude (Third International Mathematics and Science Study). L'auteur constate que cet écart correspond à un écart semblable dans la compréhension mathématique respective des enseignants de ces pays. Les élèves canadiens ont fait un peu meilleure figure que les Américains, mais c'était encore bien loin des résultats des jeunes Chinois.

En bout de ligne, la responsabilité revient certainement aux mathématiciens professionnels, c'est-à-dire vous et moi. N'est-il pas scandaleux qu'au Canada, comme aux États-Unis, si peu d'efforts soient consacrés à ce problème fondamental? Nous devons suivre l'exemple de nos prédécesseurs du CMC et prendre une part active à la formation et à l'accréditation des enseignants.

## The Canadian Mathematical Congress Summer School for Teachers - 1954(?) - 1976

A. J. Tingley, Dalhousie University

An activity of the Canadian Mathematical Congress (as the CMS was formerly called) that was of considerable importance for a period of some twenty years was the Summer School for Teachers that was organized in the Atlantic provinces some forty five years ago, i.e., long before the recollections of most present day members. A brief reference to this is given in "The Second Generation", an article by George Duff in Vol. I of *Mathematics in Canada*, published by the CMS in 1995. An attempt will be made to give a somewhat more detailed, but still brief, account of this project.

In the early 1950's mathematics curricula were in chaos, from the point of view of many, perhaps most, public school teachers. There was much talk of "the new mathematics". Although the mathematics involved was far from new, new approaches were being mooted and text books were being revised or replaced. The School Mathematics Study Group in the US had produced experimental, or sample, material, which was influencing authors of text books. Many teachers were not well trained in mathematics, and changes from existing curricula were of great concern. It is probably not an exaggeration to say that teachers were in a state of near panic.

Under the general direction of W.L.G. Williams, who was the Executive Director of the CMC, a Summer School for teachers was organized in the Atlantic area. From the point of view of those in the area Williams appeared to be the motivating force. He raised money, arranged the sites, selected the staff, and ran the operation in person in its earliest days. The writer personally went with him on fund raising visits to various Nova Scotia companies, and Henry Hicks (later President of Dalhousie and Senator) remembered being called upon by Williams when he was Minister of Education in Nova Scotia. Later, however, R.L. Jeffery of Queen's University (who, upon retirement, moved to Acadia where he remained active for many years), originally from Nova Scotia, claimed to have been much involved, even indicating that the project was his idea, and that the initial financial support had been obtained by him. Actually, both of these gentlemen were deeply concerned with the school situation generally, and both deserve much credit for the development and carrying out of a project which led to more than two decades of useful activity.

As far as is known, the only person involved from the beginning who is now living is Leonard Edwards of UNB. He recalls little from the early days and has no records. W.S.H. Crawford of Mount Allison who became associated with the project soon after its beginning was consulted before his death, but he too had no records and little recollection of the early

days. Inquiries have indicated that there are few if any relevant records in the CMS office, though this may be incorrect. In any case, what is reported here is hearsay (from those actively involved) for the period up to 1958, from the memory of the writer for the period 1959 - 1961, during which years he was involved, and from the files for the years from 1961 to 1976 which exist, though possibly not always complete. These were held at Dalhousie University until three or four years ago, when they were transferred to the national office in Ottawa.



*Faculty of 1959 CMC Summer School*  
*front: W.L.G. Williams, A.J. Tingley, L.F.S. Ritcey*  
*back: W.S.H. Crawford, D.C. Haley*

For several years, either five or six, prior to 1959, the CMC Summer School for Teachers existed essentially as a workshop. The location changed annually, being held in Lunenburg, Sussex, Charlottetown, and possibly elsewhere, in some centers at least twice. It is believed that the financing, at least in part, was provided by a grant from the Research Corporation of New York, probably negotiated by R.L. Jeffery. The CMC itself probably gave financial support, and the Nova Scotia Government, and possibly other Maritime Province Governments, gave grants. Williams also raised money from local donors. Work was done over a period of about one month, and was of course designed to advance the competence of teachers of mathematics. It is not known how many attended, but obviously the numbers sufficed to warrant a continuing effort. In any case, it is certain that useful work was

done. Such mathematicians as Coxeter of Toronto, Sumner of McMaster, Crawford of Mount Allison, Haley of Acadia and Edwards of UNB served along with others during those years. Both Williams and L.F.S. Ritcey, his successor in the CMS, were actively involved.

Williams in particular was very enthusiastic about this off-campus work. In fact, for a time he considered the possibility of establishing a permanent school at some such location as Tatamagouche (NS) where there was a Summer Festival of the Arts. He felt that the atmosphere at off-campus locations was such that work could be combined with pleasure in a profitable way.

After a few years of operation, however, the question of university credit for work done at the summer school arose. Provincial Departments of Education could, of course, have given credit towards the upgrading of licences if they wished to do so, but there was no possibility of this for university credits. After due consideration, it was decided that the school should operate in future on a university campus which had an existing summer school, and should move annually as seemed appropriate. It is not known where and among whom these deliberations took place, but according to the recollections of the writer about the early administration of the CMC, it is likely that the effective decision was made by Williams. In 1959, accordingly, the CMC Summer School was held on the Mount Allison campus in cooperation with the Mt. A. Summer School, with the understanding that those courses which were of an acceptable level would be considered by Mount Allison as part of their Summer School for credit purposes.

Here the pattern was set that was followed for the next two years. The two schools operated under completely different administrations, but cooperated with respect to offerings, and, indeed, in other ways. W.L.G. Williams was in charge of the CMC operation and offered a class. Also offering CMC classes were L.F.S. Ritcey of the CMC office (who was in the process of taking over as Executive Director from Williams), K.D.C. Haley of Acadia, W.S.H. Crawford of Mount Allison, and A.J. Tingley of Dalhousie. Any teacher registered in the CMC School could take any class offered by either Mt. A. or the CMC and similarly for Mt. A. students.

In 1960 the Summer School was held at Acadia University on the same basis as the year before at Mount Allison. Williams was still in charge of CMC affairs, but for the first time was not present (and teaching) in the summer school. He nevertheless maintained a considerable measure of control, a situation which, it appeared, was not entirely satisfactory to Ritcey who effectively acted as director.

Classes were offered by Ritcey, D.O. Snow and K.D.C. Haley of Acadia, and A.J. Tingley of Dalhousie. The surroundings were delightful, the weather ideal, the accommodations pleasant, and the general atmosphere all that could be desired. The teachers (students) worked extremely hard, and as the instructors were usually around many hours were spent

at work outside of class time. It was a very productive and happy summer for all concerned.

The plan had been to go to the University of New Brunswick in 1961. For reasons unknown to the writer this did not happen. The Province of New Brunswick did not give the support that was given by Nova Scotia and this may have been significant. In any case, the school operated at Acadia again in 1961, with the same staff except for the addition of Richard Blum of the University of Saskatchewan. Again the summer was pleasant and successful in all respects.

By this time Ritcey, who was now the Executive Director of the CMC, had decided that the work should be continued in Wolfville indefinitely. He had approached the writer, as a representative of Dalhousie, and presumably others, and evidently had received general support and no opposition. He felt that to have a permanent location in such a pleasant rural setting could have advantages.

One can only speculate as to how this would have worked, for it was not to be. At some time in 1961 the Nova Scotia Department of Education, probably in the person of the Deputy Minister, Harold Nason, requested that the CMC Summer School move to Halifax and become associated with the Nova Scotia Teachers' Summer School which was operated on the Dalhousie campus by the Nova Scotia Department of Education for teachers only, no work being offered at a university level.

There was some logic behind this proposal. The Nova Scotia Government was giving considerable financial support. Although some teachers came from other provinces (and continued to do so), the majority were from Nova Scotia. That province offered special programs in its summer school which had the effect of raising the licences of teachers who completed them and the offerings of the CMC could fit into these. Teachers of mathematics would have a wide range of choices if the offerings of the two schools were combined. They could do refresher courses, could upgrade their licences either in special programs, known as Block Programs, or by working towards degrees, or, eventually (see below) by doing graduate work.

How the decision was formally made is not known. There were apparently no objections from anyone, and it seems probable that Ritcey discussed the matter with CMC officers as he deemed appropriate and then made the decision. There was, on paper at least, a local committee, for on Feb. 12, 1962, Ritcey addressed a letter to members of the Nova Scotia Committee, as follows:

K.D.C. Haley (Acadia) Chairman  
J.G. Adshead (Dalhousie)  
F.J. Ginivan (St Francis Xavier)  
H.S. Heaps (N.S. Technical College)  
D.O. Snow (Acadia)  
A.J. Tingley (Dalhousie)  
R.D. James (UBC) Ex-officio

Minutes of the CMC may show that such a committee was appointed but the writer, one of those named, has no recollection that it ever functioned. James of course was the President of the CMC so was an ex-officio member. It is not recalled that either Heaps or Adshead was ever involved, though the latter, as Head of Mathematics at Dalhousie, had a nominal role in giving approval to the classes offering university credit. Heaps was Chairman of the mathematics sub-committee of the Atlantic Provinces Inter-University Committee on the Sciences (APICS) which later played a role in the offering of classes at the graduate level. As things evolved, the effective committee consisted of Crawford, Haley, Jeffery, Tingley, and later, Ginivan. The chairmanship seems to have been initially somewhat indeterminate. Ritcey was the effective director until he retired.

The request to operate in Halifax was acceded to, in principle, but there were some difficulties. A major problem was that Dalhousie did not operate a summer school so the pattern that had been followed at Mount Allison and Acadia could not be followed. Furthermore, no credit for summer work done anywhere had ever been given by Dalhousie. It seemed clear that if work given on the Dalhousie campus was not acceptable to Dalhousie there would be serious problems. After rather extensive negotiations, this problem was overcome, and it was agreed that Dalhousie would accept for credit those offerings of the CMC Summer School with which its mathematics department was satisfied.

This, however, did not mean that the classes were to be considered Dalhousie classes. This would not have been acceptable to other universities in the area which operated their own summer schools, who would resent any apparent advantage to Dalhousie. So it was emphasized from the beginning and throughout the life of the project that the classes were CMC classes, offered under the aegis of the CMC. Though those at the University level were always equivalent in content to specified Dalhousie classes, the students were not considered Dalhousie students and no records were kept by the Dalhousie Registrar. This was so even after Dalhousie instituted its own summer school. Results were sent out to the students from the Congress office initially, later by the Director of the school. When, at the time or in later years, someone who had taken a class wanted credit at a university or elsewhere, a letter would be sent by the Director, or in later years the former Director of the summer school, which stated that if the person wished credit at Dalhousie, he would be given credit for a particular course as described in the Dalhousie calendar of the time. It seems that there were never difficulties with this peculiar arrangement, and there were never complaints from students that other universities did not give due recognition to their work. Requests for such certification were received as recently as 1994. Naturally, no student who failed a class ever asked for credit, so no record ever showed a failure for a class taken in the CMC Summer School!

Initially, there were numerous problems. The CMC was involved, the N.S. Department of Education was involved, the local rather informal CMC Committee, essentially R.L. Jeffery, was involved, and even Dalhousie was involved. While all of these groups were cooperative, each had its own ideas, and all concerned wanted things done their way. On March 20, 1962, Ritcey summarized the plans to date in one word: confusion.

Eventually, by judicious application of carrots and sticks, and compromises on all sides, all difficulties were overcome. Ritcey was in charge of the Summer School and gave a class. Other instructors were R.L. Jeffery of Acadia, S.E. Melamed of McGill, and A.J. Tingley of Dalhousie. See the Appendix for a listing of the offerings. (*Editors' note: The original manuscript, including the Appendix, which lists offerings and instructors 1962-76, is available on request from the CMS office.*)

The School operated smoothly with an extremely enthusiastic group of teachers. Fortunately it had been possible to arrange reading rooms in Howe Hall, the residence where most were accommodated. Students worked alone, in groups, and with instructors more hours per day than one would have believed possible. A small number of university students, including Dalhousie students taking summer classes for the first time in history, were enrolled.

After this successful summer, there was no problem in arranging for similar programs in future years. Indeed, there were interesting advances.

In the summer of 1963 Dalhousie began offering summer classes. It may be conjectured that this was at least partly because of the success of the 1962 CMC school. Undergraduate classes in mathematics were included in the Dalhousie offerings. As had been the case at Acadia and Mount Allison, university students could enrol in the CMC classes, and vice versa. Soon there was a further development. The CMC had been considering the general question of graduate level summer work, and, independently, the Atlantic Provinces Inter-University Committee on the Sciences (APICS) had been established and had as one of its objectives the advancing of summer graduate work in science, including mathematics. Probably as a result of approaches made by Jeffery, a meeting took place in October 1964 involving Drs. Trost and Jamieson, Chairman and Coordinator respectively of APICS, and Jeffery, Haley and Tingley representing the CMC. This informal group reached the conclusion that the possibility of developing summer work in mathematics at the graduate level should be explored. This was followed by a meeting of the Mathematics Sub-Committee of APICS on October 31 which supported the concept and recommended a grant. Following this meeting and correspondence between Jamieson and Ritcey it was agreed that APICS would give a grant of \$3000 for the support of summer graduate work. It was understood that Dalhousie would support its own graduate students.

Jeffery, Haley and Tingley were delegated to represent APICS. These three along with Ritcey arranged the 1964 summer school. This was now to include work suitable for teachers as in the past, most of it at a level which would carry university credit, and two classes at the graduate level. In addition, the mathematics classes offered by Dalhousie would be available for those registered in the CMC summer school.

Close contact was kept with the officials of the N.S. Department of Education. Awards for teachers were provided and administered through the department and/or the school districts so only in special cases were funds available to the CMC used to support teachers. Though details seem not to be available, it would appear that there was support from districts in the form of awards to teachers, from the province to the CMC for instructors salaries, from APICS for the support of graduate classes, from the International Nickel company (INCO) for the support of teachers and instructors salaries, from general CMC funds, and from Dalhousie for support of its own graduate students. Clearly the work involved in distributing the money was in itself a non-trivial task and required considerable juggling. In the main this was done by Ritcey and Tingley.

There were thus classes offered by the CMC selected particularly to satisfy the interests of teachers, undergraduate classes offered by Dalhousie, and graduate classes arranged by the CMC. The CMC Summer School and the Dalhousie Summer School operated independently but in close cooperation with one another and with the Nova Scotia Teachers' Summer School.

In a sense the school had been considered experimental by the various sponsoring bodies. All seem to have been satisfied. The N.S. Department of Education indicated in November 1964 that they wished the school to continue. APICS promised that the support that had been granted for one year would be continued. In January 1965 the Executive of the CMC approved that the work proceed. Jeffery was appointed Chairman of the local committee. There seems to be no record of who the members of the committee were, but it is clear that the active members were Crawford of Mount Allison, Haley of Acadia, and Tingley of Dalhousie, and later Ginivan of St. Francis Xavier. The machinery was now in place for what proved to be a decade of operation.

In negotiations with the N.S. Department of Education the matter of specialist licences for teachers of mathematics was raised, and it was agreed in principle by all concerned that this be pursued. For a time it was thought that the Summer School might play a major role in bringing this about by providing necessary upgrading. In the event, this plan came to nothing.

In 1966 John McNamee replaced Lee Ritcey as Executive Director. An accounting prepared at his request showed a total income of some \$14,000, including grants of \$3,000 from APICS, \$5,000 from INCO, \$2,500 from the province and \$3,000 from the CMC. It was also reported that registration

in the 1966 classes had been as follows:

Junior High School Mathematics – 92  
 Senior High School Mathematics – 53  
 Projective Geometry – 12  
 Numerical Analysis – 20  
 Real Variables and Measure Theory – 15  
 Abelian Groups – 10

McNamee proceeded to have arrangements made so that the administrative work would be done in Halifax to a greater extent. In particular it was clear that he would not spend as much time in the area as had Ritcey, who had roots in Nova Scotia. To this end the local committee was formally established, the members being as follows:

R.L. Jeffery (Acadia) Chairman  
 L.P. Edwards (UNB)  
 K.D.C. Haley (Acadia)  
 J.J. McNamee (CMC)  
 A.J. Tingley (Dalhousie)

There was some concern about Jeffery, who was then in his latter seventies. He was still energetic, and was director of the Halifax branch of the Summer Research Institute in 1966. He was eager to play a full role in all possible mathematical activities, but was beginning to be a bit vague in some respects. Before his appointment as Chairman, McNamee got assurances for certain local people that the situation would be kept under control.

Advice was received to the effect that INCO would increase its grant to \$7,500. The income for 1967 was therefore as follows: CMC \$4,700, Province of NS \$4,500, APICS \$4,000 and INCO \$7,500, for a total of \$20,000.

McNamee was concerned that the expenses of Dalhousie should be shown. Dalhousie made no direct financial contribution to the Summer School, except to support its own graduate students, but it did provide class rooms, offices, secretarial services, telephones, postage, and so on. Also its business office handled the finances, holding the funds and making disbursements as instructed by the CMC authorities. At the end of the summer of 1966 \$40 remained unspent, so this amount was paid to Dalhousie.

For several years things proceeded with little change in the arrangements or the financial situation. Enrolment increased to over 200 and there was a shift away from the non-credit classes. McNamee reported annually to the grantors and these seemed satisfied. Other work, including the dispersal of funds, was assigned to the local committee, which by the late sixties consisted of Haley, Crawford, Ginivan and Tingley, the latter having been appointed Chairman of the committee and Director of the Summer School. Jeffery had become less active due to age, and did not teach after 1972, at which time he was 82 years old.

In the 1970's, things began to change. The APICS grant was discontinued and the last graduate level classes were offered in 1970. At about this time, apparently, the INCO grant was also discontinued. Other changes soon followed.

The non-credit classes were discontinued in 1972. This indicated progress. On the one hand it was felt that few teachers needed help at that level, and on the other hand requirements of the N.S. Department of Education became such that pre-university work no longer sufficed for the raising of qualifications.

There was a rather interesting occurrence in 1973. In the spring of that year a request was made by people in the N.S. system that Dr. Kenneth Iverson of IBM be asked to give a course in the Summer School. This was because APL, a machine language that was apparently developed by him, was being introduced in the schools. The writer felt it was pointless to approach him, but, under pressure, wrote, in his capacity as Director of the Summer School, asking Iverson if he would be willing to give a course. To the surprise of all concerned, he not only agreed to come, but did so without salary! His only requirement was that he have specified access to an IBM computer. At first this seemed impossible. It turned out, however, that the province had what was required, and after negotiations with the Deputy Minister of Education, Harold Nason, sufficient terminals linked to the provincially owned computer were installed in the Life Sciences Building (where the Dalhousie Mathematics Department was located and where most of the summer work was done), at no charge to the Summer School budget. There was a large enrolment,

all that could be accommodated. Some consideration was given to repeating the effort the next year, but this did not work out.

In November 1973 it was announced by the N.S. Department of Education that their role in the school would be phased out in stages, their grant to be decreased by \$1,500 per year from \$6,000 in 1973 to \$1,500 in 1976, after which there would be none. From the point of view of the Department, the need for the upgrading of teachers that had been so necessary was no longer acute, partly because of the work of the CMC Summer School, but also because better qualified teachers were coming into the system.

Also universities had developed graduate work to a point where the need that some members of the CMC had once seen for summer work at certain places across the nation no longer seemed necessary, and the one time objective of APICS for a graduate summer school in the Atlantic Provinces, the mathematics work being considered a first step, no longer seemed viable.

The Summer School thus came to an end. Some of the local people who had been involved naturally had some regrets about this. The situation had certainly changed greatly in the two decades since the summer work had started, but there was some reflecting as to whether there were not other activities in which the existing organization might play a useful role. No significant ideas were forthcoming. One cannot but wonder whether, if such innovative and dynamic personalities as Ralph Jeffery and Lloyd Williams had still been involved, the summer work might have continued in some form.

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## LETTER TO THE EDITORS

*The following letter dated October 16, 1999 was addressed to Laura Logan, CORS president, and copied to the editors.*

I am a graduate student in pure math. I was reading this morning the CORS Corner in the October issue of the CMS Notes. Unfortunately, I didn't learn much from this CORS Corner. You say at the end of your article that you will speak about other projects and

services of CORS in following issues. I would like to suggest something that might be even more useful to both CMS and CORS.

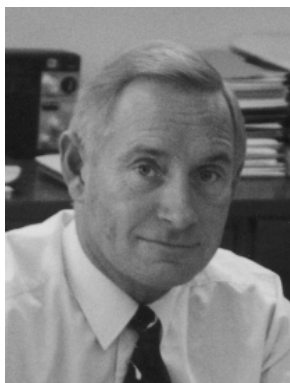
Since CORS is trying to promote the awareness of Operational Research and its many applications, perhaps the best way to use the new CMS-CORS link would be to let people of the CMS know a little bit more about OR.

Maybe few pages explaining what

OR is, what are the related problems, what areas of mathematics OR touches, what have been the most recent developments, etc., would be more interesting than explaining current activities of CORS. This approach could benefit both CMS and CORS, CMS members learning more and CORS fulfilling one of its goals.

*Benoit Charbonneau (MIT)*

## FROM THE EXECUTIVE DIRECTOR'S DESK



Graham Wright

### A proud past and an exciting future

As this year ends and the next century is nearly upon us, it is hard not to reflect on the past and look forward to the future.

A great number of individuals have been involved in the growth of the CMS and the *Record of Service* published in "Mathematics in Canada", Volume 1 of the Society's 50<sup>th</sup> anniversary books, is an impressive testament to the commitment and help from the Canadian mathematical community. Also noteworthy, is the fact that every university mathematics department in Canada has supported the work of the CMS in some way.

All of the research, educational, publishing, electronic and other national and international activities are carried out under the direction of the

Board of Directors, the Executive Committee, thirteen Standing Committees, 7 sub-committees, and six Editorial Boards. Together with a number of full-time and part-time staff, the CMS has established an invaluable infrastructure *to promote and advance the discovery, learning and application of mathematics.*

Although the CMS is fortunate to have a remarkable level of volunteer support, every activity involves costs. The 2000 Budget being presented to the Board for approval in December requires that significant additional revenues be obtained to cover expenditures. A successful fund raising campaign is crucial in reaching revenue projections.

The Society is pleased that the Endowment Fund has reached a level where some of the annual income can now be used to support a number of mathematics activities in Canada. The amount of money available is dependent on the return from the investments that constitute the Fund and the Finance Committee is responsible to the Board for the good management of these investments. A newly formed Endowment Grants Committee, is responsible for the *Endowment Fund Competition* and the results of the first competition should be announced in January.

New members are vital for the long-term health of the CMS and various

steps are underway to help increase membership. A recent initiative to ensure that the CMS can effectively support and encourage the activities of both graduate and undergraduate mathematics students is the formation of a Student Committee. This committee will have its first meeting in Montreal in December.

It is important that revenues and other resources be appropriately directed and the various Task Forces that either have reported, or will be reporting during the next year, will constitute a crucial review of the Society's operations and help ensure the CMS can plan properly for the future, both financially and administratively.

The CMS is a very active Society and next year will be even more so: for example, the Joint Math 2000 Meeting in Hamilton, the Winter Meeting in Vancouver, the numerous activities associated with World Math Year 2000, increased cooperation with the research institutes, and other societies, and consideration of the Task Force Reports.

To all of those who helped the CMS reach its current position and be able to look back with a degree of pride, I extend sincere thanks. The future promises to be exciting and rewarding and I hope many members, particularly new members, will continue to be involved or will become involved in one or more of our activities.

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## DU BUREAU DU DIRECTEUR ADMINISTRATIF

### Un passé dont nous sommes fiers et un avenir stimulant

En cette fin d'année et de siècle, il serait difficile de ne pas jeter un regard à la fois sur notre passé et notre avenir.

Un grand nombre de personnes ont contribué à l'évolution de la SMC. À cet égard, les *États de service*

publiés dans Les mathématiques au Canada, volume 1 de la collection publiée à l'occasion du 50<sup>e</sup> anniversaire de la SMC, constituent un témoignage impressionnant du dévouement et de l'aide reçus de la communauté mathé-

matique canadienne. Il convient également de souligner que tous les départements de mathématiques des universités canadiennes ont soutenu la SMC d'une façon ou d'une autre.

Toutes nos activités nationales et

internationales de recherche, de publication, d'éducation, de publication électronique et autres relèvent du conseil d'administration, du comité exécutif, de treize comités permanents, de sept sous-comités et de six conseils de rédaction. Aidée en outre de plusieurs employés à plein temps et à temps partiel, la SMC a constitué une infrastructure inestimable dans le but *de promouvoir et de favoriser la découverte et l'apprentissage des mathématiques, et les applications qui en découlent*.

La SMC est bien chanceuse de pouvoir compter sur un nombre remarquable de bénévoles, mais toute activité entraîne tout de même des coûts. Pour défrayer les dépenses prévues au budget de l'an 2000, qui sera présenté au Conseil en décembre, à des fins d'approbation, nous devrons aller chercher une somme supplémentaire considérable. Il faudra donc mener une campagne de financement musclée si nous voulons recueillir les recettes prévues au budget.

La Société constate avec plaisir que son fonds de dotation a atteint un niveau qui nous permet d'utiliser une partie des revenus d'intérêts annuels

pour financer des activités mathématiques tenues au Canada. Le montant disponible dépend des intérêts tirés des placements dont le fonds est constitué, et c'est le Comité des finances qui gère ces investissements au nom du Conseil. Le tout nouveau Comité d'attribution des bourses du fonds de dotation assume, pour sa part, la gestion du *concours de bourses du fonds de dotation*, dont les résultats de la première année devraient être annoncés en janvier.

L'apport de nouveaux membres est essentiel à la vitalité à long terme de la SMC. À ce chapitre, nous avons pris plusieurs mesures pour tenter d'augmenter notre effectif. Récemment, dans le but de veiller à ce que la SMC puisse appuyer et encourager efficacement les activités des étudiants de tous les cycles, nous avons créé un Comité étudiant. Ce comité tiendra sa première réunion en décembre à Montréal.

Par ailleurs, il est important que nos recettes et autres ressources soient correctement utilisées. Les divers groupes de travail qui ont présenté leur rapport ou qui le feront au cours de la prochaine année nous fourniront

une vue d'ensemble inestimable des activités de la Société. Ces rapports nous aideront à bien planifier notre avenir, tant sur le plan financier qu'administratif.

La SMC est un organisme très actif, et l'année à venir ne fera pas exception, au contraire. Notamment au programme : la Réunion conjointe de l'an 2000 à Hamilton; la Réunion d'hiver à Vancouver; les nombreuses activités dans le cadre de l'année internationale des mathématiques en l'an 2000; une collaboration accrue avec les instituts de recherche et les autres sociétés; l'étude des rapports des groupes de travail.

Je remercie sincèrement tous ceux et celles qui ont fait de la SMC ce qu'elle est aujourd'hui et grâce auxquels nous pouvons nous remémorer notre passé avec fierté. L'avenir semble prometteur et stimulant. J'espère que nos membres continueront de prendre part à une ou à plusieurs de nos activités en grand nombre et que de nouveaux visages, notamment parmi les nouveaux membres, se joindront à ce groupe de participants actifs.

## EDUCATION NOTES

Ed Barbeau, University of Toronto

### A year of honours for Andy Liu

This has been quite a year for our colleague, **Andy Liu**, at the University of Alberta. Earlier this year, he received the Canadian Professor of the Year Award from the Canadian Council of the Advancement of Education, a Michael Smith Award for Science Promotion and a Distinguished Educator award from the Ontario Institute for Studies in Education at the University of Toronto.

Now, it has been announced that he is one of ten recipients of this year's

prestigious 3M Teaching Fellowships; in fact, four of the ten were professors at the University of Alberta. These honours were reported in the August-September and October issues of this year *University Affairs* magazine.

According to the *University Affairs* story, Andy wanted to be an elementary teacher, but being "over-qualified" with a doctorate in mathematics, he was bumped from the program and had to settle for teaching mathematics at university. However, he has nurtured the interest of students of all ages in mathematics through numerous activities for students at both the school and uni-

versity levels. With a colleague, Ted Lewis, he has devised an interactive math fair for elementary students and they plan to have a "mathmobile" to tour a version of the fair through northern Alberta. He plans to use some of the award money to help build a mathematical resource centre at the University of Alberta that will offer half-day interactive programs to local elementary classes.

We offer him heartiest congratulations and our best wishes for the flourishing of his many enterprises in mathematics!

## Honours for University of Manitoba colleagues

On April 29, 1999, **Tom Berry** and **Don Trim**, of the Department of Mathematics at the University of Manitoba, were both recognized at the student-teacher recognition reception. This is an annual university-wide event at which graduating students single (in this case “dual”) out professors that have influenced them and at the same time recognize a school teacher that was influential in their education. Soon after, on May 27, at Convocation, Tom Berry was awarded the Saunderson Award for Teaching, 1998-99, which comes with a cash prize. This is a university-wide award. It is unusual for a mathematician to win this.

## Should colleges be teaching remedial mathematics?

Particularly in the United States, a significant proportion of mathematics teaching is devoted to teaching school mathematics to students who did not get it the first time around. But is this a good use of resources? One college of the City University of New York does not think so, and has just finished jettisoning its remedial program.

In a recent article in *The Chronicle of Higher Education*, Lois Cronholm, who was interim President of Bernard M. Baruch College explains why that college made this decision. She refers to the curriculum deflation and grade inflation that the presence of under-prepared students cause and decries the demoralization of those students in the same class who are equipped to proceed. She sees that the large number of remedial programs has symbolized for the taxpayer a decline in public education and perhaps is responsible for the decrease in spending.

Baruch administrators did a study of which students needed remediation. They tended to come from certain schools and so it was felt that resources

could be better devoted to improving those schools rather than picking up after them. Last year, Baruch raised its admission standards and eliminated its remedial courses; it now tests students at different levels in the New York high school system to see whether they are likely to meet its admission standards and collaborates with the teachers to help make up deficiencies. The costs of this outreach are similar to the previous charges for remediation.

Last year, Baruch was the only CUNY college that had an increase in enrolment (of about 4 per cent to 11,380). According to Cronholm, “you will see the same motivation in the students today that was there decades ago, and you will find faculty members unusually enthusiastic about their students. The institution is a powerful rejoinder to today’s focus on esteem as a self-contained concept severed from accomplishment. Baruch’s enthusiasm comes from a student body and faculty who know that real self-esteem comes from meeting a real challenge.”

## Examinations for admission

After a hiatus of several years, I am teaching one of several sections of a large first-year calculus course for science students. This gives me a fresh take on the preparation of these recent high school graduates. It is possible to make the traditional complaints of their lack of basic facility, but the issue goes deeper. It seems that the problem is a lack of certain basic attributes, notably the inability to see the coherence of mathematics and to make distinctions and judgments.

In Ontario, we have just gone through the preparation of a new school curriculum, a process that has led to a lot of discussion, soul-searching and some measure of consensus, but a final product that is somehow less satisfying than was originally intended. We do not seem to have resolved the dilemma of ensuring the prerequisites of knowledge and technique that students need

to have, while at the same time engendering the sort of inquisitive and discerning attitudes that they also need to soar with their university mathematics.

There is considerable opinion in the Province that the reintroduction of central examinations might be useful. While certainly one has to be concerned at how examinations might drive the curriculum and curtail more investigative activities, they do seem to be one way of requiring students to summarize and review a large body of mathematics, and there is a nonzero probability that some of them at least may get a better sense of how the subject fits together. My purpose here is to describe the experience in two jurisdictions where these have appeared in some guise, British Columbia and Ontario.

In British Columbia, George Bluman, current Chair of the Mathematics Department at the University of British Columbia, lobbied successfully for a return of mandatory provincial examinations in that province. He referred me to the departmental webpage [www.math.ubc.ca](http://www.math.ubc.ca) with a reference to *Schools: Developments at UBC of interest to schools*. In brief, the restoration of examinations was a response to increasing failure rates in first-year university calculus courses and the variability of grades reported by schools. Students have five opportunities during the year to write the provincial examination. Until 1997, there was a grade 12 scholarship paper, and it was discovered that students who wrote this performed better in university than others with similar high school grades or marks in the regular provincial examination. The main criterion for entry into the honours calculus course at UBC is performance on the *Euclid* contest, but for entry to the University, school grades are looked at initially. If these are high enough, the student is offered unconditional admission. Otherwise, an offer of admission is conditioned by how well they perform on provincial ex-

aminations; many students lose the opportunity when their final admission average falls too far below the conditional admission cut-off.

The examination regime in British Columbia has had a general positive effect. The University of British Columbia reports a “steady improvement” in the attainments of its mathematics students that is not seen in other provinces. We should not regard examinations as a panacea. Indeed, in British Columbia the final word has not been said. There is discussion on the most appropriate type of questions and the universities are working with the Education Ministry on a provincial Calculus 12 course whose examination would be the Calculus Challenge Examination now offered by the universities in the province.

In the meantime, beginning in the 1999 admission cycle, the *Canadian Mathematics Competition* at the University of Waterloo has changed the character of the *Descartes Competition* to allow it to function as a university entrance requirement for students entering faculties of mathematics or engineering at that university. It approached other universities to see whether they might be willing to grant the *Descartes Competition* admission status. Because it is not officially attached to an OAC credit and because the mathematics department in most universities is part of a faculty with a variety of disciplines, it does not

seem feasible for a university to have significantly different entrance requirements for its mathematics and non-mathematics students.

I am indebted to Ron Scoins for information on how the *Descartes Competition* is used for admission to the University of Waterloo. Up to 1998, the Faculty of Mathematics used a hand selection admission process, OAC (Ontario Academic Courses) average, *Descartes* score, and supplementary information submitted by the applicant. Up to 4 bonus points might be added to an applicant’s average on the basis of their performance in the *Descartes Competition*. In 1999, students wanting to enter the faculty were *required* to take the *Descartes* Contest. Of course, they still need six OAC credits. The final admission score of the applicant is equal to 6 times the OAC average plus 1.25 times the *Descartes* score, divided by 7, augmented by an AIF score which could be some number between 0 and 12. The *Descartes* thus functions as a seventh OAC; the mark is scaled by 1.25, as only the first three parts (80% of the paper) of the *Descartes* are used in the score. Admission is refused to any student not getting a score of 40 (out of 100) on the *Descartes*.

In the Faculty of Engineering, the *Descartes Contest* is highly recommended, and in fact few students fail to take it. This faculty compares the performance of the student with the av-

erage performance on the paper, and may use the result to augment the student’s admission average. This faculty is waiting to study the experience in the mathematics faculty before moving to require the *Descartes*. Scoins reports that, according to anecdotal evidence, the effect of the new requirement in mathematics is positive and plans to do a detailed analysis when the first term results are in.

It seems clear that with the diversity of students, examinations can play an important role, but they should be supplemented by other things. It is important for students to review and consolidate what has been learned; the three main ways for ensuring this are examinations, recitals and competitions. In mathematics, *recitals* could be a requirement that students present talks or demonstrations, or perform some tutorial work, while competitions can include traditional individual competitions as well as science fairs and group events. Probably we will not have a good handle on the preparation of our incoming students until they come, not only having written an entrance examination paper, but also bearing a portfolio describing and demonstrating their mathematical achievements. This is a model used by professional schools such as music and architecture, and one needs to adopt the attitude that students entering university science and engineering program will be professional users of mathematics.

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## FROM THE INSTITUTES

### NSERC President Thomas Brzustowski praised

In a speech at the recent Canada-China 3x3 conference, PIMS Director Nassif Ghoussoub expressed the appreciation of the Canadian delegation for Thomas Brzustowski’s presence, citing his administration at NSERC. “Tom started

his term as President of NSERC at a time when the Canadian mathematical community was at a crossroad and was doing lots of soul-searching. Very early on, Tom Brzustowski saw the importance of the moment and, unfazed by risk or political considerations, he managed to find and give the mathematical community this little bit of space,

this little margin to allow it to collectively experiment, innovate, restructure and grow. He then dared us to succeed. The result has been one of the success stories of Canadian science and also of the Canadian granting system. In many ways, our community is here because of you Tom and we thank you for that”.

## AWARDS / PRIX

### 3rd CMS Doctoral Prize

The third Doctoral Prize Lecture will be given by Jiang Shen at the meeting of the Society this month in Montreal. This prize recognizes outstanding performance by a doctoral student graduating from a Canadian university during the preceding year.



*Jiang Shen*

Born in P. R. China in 1967, Jiang Shen was the 2nd placed student in the final of the Chinese Mathematical Olympiad 1985 and was one of the six high school students of Team China to attend the 27th International Mathematical Olympiad in 1986. He earned his Bachelor's degree in 1991 and Master's degree in 1994 from the University of Science and Technology of China. He earned his Ph. D. in 1998 from Queen's University in Kingston under the supervision of David Gregory. Recently, he won the 1999 Governor General's Gold Medal for achieving the highest academic standing in all graduate programs at Queen's University in 1998. He is now an NSERC postdoctoral fellow working with Professor Richard Brualdi at the University of Wisconsin in Madison. He will be a visiting assistant professor at

the University of Illinois in Urbana-Champaign for the spring semester of 2000. He has accepted a tenure-track assistant professor position at the Southwest Texas State University (currently on leave due to a visa problem in USA).

Shen's thesis dealt with a number of problems in combinatorial matrix theory and graph theory. He proved a conjecture raised in 1984 by R. Hartwig on the exponent of primitive matrices. (A square matrix  $A$  with non-negative entries is called primitive if some power of  $A$  has all positive entries; and the smallest such power is called the exponent of  $A$ . This conjecture was also proved independently by S. Neufeld.) Perhaps the most interesting conjecture he worked in his thesis is the following Caccetta-Häggkvist Conjecture raised in 1978: Any directed graph with  $n$  vertices and minimum out-degree  $r$  contains a directed cycle of length at most  $\lceil n/r \rceil$ . The Caccetta-Häggkvist Conjecture, if true, implies another interesting conjecture of Behzad, Chartrand and Wall (1970). Shen proved in his thesis that, for each given  $r$ , the number of counterexamples to the Caccetta-Häggkvist Conjecture, if any, is finite.

### Lee Lorch receives honorary degree

Lee Lorch was awarded an honorary Doctor of Science degree by Spelman College at its May 1999 convocation.

Dr. Lorch, Professor Emeritus and Senior Scholar at York University, has not only made significant contributions to the field of mathematics but also has been a tireless fighter for human rights and educational opportunities for minorities and women. His more than 75 mathematical publications have illuminated several difficult problems and have generated international interest.

Dr. Lorch is a Fellow of the Royal Society of Canada, a Fellow of

the American Association for the Advancement of Science and has been elected to the Councils of the Canadian and American Mathematical Societies. He served as Chair of the Mathematics Department at Fisk University and Philander Smith College, and as a Visiting Professor at Spelman College and Howard University.

Dr. Lorch, who has held positions at seven international universities and several other institutions in the United States, has waged a long, courageous and continuing struggle for civil rights and equal educational opportunities for minority groups. His struggle was carried on at great personal cost including loss of employment. In the early 1940s he was dismissed from the City College of New York for attempting to end racial segregation in Stuyvesant Town, a large housing development in New York City. He later lost his position at Pennsylvania State University for subletting his apartment in Stuyvesant Town to a black family. He lost his position at Fisk University after attempting to force the Mathematical Association of America to admit his black mathematics department colleagues to a banquet at the regional meeting in Nashville and after attempting to enroll his daughter in the neighbourhood school in the black neighbourhood surrounding Fisk University.

He has provided invaluable encouragement to women and African American women, in particular, to pursue higher degrees in mathematics. His teaching style, encouragement and mentoring have been immensely influential in producing African American mathematicians who are currently working at colleges and universities across the nation. Three of his Fisk students are among the first 10 African American women to earn the PhD in mathematics. He has been recognized for his contributions to human rights through awards from several universities and national organizations.

(FERMAT—continued from page 1)

concepts in scientific discovery. It is easy for students to grasp a time in history when there was no concept of zero, no notion of the decimal system. We can impress upon them of how difficult life would be if we had to work with Roman numerals and this way lead them to appreciate the greatness of the concept of zero, the value of the decimal system. Civilization, as we know it, could not have developed without this and technology could not have spawned without the binary system (which is the base 2 variant of the decimal system). In the world we now inhabit, where literally everything has been digitalized, we can say true to the Pythagorean philosophy that ‘everything is number.’ Civilization is supported by abstract thought. All of our scientific understanding comes through conceptual thinking. Without concepts, there can be no foundation for science.

An unsolved problem in mathematics or science is a pointer to missing concepts. If all existing methods available cannot tackle the problem, then that means our notions need revision and expansion. If in 1637, Fermat had conjectured that the equation

$$x^n + y^n = z^n$$

has no non-trivial solutions in integers for  $n \geq 3$ , then our inability to settle the conjecture only led to the creation of new concepts, and new branches of mathematics. Kummer’s theory of ideals for instance was discovered as a consequence and out of it grew algebraic number theory and ring theory as an offshoot. This trail of development is best described in Ribenboim’s earlier book, *Thirteen lectures on Fermat’s Last Theorem*.

In any case, an unsolved problem presents a challenge. How are we to know if the reason we are unable to solve it is due to lack of concepts or just our inability to use existing methods. That is difficult to answer and for any given unsolved problem, we have two categories of attackers. One category is the conceptual kind, epitomized by Kummer’s approach to Fermat’s Last Theorem. The second category is the ‘amateur-professional’ kind that use existing methods and try to fine tune them for the occasion. Both categories have their serious contribution to make. The first creates new ways of thinking and new branches of mathematics. The latter, by refining existing methods, simplifies it in the process and enlarges our understanding of them. There is often a hidden symbiosis between the two categories.

*FLT for Amateurs* has 11 chapters, with the final chapter devoted to a very brief description of the developments since 1985. The first chapter deals with special cases like  $n = 4$  which could have been solved by Euclid, but was actually solved by Fermat in 1636 by his method of infinite descent. This immediately reduces FLT to the case of  $n = p$  an odd

prime and FLT assumes the symmetric form of showing that the equation  $x^p + y^p + z^p = 0$  has no non-trivial solutions in integers. The case  $n = 3$  quickly leads one to the ring of Eisenstein integers and already suggests a natural division of FLT into the first case when  $p$  is coprime to  $xyz$  and the second case when  $p$  divides  $xyz$ . For example, in the case  $p = 3$ , the first case is easily disposed of by considering the equation mod 9.

The extension of this argument to other prime exponents  $p$  such that  $2p + 1 = \ell$  is prime was discovered by Sophie Germain in the 19th century. The idea is simple. We first observe that if  $x + y$  and  $(x^p + y^p)/(x + y)$  have a common prime factor, it must be  $p$ . Indeed if  $q$  were a common prime factor, then

$$0 \equiv (x^p + y^p)/(x + y) = x^{p-1} - x^{p-2}y + \dots + y^{p-1} \equiv px^{p-1} \pmod{q}$$

so that  $q = p$ . Now suppose  $x^p + y^p + z^p = 0$  and  $(p, xyz) = 1$ , then  $x + y = a^p$  and  $(x^p + y^p)/(x + y) = c^p$  for some integers  $a, c$ . By symmetry,  $y + z = b^p$  and  $x + z = d^p$  for some integers  $b, d$ . If  $(\ell, xyz) = 1$ , we consider FLT mod  $\ell$  which leads to  $\pm 1 \pm 1 \pm 1 \equiv 0 \pmod{\ell}$ , an impossibility. So we may suppose  $\ell$  divides  $xyz$ . Without loss of generality, we can suppose  $\ell$  divides  $x$  and  $(\ell, yz) = 1$ . But then,  $2x + y + z = (x + y) + (x + z) = a^p + d^p \equiv b^p \pmod{\ell}$  which again is impossible if  $\ell$  is coprime to  $adb$ . So one of  $a, d, b$  must be divisible by  $\ell$  and this must be  $b$  for otherwise  $x, y, z$  would not be mutually coprime. Hence,  $y + z$  is divisible by  $\ell$ . Since  $(y^p + z^p)/(y + z)$  is also a  $p$ -th power (say  $t^p$ ), we get  $t^p \equiv py^{p-1} \pmod{\ell}$ . As  $t$  is coprime to  $\ell$ , we must have  $py^{p-1} \equiv \pm 1 \pmod{\ell}$ . Also,  $x + y = a^p$  implies  $y$  is a  $p$ -th power mod  $\ell$ . Thus  $p \equiv \pm 1 \pmod{\ell}$  a contradiction. This is essentially the content of Chapter 4 devoted to Sophie Germain’s theorem.

The chapters are sprinkled with brief interludes touching on various relevant topics such as  $p$ -adic numbers, cyclotomic polynomials, and Lagrange resolvents.

The book has its merits in that the level is definitely kept at the undergraduate level. For the ‘amateur’ who wants to turn ‘professional’, I would recommend that this book be followed up by Alf van der Poorten’s book, *Notes on Fermat’s Last Theorem* published by the Canadian Mathematical Society in the Wiley series. This can be followed by the reviewer’s *Topics in Number Theory* which is a series of lectures delivered at Mehta Research Institute in Allahabad, India shortly after the announcement of Wiles in June 1993. After this initiation, the amateur will be prepared to tackle *Seminar on Fermat’s Last Theorem* (edited by V. Kumar Murty) and published by the Canadian Mathematical Society. Later, he can study *Modular Forms and Fermat’s Last Theorem* (edited by G. Cornell, J. Silverman and G. Stevens) and published by Springer-Verlag. If he has gotten this far, the amateur would have turned professional.

In conclusion, the book is a pleasant read interspersed with interesting historical information. For instance, Appendix A

gives references to wrong proofs of FLT. It seems that when the Wolfskehl Prize was established in 1908 for a correct proof FLT, more than 620 wrong solutions were submitted in the first year alone. Remarkable is the case of F. Lindemann, who proved that  $\pi$  is transcendental and thus ended the controversy of squaring the circle. During the period of 1901 to 1908, Lindemann wrote three papers attempting to solve FLT but in each case, there was a gap.

FLT has stimulated the minds of mathematicians, both amateur and professional for more than 3 centuries. It may continue to stimulate and inspire further generations to come.

For indeed, it is conceivable there may be a solution which circumvents the theory of elliptic curves. Nevertheless, its solution has raised new questions such as the generalized Fermat equation, or more generally the ABC conjecture. We close with a special case of the Darmon - Granville conjecture: for positive integer exponents  $r, s, t \geq 3$ , the equation

$$x^r + y^s = z^t$$

has no non-trivial solutions in coprime integers. This should keep the amateurs and professionals busy for the next millennium, we hope.

## SÉMINAIRE DE MATHÉMATIQUES SUPÉRIEURES SÉMINAIRE SCIENTIFIQUE OTAN

Université de Montréal, 3 - 14 juillet 2000  
39e Session

### APPROXIMATION, ANALYSE COMPLEXE ET THÉORIE DU POTENTIEL

#### Conférenciers:

- A. ANCONA (Orsay)  
*Topics on Martin boundaries and harmonic measures*
- N. ARAKELIAN (Armanian Nat'l Acad. Sci.)  
*Holomorphic approximation and singularities*
- D.H. ARMITAGE (Queen's, Belfast)
- S.J. GARDINER (Univ. Coll. Dublin)  
*Uniform and tangential harmonic approximation and applications*
- T. BAGBY (Indiana, Bloomington)  
*Differential operators and approximation problems on manifolds*
- M. BONK (TU Berlin)  
*Negative curvature in real and complex analysis*
- H. CHEN (Nanjing)  
*Bloch constant for holomorphic and harmonic mappings in high dimension*
- D. DRASIN (Purdue)  
*Approximation theorem, normal families and meromorphic functions*
- P.M. GAUTHIER (Montréal)  
*Approximation on Riemann surfaces and complex manifolds*
- A.A. GONCHAR (Steklov, Moscow)  
*Interpolation and approximation by rational functions in the complex domain*
- T. RANSFORD (Laval)  
*Jensen measures*
- A. STRAY (Bergen)  
*Simultaneous approximation in various function spaces*

Demande de participation avant le 21 février 2000.

Renseignements: G. David, Département de mathématiques de statistique, Université de Montréal, CP 6128-Centre-ville, Montréal (Qc) H3C 3J7, tél. (514) 343-6710, fax (514) 343-5700, sms@dms.umontreal.ca, <http://www.dms.umontreal.ca/activite/sms>

## CMS Winter 1999 Meeting Renaissance - Hôtel du Parc Montréal, Québec December 11 - 13, 1999

### Fifth Announcement

Please refer to the Second, Third and Fourth Announcements in the September, October and November issues of the *CMS Notes* for more complete information on the scientific, education and social programmes. This announcement features an updated timetable and any changes to the programmes previously announced. It also features the most updated listing of confirmed speakers and their titles. The most up-to-date information concerning the programmes, including scheduling, is available at the following world wide web address:

<http://www.camel.math.ca/CMS/Events/>

Meeting registration forms, abstract forms, and hotel accommodation forms may be found in the September issue of the *CMS Notes* and at our website.

### Programme Updates

There are no updates to the programme previously announced.

### Acknowledgements

The support of the following organizations is gratefully acknowledged:

- Centre de recherches mathématiques

- Institut des sciences mathématiques
- Laboratoire de combinatoire et d'informatique mathématique
- Network for Computing and Mathematical Modeling
- The Fields Institute for Research in Mathematical Sciences
- The Pacific Institute for the Mathematical Sciences.

The CMS wishes to acknowledge the contribution of the members of the Meeting Committee for organizing this meeting and presenting these exciting scientific, educational, and social programs.

### Meeting Committee

*Meeting Director:* Michel Delfour (Montréal)

*Local Organizing Committee Chair:* Véronique Hussin (Montréal).

Paul Arminjon, François Bergeron, Nantel Bergeron, George Bluman, Monique Bouchard (CMS ex-officio), Abraham Broer, Martin Goldstein, Michel Grundland, Lucien Hadad, Pierre Hansen, Alexandra Haedrich (ISM), Joel Hillel, Jacques Hurtubise (CMS ex-officio), Jacqueline Klasa, François Lalonde, Gilbert Laporte, Benoît Larose, Sabin Lessard, Paul Libbrecht, Wendy MacCaull, Thomas Mattman, Angelo Mingarelli, Richard O'Lander, Ivo Rosenberg, Christiane Rousseau, David Sankoff, Phil Scott, Ronald Sklar, Gordon Slade, Graham Wright (CMS ex-officio), Mike Zabrocki.

### Items also published with this announcement

Updated Timetable - block schedule

Updated List of Scheduled Speakers and Titles

### SPECIAL NOTICE!!

The Centre de recherches mathématiques invites all those attending the 1999 CMS Winter Meeting to join them in celebrating its 30th Birthday Party. The evening registration will be held during the reception to be held at the University of Montreal on Friday, December 10, 1999, beginning at 6:00 p.m. Come join the celebration and pick up your registration packages for the CMS Winter Meeting 1999 at the same time. For those who plan to attend this reception, please let us know by filling out a special registration form at [www.CRM.UMontreal.CA](http://www.CRM.UMontreal.CA). Additional information regarding the 30th anniversary programme and the evening's events will also be available at the web site.

### MATH 2000

**June 10-13, 2000  
McMaster University**

Look for programme information in the February 2000 issue of the *CMS Notes* or at <http://www.camel.math.ca/CMS/Events/Math2000>

CMS WINTER MEETING 1999 RÉUNION D'HIVER DE LA SMC RENAISSANCE - HÔTEL DU PARC 3625, Avenue du Parc, Montreal (Québec) Canada					
LECTURES : Conference Center		SCHEDULE - HORAIRE		CONFÉRENCES : Centre de Conférence	
Time Heure	Thursday / jeudi December 9 décembre	Friday / vendredi December 10 décembre	Saturday / samedi December 11 décembre	Sunday / dimanche December 12 décembre	Monday / lundi December 13 décembre
8:00			Registration open from 8:00 a.m. to 5:00 p.m. Bureau d'inscription ouvert de 8:00 à 17:00 Coffee will be available in the Exhibit area / Le café sera servi dans l'aire d'exposition		
8:30			8:00 - 17:00 Exhibits - Expositions	8:00 - 17:00 Exhibits / Expositions	
			8:30 - 9:00 Welcome - bienvenue		
9:00	9:00 - 16:00  Executive Committee Meeting Réunion du Comité exécutif  Salon Jeanne-Mance Conference Center		9:00 - 9:50 <b>ADRIANO GARSIA</b>	9:00 - 9:50 SESSIONS	9:00 - 9:50 <b>JIAN SHEN</b> PRIX DOCTORAT DE LA SMC CMS DOCTORAL PRIZE
10:00			10:00 - 10:30 <b>COFFEE BREAK / PAUSE CAFÉ</b>		
10:30			10:30 - 11:20 <b>PAVEL A. PEVZNER</b>	10:30 - 11:20 <b>ZHIHONG XIA</b>	10:30 - 11:20 <b>ANDREAS DRESS</b>
11:00		11:30 - 14:00 <b>DELEGATES' LUNCHEON LUNCH DES PARTICIPANTS</b>			
11:30			Renaissance-Hôtel du Parc	12:30 - 14:00 <b>LUNCH / DÉJEUNER</b>	12:30 - 14:00 <b>LUNCH / DÉJEUNER</b>
12:30		13:00 - 18:00 Board of Directors Meeting Réunion du Conseil d'administration  Salon Des Pins Renaissance-Hôtel du Parc			
13:00					
14:00					

<b>CMS WINTER MEETING 1999 RÉUNION D'HIVER DE LA SMC</b> <b>RENAISSANCE - HÔTEL DU PARC</b> <b>3625, Avenue du Parc, Montreal (Québec) Canada</b> <b>LECTURES : Conference Center      SCHEDULE - HORAIRE      CONFÉRENCES : Centre de Conférence</b>					
Time Heure	Thursday / jeudi December 9 décembre	Friday / vendredi December 10 décembre	Saturday / samedi December 11 décembre	Sunday / dimanche December 12 décembre	Monday / lundi December 13 décembre
15:00	9:00 - 16:00 Executive Committee Meeting Réunion du Comité exécutif	13:00 - 18:00 Board of Directors Meeting Réunion du Conseil d'administration  Salon Des Pins Renaissance-Hôtel du Parc	15:00 - 15:30 COFFEE BREAK / PAUSE CAFÉ		
15:30	Salon Jeanne-Mance Conference Center		15:30 - 17:30 SESSIONS	15:30 - 17:30 Assemblée Générale General Meeting	15:30 - 18:30 SESSIONS  17:30 - 19:30 Forum sur l'enseignement de l'algèbre linéaire Forum on the teaching of linear algebra
Evening		18:00 - 21:00 Reception Evening Registration  Réception et inscription  30 <sup>e</sup> anniversaire du CRM 30 <sup>th</sup> Anniversary of the CRM  University of Montreal	18:00 - 18:30 Reception (Cash bar)  18:30 - 19:30 <b>JENNIFER CHAYES</b> CONFÉRENCE GRAND PUBLIC PUBLIC LECTURE	18:30 - 19:00 Reception (Cash bar)  19:00 - 22:00 Banquet  Renaissance-Hôtel du Parc	

SESSIONS WILL BE RUN IN PARALLEL ON ALL 3 DAYS OF THE MEETINGS. / TOUTES LES SESSIONS SE DÉROULERONT EN PARALLÈLE PENDANT LES 3 JOURS DE LA RÉUNION.  
 CONTRIBUTED PAPER SESSIONS WILL BE RUN ON THE LAST DAY. / LA SESSION CONSACRÉE AUX COMMUNICATIONS EST PRÉVUE POUR LE DERNIER JOUR.

Algebraic Combinatorics, group representations and Macdonald / Combinatoire algébrique, représentations des groupes et polynômes de Macdonald  
 Mathematical physics / Physique mathématique  
 Orders, lattices and universal algebra / Ordres, treillis et algèbre universelle  
 Computing and mathematical modelling / Calcul et modélisation mathématique  
 Teaching of linear algebra / L'enseignement de l'algèbre linéaire  
 Graduate students seminar / Séminaire des étudiants aux cycles supérieurs  
 Mathematical genetics and genomics / Génétique et génomique mathématiques  
 Applied logic / Logique appliquée  
 Algebraic and geometric methods in differential equations / Méthodes algébriques et géométriques en équations différentielles  
 General History of Mathematics / Histoire générale des mathématiques

## Réunion d'hiver de la SMC Renaissance Hôtel du Parc Montréal (Québec) du 11 au 13 décembre, 1999

### Cinquième annonce

Veillez consulter la deuxième, troisième et quatrième annonce dans les numéros de septembre, octobre et novembre des *Notes de la SMC* pour obtenir de l'information détaillée sur les programmes scientifique et pédagogique, et les activités sociales. La présente annonce contient l'horaire révisé et tous les changements aux programmes annoncés précédemment. Vous trouverez ci-dessous la liste des conférenciers prévus et les titres des conférences. Vous trouverez l'information la plus récente sur les programmes, y compris les horaires, à l'adresse Web suivante:

<http://www.camel.math.ca/CMS/Events/>

Un formulaire d'inscription, un formulaire de résumé et un formulaire de réservation d'hôtel étaient inclus dans le numéro de septembre des *Notes de la SMC* et au site Web.

### Changements au programme

Il n'y a pas de changements aux programmes annoncés précédemment.

### Remerciements

Nous remercions les organisations suivantes pour leur soutien financier

- Centre de recherches mathématiques
- Institut des sciences mathématiques
- Réseau de calcul et de modélisation mathématique
- Laboratoire de combinatoire et d'informatique mathématique
- The Fields Institute for Research in Mathematical Sciences
- The Pacific Institute for the Mathematical Sciences

La SMC tient à remercier tous les membres du comité de coordination pour l'organisation de la réunion et des activités scientifiques, éducationnelles et sociales.

### Comité de Coordination

*Président et coordinateur* : Michel Delfour (Montréal)

*Présidente du Comité local* : Véronique Hussin (Montréal).

Paul Arminjon, François Bergeron, Nantel Bergeron, George Bluman, Monique Bouchard (SMC ex-officio), Abraham Broer, Martin Goldstein, Michel Grundland, Lucien Hadad, Alexandra Haedrich (ISM), Pierre Hansen, Joel Hillel, Jacques Hurtubise (SMC ex-officio), Jacqueline Klasa, François Lalonde, Gilbert Laporte, Benoît Larose, Sabin Lessard, Paul Libbrecht, Wendy MacCaull, Thomas Mattman, Angelo Mingarelli, Richard O'Lander, Ivo Rosenberg, Christiane Rousseau, David Sankoff, Phil Scott, Ronald Sklar, Gordon Slade, Graham Wright (SMC ex-officio), Mike Zabrocki.

### Documents publiés avec cette annonce

Horaire et programme révisé

Liste des conférenciers prévus révisé

### AVIS SPÉCIALE!!

Le Centre de recherches mathématiques invite tous les participants de la Réunion d'hiver 1999 de la SMC à célébrer le 30e anniversaire du CRM. L'inscription du vendredi, 10 décembre 1999, aura lieu à l'occasion d'une réception spéciale à l'Université de Montréal, prévue pour 18 h 00. On vous invite à célébrer avec nous et prendre possession de votre trousse d'inscription pour la Réunion d'hiver. Afin d'avoir un juste aperçu du nombre de participants, nous vous prions de bien vouloir remplir le formulaire d'inscription sur le site web du CRM: [www.CRM.UMontreal.CA](http://www.CRM.UMontreal.CA). Veuillez consulter cette page d'accueil pour de plus amples renseignements sur le programme du 30e anniversaire et de la soirée.

### MATH 2000

**10-13 juin, 2000**  
**Université McMaster**

Veillez consulter le numéro de février 2000 des Notes de la SMC pour les renseignements sur le programme ou consulter le site Web: <http://www.camel.math.ca/CMS/Events/Math2000>

## SCHEDULED SPEAKERS / CONFÉRENCIERS PRÉVUS

The following is a list of the confirmed speakers. Abstracts for all talks may be found at the following world wide web page:

<http://www.camel.math.ca/CMS/Events/>

Le suivant est une liste des conférenciers prévus à ce jour. Les résumés pour toutes les conférences seront disponibles à l'adresse Web suivante :

<http://www.camel.math.ca/CMS/Events/>

### COXETER-JAMES LECTURE CONFÉRENCE COXETER-JAMES

**Maciej Zworski** (Berkeley) *The inverse problem for resonances*

### DOCTORAL PRIZE LECTURE CONFÉRENCE PRIX DE DOCTORAT

**Jian Shen** (Queen's) *On the Caccetta-Haggkvist conjecture and some related conjectures*

### PUBLIC LECTURE CONFÉRENCE PUBLIQUE

**Jennifer Chayes** (Microsoft Research) *Phase transitions in computer science: what makes hard problems hard*

### PLENARY SPEAKERS CONFÉRENCIERS PRINCIPAUX

**Andreas Dress** (Bielefeld) *Cluster analysis and phylogenetic nets*

**Adriano Garcia** (USCD) *Update on the  $n!$  Conjecture*

**François Lalonde** (UQAM) *Symplectic topology in dimensions 2 and 4*

**David Lay** (Maryland) *Recent advances in teaching of linear algebra*

**Elliott H. Lieb** (Princeton) *The quantum-mechanical world view: a remarkably successful but still incomplete theory*

**Pavel Pevzner** (USC) *Transforming mice into men*

**Zhihong Xia** (Northwestern & Georgia Tech) *Hamiltonian dynamical systems*

**Jacques Bélair** (Montréal) *Tors invariants et bistabilité de solutions périodiques dans un système d'équations différentielles à retards*

**Sue Ann Campbell** (Waterloo) *Calculating center manifolds for delay equations in Maple*

**Freddy Dumortier** (Belgium) *Limit cycles in polynomial Liénard equations*

**Jean-Pierre Francoise** (Paris) *The local Hilbert's 16th problem and its generalization to any dimension*

**John Guckenheimer** (Cornell) *Computing periodic orbits of vector fields*

**Philip Holmes** (Princeton) *Non-holonomic and piecewise-holonomic mechanical systems*

**Yulik Il'yashenko** (Moscow & Cornell) *Restricted versions of Hilbert's 16th problem and related topics*

**Kenneth Meyer** (Cincinnati) *Integral manifolds of the restricted three-body problem*

**Dan Offin** *Variational structure of the domains of stability*

**Ernesto Perez-Chavela** (Mexico) *Heteroclinic phenomena in the Sitnikov problem*

**Robert Roussarie** (Dijon) *Melnikov functions and Bautin ideal*

**Christiane Rousseau** (Montréal) *Finiteness part of Hilbert's 16th problem for quadric vector fields*

**Dana Schlomiuk** (Montréal) *Hilbert's 16th problem - meeting ground of analysis, algebra and geometry*

**Tadashi Tokerda** (UQAM) *Perturbation theory for symmetric Hamiltonian systems*

### SYMPOSIA

#### ALGEBRAIC GEOMETRIC METHODS IN DIFFERENTIAL EQUATIONS: THE 20th CENTURY IN CELESTIAL MECHANICS AND ONE CENTURY OF WORK ON HILBERT'S 16th PROBLEM (CMS-CRM)

#### MÉTHODES ALGÈBRIQUES ET GÉOMÉTRIQUES EN ÉQUATIONS DIFFÉRENTIELLES: LA MÉCANIQUE CÉLESTE AU 20<sup>È</sup> SIÈCLE ET UN SIÈCLE DE TRAVAIL SUR LE 16<sup>È</sup> PROBLÈME DE HILBERT (SMC-CRM)

(Org: Angelo Mingarelli and Christiane Rousseau)

#### APPLIED LOGIC / LOGIQUE APPLIQUÉE (Org: Wendy MacCaull, Phil Scott and Prakash Panangaden)

**Fahiem Bacchus** (Waterloo) *Engine based on model checking*

**Rick Blute** (Ottawa) *Nuclear ideals*

**Marta Bunge** (McGill) *Relative Stone duality*

**Peter Caines** (McGill) *COCOLOG: A logic for systems and control*

**Robin Cockett** (Calgary) *Double glueing*  
**Josée Desharnais** (McGill) *A logical characterization of bisimulation for labelled Markov processes*  
**Amy Felty** (Bell Labs) *A semantic model of types for proof-carrying code*  
**Esfandiar Haghverdi** (Ottawa) *Linear logic, geometry of proofs and full completeness*  
**Doug Howe** (Bell Labs) *Combining functional programming languages and set theory in support of software verification*  
**Joachim Lambek** (McGill) *Bilinear logic in linguistics*  
**François Lamarche** (INRIA) *Spaces for linguistic representations and the semantics of linear logic*  
**Gonzalo Reyes** (Montreal) *Topics in synthetic differential geometry*  
**Robert Seely** (John Abbott College) *Semantics for various noncommutative linear logics*  
**Alasdair Urquhart** (Toronto) *Complexity problems for sub-structural logics*  
**Franck van Breugel** (York) *Towards quantitative verification of systems: a coalgebraic approach*

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**ALGEBRAIC COMBINATORICS, GROUP REPRESENTATIONS AND MACDONALD POLYNOMIALS (CMS-CRM-LaCIM)**  
**COMBINATOIRE ALGÈBRIQUE, REPRESENTATIONS DES NOMBRES ET POLYNÔMES DE MACDONALD (CRM-LaCIM-SMC)**  
 (Org: François Bergeron, Nantel Bergeron and Mike Zabrocki)

**Ed Allen** (Wakeforest) *Bitableaux for some Garsia-Haiman modules and other related modules*  
**François Bergeron** (UQAM) *Diagonal harmonics and generalizations*  
**Carol Chang** (Northeastern) *Representations of quivers with free modules of covariants*  
**Tudose Geanina** (York) *Littlewood-Richardson rule for special fusion coefficients*  
**Victor Ginzburg** (Chicago) *Principal nilpotent pairs in a semisimple Lie algebra*  
**Mark Hainman** (UCSD) *The McKay correspondence and the  $n!$  conjecture*  
**Alain Lascoux** (Marne la Vallée) *Graphe de Yang-Baxter*  
**Jennifer Morse** (UCSD) *A new basis for Macdonald polynomials*  
**Mike Zabrocki** (UQAM-CRM) *Special cases of positivity for  $(q, t)$ -Kostka coefficients*

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**COMPUTING AND MATHEMATICAL MODELLING (CMS-NCM2)**

## CALCUL ET MODÉLISATION MATHÉMATIQUE (SMC-RCM2)

(Org: Pierre Hanson and Gilbert Laporte)

**Gilles Caporossi** (Ecole Polytechnique) *Automated search for relations between graph invariants*  
**P. W. Fowler** (Exeter) *The fullness: interesting graphs and fascinating molecules*  
**Pierre Hansen** (GERAD) *Computer-aided search and applications*  
**Charles Lin** (Montreal) *Regional modelling of the atmosphere*

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## GENERAL HISTORY OF MATHEMATICS HISTOIRE GÉNÉRALE DES MATHÉMATIQUES

(Org: Richard O'Lander and Ronald Sklar)

**Tom Archibald** (Acadia) *Mathematics in France, 1870-1890: A view via doctoral theses*  
**Ed Barbeau** (Toronto) *Bringing history close to home: Pell's equation*  
**Liliane Beaulieu** (CRM) *Clips from Bourbakian skits*  
**Len Berggren** (Simon Fraser) *Three geometrical gems from Islamic mathematics*  
**Stanley Burris** (Waterloo) *Reconstructing Boole's discovery of an algebra of logic*  
**Jal Choksi** (McGill) *A history of the convergence theorems of (Lebesgue) integration*  
**Suh Chun Chongs** (Athabasca) *Historical background for sequences and calculus*  
**Florin Diacu** (Victoria) *A century long loop: celestial mechanics to algebraic topology to celestial mechanics*  
**Hardy Grant** (York) *Greek mathematics in cultural context*  
**Minoru Hasegawa** (Lakehead) *From data manipulation to data exploration - a new frontier*  
**Bernard Hodgson** (Laval) *Histoire des mathématiques et formation des enseignants du secondaire : une expérience d'utilisation de textes originaux*  
**Richard O'Lander** (St. John's) *The new math: a look back*  
**Norbert Schlomiuk** (Montréal) *André Weil (1906-1998), in memoriam*  
**Ronald Sklar** (St. John's) *Computational logic: 1950- 1965*  
**Viena Stastna** (Calgary) *Math caught a wedding bouquet: young years of Sonja Kovalevskaja*  
**Peter Zvengrowski** (Calgary) *Vector analysis and the great 1890's controversy*

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## GRADUATE STUDENT SEMINAR (CMS-ISM) SEMINAIRE DES ÉTUDIANTS AUX CYCLES SUPÉRIEURS (SMC-ISM)

(Org: Abraham Broer, Alexandra Haedrich, Paul Libbrecht and Thomas Mattman)

**Leo Butler** (Queen's) *New examples of integrable geodesic flows*

**Yin Chen** (Laval) *Estimation de spectre pour les éléments algébriques*

**Khalid El Yassani** (Sherbrooke) *Analysis of two interior-exterior penalty algorithms for linear programming*

**Hà Huy Tai** (Queen's) *Box-shaped matrices and their ideals of  $2 \times 2$  minors*

**Mikhail Kotchetov** *Identities in Hopf algebras*

**Nathan Ng** (Memorial) *Prime number races*

**Martin Pergler** (Chicago) *Connection preserving actions and observable and epimorphic subgroups*

**Shaloub Razek** (Toronto) *Classifying  $C^*$ -algebras*

**Dominic Rochon** (Montréal) *Dynamique bicomplexe*

**Kone Siaka** (Wits, South Africa) *Mixed order systems of ordinary linear differential equations*

**Gregory Smith** (Berkeley) *Irreducible components of characteristic varieties*

**Michael Soltys** (Toronto) *Boolean programs and quantified propositional proof systems*

**Adam van Tuyl** (Queen's) *Computing the spreading and covering numbers*

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## MATHEMATICAL PHYSICS (CMS-PIms) PHYSIQUE MATHÉMATIQUE(SMC-PIms)

(Org: George Bluman, Michel Grundland  
and Gordon Slade)

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### I. Probability Methods and Applications Méthodes probabilistes et applications

**Christian Borgs** (Microsoft) *Partition function zeros for first order phase transitions*

**Almut Burchard** (Virginia) *Minimal and random spanning trees in two dimensions*

**Neal Madras** (York) *Self-avoiding walks with drift*

**Jeremy Quastel** (Toronto) *Hydrodynamic limits*

**Mary Beth Ruskai** (Massachusetts) *Pauli exchange errors in quantum computation*

**Yvan Saint-Aubin** (Montréal) *Boundary states for a free Boson defined on finite geometries*

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### II. Group Theory Methods and Applications Méthodes de la théorie des groupes et applications

**Stephen Anco** (Concordia) *Conservation laws of field equations*

**Lyudmila Bantsur** (Ternopil State Pedagogical University) *On one approach to the stability analysis of nonlinear systems*

**Paul Bracken** (Montréal & McGill) *The generalized Weierstrass system for mean curvature surfaces and the completely integrable sigma model*

**John Harnad** (Concordia) *The bilinear differential equations satisfied by Fredholm determinants appearing in random matrices*

**Nicky Kamran** (McGill) *Non-existence of time-periodic or quasi-periodic solutions of the Dirac operator in stationary axisymmetric black hole geometries*

**François Lalonde** (Concordia) *Vers une géométrie intrinsèque sur le groupe des difféomorphismes hamiltoniens et ses relations avec la cohomologie quantique*

**Martin Légaré** (Alberta) *Low dimensional integrable systems and topological Yang-Mills theories*

**Jiri Patera** (Montréal) *Non-standard exploitation of cut and project point sets ("Quasicrystals for cryptography")*

**Greg Ried** (Okanagan) *Deformations and symmetries on nonlinear differential systems*

**Pavel Winternitz** (Montréal) *Nonlinear differential and difference equations with superposition formulas*

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## MATHEMATICAL GENETICS AND GENOMICS (CMS-Fields)

## GÉNÉTIQUE ET GÉNOMIQUE MATHÉMATIQUES (SMC-Fields)

(Org: Sabin Lessard and David Sankoff)

**Kevin Atteson** (Yale) *Identifiability and consistency in phylogenetics*

**Andreas Dress** (Bielefeld) *Cluster analysis and phylogenetic nets*

**R.C. Griffiths** (Oxford) *Ancestral inference from gene trees*

**Tao Jiang** (McMaster) *Quartet cleaning: efficient algorithms and simulations*

**Ming Li** (Waterloo) *Whole genome phylogeny*

**Nicolas Shork** (CWRU) *The future of genetic case-control studies*

**Katy Simonsen** (Purdue) *Probability models for genetic factors underlying a binary phenotype*

**Simon Tavaré** (USC) *The genealogy of branching processes and the reconstruction of tumor histories*

**Elisabeth Thompson** (Washington) *Conditional genome sharing from dense marker maps*

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## ORDERS, LATTICES AND UNIVERSAL ALGEBRA ORDRES, TREILLIS ET ALGÈBRE UNIVERSELLE

(Org: Benoit Larose, Lucien Haddad and Ivo Rosenberg)

**Stanley Burris** (Waterloo) *Density in abstract number systems*

**Isidore Fleischer** (CRM, Montréal) *Functional representation of pre-iterative combinatory formalism*

**George Gratzer** (Manitoba) *On the endomorphism monoids of (uniquely) complemented lattices*

**Jennifer Hyndman** (UNBC) *Strong duality of finite algebras that generate the same quasivariety*

**Hajime Machida** (Hitsotsubashi University, Japan) *Hyperclones on the two-element set*

**Bob Quackenbush** (Manitoba) *Duality and nonduality theorems for finite groups*

**Luigi Santocanale** (UQAM) *Free  $\mu$ -lattices*

**Claude Tardif** (Regina) *Projectivity and product colourings*

**Shelly Wismath** (Lethbridge) *Hyperidentities for varieties of star bands*

**Laszlo Zadori** (Szeged) *Finite posets with symmetric idempotent operations*

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### TEACHING OF LINEAR ALGEBRA (CMS-ISM) L'ENSEIGNEMENT DE L'ALGÈBRE LINÉAIRE (SMC-ISM)

(Org: Joel Hillel, Véronique Hussin and Jacqueline Klasa)

**John Auer** (Brock) *Ten years of teaching linear algebra using Maple V at Brock University.*

**Jeffrey Boats** (Detroit) *On using computer tutorials to tailor linear algebra for secondary teachers*

**Bill Byers** (Waterloo) *Working with ambiguity in linear algebra*

**Bill Casselman** (UBC) *Linear algebra with Java-based programmable calculator*

**Daniel Norman** (Queen's) *Teaching linear algebra independence via unique representation*

**Asuman Oktac** (Concordia) *Linear algebra: Is it possible at a distance?*

**Morris Orzech** (Queen's) *Linear algebra and rigour-mixed messages as an opportunity*

**David Poole** (Trent) *Does linear algebra need to be "reformed"?*

**Anna Sierpinska** (Concordia) *Practical, theoretical, synthetic and analytic modes of thinking in linear algebra*

**Gilbert Strang** (MIT) *Partly random graphs and small world networks*

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### CONTRIBUTED PAPERS COMMUNICATIONS LIBRES

(Org: Paul Arminjon)

**Paul Arminjon** (CRM, Montréal) *Numerical computation of 3-D flows with a non-oscillatory central scheme on unstructured tetrahedral grids*

**Nataliya Bantsur** (Ukraine) *Existence of T-periodic solutions on nonlinear scalar differential equations with maxima*

**Boris Dekster** (Mount Allison) *Each convex body in  $E^3$  symmetric about a plane can be illuminated by 8 directions*

**Paul Gauthier** (Montréal) *Les théorèmes de Cauchy et Green pour connexité arbitraire*

**Mykola Hladiy** (Ternopil State Pedagogical University) *Generalized Green's operator of boundary value problem with impulse action*

**Omar Kihel** (Laval) *Sur un problème de Diophante*

**Peter Lancaster** (Calgary) *Numerical ranges of selfadjoint quadratic matrix polynomials*

**Claude Levesque** (Laval) *Sur les sommes de puissances consécutives*

**Jun Li** (Montréal) *Asymptotic behavior of a linear vector recurrence*

**Wei-Jiu Liu** (Dalhousie) *Adaptive control of Burgers' equation with unknown viscosity*

**François Perron** (Montréal) *An exponential bound for a 0-1 function of a reversible Markov chain*

**Dieter Ruoff** (Regina) *Proportionality of non-Euclidean plane*

**Konstantin Rybnikov** (Queen's) *Loss of tension in an infinite membrane with holes distributed by a Poisson law*

**Christina Stoica** (Victoria) *The relative two-body problem in quasi-homogenous potentials fields*

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## CALL FOR SESSIONS / APPEL AUX COMMUNICATIONS

Additional self-supported sessions play an important role in the success of the Society's semi-annual meetings. The CMS welcomes and invites proposals for self-supported sessions for Winter 2000 (University of British Columbia, Vancouver, B.C.).

Proposals should include a brief description of the focus and purpose of the session, the number and expected length of the talks, as well as the organizer's name, complete address,

telephone number, e-mail address, etc. Although such sessions would not usually have a plenary speaker, any special situations are left to the discretion of the Meeting Director.

These additional sessions will be incorporated with the other sessions, time blocks allocated by the Meeting Director and advertised in the *CMS Notes*, on *Camel* and, if possible, in the *Notices of the AMS* and in publications of other societies. Speakers in these additional sessions will be requested

to submit abstracts which will be published in the meeting programme.

The following provides information on the sessions confirmed to date.

**Those wishing to organize a session should send a proposal to the Meeting Director by January 31, 2000.**

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Les sessions autofinancées contribuent de plus en plus au succès des réunions semi-annuelles de la Société. La SMC encourage ces initiatives et invitent les organisateurs(trices) potentiel(les) à soumettre leurs projets pour ce type de sessions à l'occasion de la réunion d'hiver 2000 (Université de Colombie Britannique).

Les projets doivent inclure une brève description du thème et de la motivation de la session, le nombre et la durée

des communications prévues, ainsi que le nom et les coordonnées physiques et électroniques de l'organisateur(trice). Ces sessions ne comprennent pas non seulement de conférence plénière, mais les situations particulières sont laissées à la discrétion du directeur de la réunion.

Ces sessions additionnelles feront partie du programme, leur horaire sera établi par le directeur de la réunion, et elles seront publicisées dans les *Notes de la SMC*, sur *Camel* et, si possible, dans les *Notices de l'AMS* et les publications d'autres sociétés. Les conférenciers devront soumettre un résumé de leur communication, que paraîtra dans le programme de la réunion.

**Toute personne désireuse d'organiser une session doit faire parvenir un projet au directeur de réunion avant le 31 janvier 2000.**

### Winter 2000 / Hiver 2000

#### Algebraic geometry / Géométrie algébrique

(Peter Russell, McGill)

#### Classical and computational analysis / Analyse classique et quantitative

(Peter Borwein, Simon Fraser)

#### Ordered groups / Groupes ordonnés

(Akbar Rhemtulla, Alberta)

#### Partial differential equations / Equations différentielle et partielle

(Nassif Ghoussoub and / et Changfeng Gu, UBC)

#### Probability theory / Théorie des probabilités

(Martin Barlow, British Columbia)

#### Meeting Director / Directeur de réunion :

*Dale Rolfsen*

Department of Mathematics

University of British Columbia

#121-1984 Mathematics Road

Vancouver, B.C., Canada V6T 1Z2

Tel: (604) 822-6324

Fax: (604) 822-6074

e-mail: rolfsen@math.ubc.ca

## COMMITTEES AT WORK

### CMS Electronic Services Committee

*Edgar Goodaire, Memorial University, Committee Chair*

Almost from the arrival of the first personal computers, I have been fascinated by computers and the possibility of changing the way we academics do business. Too impatient to await normal delivery, I can still remember, round about 1985, fetching from Radio Shack and then carrying into our department some Tandy 1200s. Borrowing from the local vernacular, "We were some impressed". When the CMS started to develop its own web site and got into the delivery of electronic services in the broadest sense, I was one of several people who actually asked to attend meetings of the Society's Electronic Services Committee as an observer. Surely this has never happened before with any other CMS committee! On January 1 last, the inevitable happened and I write you today in my new capacity as chair of the ESC.

My first official meeting was here in St. John's at the end of May. We started at 5:30 p.m. on a Saturday and stopped just before 8:00 p.m., agenda not complete, because several of us wanted to attend Ed Barbeau's public lecture (which proved to be a treat). Since almost every activity of the CMS involves Electronic Services in one way or the other, most CMS committees are represented on the ESC, attendance is always high and agendas very full. And it is not unusual to have visitors. In May, we were joined by Mr. David Bates of Aetna Life Insurance in Toronto. A recent new appointment to the CMS Board and member of the CMS task force on fund raising activities, David raised the issue of advertising on Camel. Should we do it, is Camel an effective medium for advertising and, if the answers are yes, what sorts of policies should we have? I ask the same questions of you and would be grateful for your comments at any time.

Are there other ways to raise revenue through Camel?

Could we create a job site, for instance, and charge companies for posting advertisements? Could Camel become a conduit between young mathematicians in Canada seeking employment and companies looking for mathematicians?

I am eager to hear from the CMS membership at any time about any aspect of the electronic services the CMS is providing. If you notice a broken link on camel, or an error, if a particular site seems hard to find, if you are frustrated by too

many clicks, please notify camel@cms.math.ca and, if you can, send a copy to me, chair-esc@cms.math.ca. Changes for Camel's front page are in the works. Do you have any suggestions?

*This report was originally scheduled to appear in October; the editors apologize for the oversight which caused the delay in its publication.*

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## CALL FOR NOMINATIONS / APPEL DE CANDIDATURES

### 2000 Canadian Mathematical Society Doctoral Prize Le Prix de doctorat 2000 de la Société mathématique du Canada

The CMS Doctoral Prize recognizes outstanding performance by a doctoral student who graduated from a Canadian university. Nominations are limited to doctoral students who graduated from a Canadian university in the preceeding year (ie: January 1st to December 31st, 1999). Although the dissertation will be the most important criterion (the impact of the results, the creativity of the work, the quality of exposition, etc.) it will not be the only one. Other publications, activities in support of students and other accomplishments will also be considered.

The CMS Doctoral Prize will consist of an award of \$500, a two-year complimentary membership in the CMS, a framed Doctoral Prize certificate and a stipend for travel expenses to attend the CMS meeting to receive the award and present a plenary lecture.

#### Nominations

Candidates must be nominated by their university and the nominator is responsible for preparing the documentation described below, and submitting the nomination to the address below.

No university may nominate more than one candidate and the deadline for the receipt of nominations is **January 31, 2000**.

The documentation shall consist of:

- A curriculum vitae prepared by the student.
- A resumé of the student's work written by the student and which must not exceed ten pages. The resumé should include a brief description of the thesis and why it is important, as well as of any other contributions made by the student while a doctoral student.
- Three letters of recommendation of which one should be from the thesis advisor and one from an external reviewer. A copy of the external examiner's report may be substituted for the latter. More than three letters of recommendation are not accepted.

La SMC a créé ce Prix de doctorat pour récompenser le travail exceptionnel d'un étudiant au doctorat qui aura reçu son diplôme de troisième cycle d'une université canadienne. Seules les candidatures d'étudiants au doctorat ayant obtenu leur diplôme d'une université canadienne au cours de la dernière année (entre le 1er janvier et le 31 décembre 1999) seront acceptées. La dissertation constituera le principal critère de sélection (impact des résultats, créativité, qualité de l'exposition, etc.), mais ne sera pas le seul aspect évalué. On tiendra également compte des publications de l'étudiant, de son engagement dans la vie étudiante et de ses autres réalisations.

Le lauréat du Prix de doctorat de la SMC aura droit à une bourse de 500 \$. De plus, la SMC lui offrira l'adhésion gratuite à la Société pendant deux ans et lui remettra un certificat encadré et une subvention pour frais de déplacements lui permettant d'assister à la réunion de la SMC où il recevra son prix et présentera une conférence.

#### Candidatures

Les candidats doivent être nommés par leur université; la personne qui propose un candidat doit se charger de regrouper les documents décrits aux paragraphes suivants et de faire parvenir la candidature à l'adresse ci-dessous.

Aucune université ne peut nommer plus d'un candidat. Les candidatures doivent parvenir à la SMC au plus tard **le 31 janvier 2000**.

Le dossier sera constitué des documents suivants :

- Un curriculum vitae rédigé par l'étudiant.
- Un résumé du travail du candidat d'au plus dix pages, rédigé par l'étudiant, où celui-ci décrira brièvement sa thèse et en expliquera l'importance, et énumérera toutes ses autres réalisations pendant ses études de doctorat.
- Trois lettres de recommandation, dont une du directeur de thèse et une d'un examinateur de l'extérieur (une copie de son rapport fera aussi l'affaire). Le comité n'acceptera pas plus de trois lettres de recommandation.

Chair/Président  
Doctoral Prize Selection Committee/Comité de sélection du Prix de doctorat  
CMS Executive Office/Bureau administratif de la SMC  
577 King Edward, Suite 109  
P.O. Box 450, Station A/C.P. 450, Succursale A  
Ottawa, Ontario Canada  
K1N 6N5

### **CMS Distinguished Service Award Prix de la SMC pour service méritoire**

In 1995, the Society established this award to recognize individuals who have made sustained and significant contributions to the Canadian mathematical community and, in particular, to the Canadian Mathematical Society.

The first awards were presented at the 1995 Winter Meeting in Vancouver to Donald Coxeter, Nathan Mendelsohn, John Coleman, Maurice L'Abbé and George Duff. The second awards were presented at the 1996 Winter Meeting in London, Ontario to David Borwein and P.G. (Tim) Rooney. The next awards were presented at the 1999 Summer Meeting in St. John's, Newfoundland to Michael Doob and S. Swaminathan.

Nominations should include a reasonably detailed rationale and be submitted by **March 31, 2000**, to the address below.

En 1995, la Société mathématique du Canada a créé un nouveau prix pour récompenser les personnes qui contribuent de façon importante et soutenue à la communauté mathématique canadienne et, notamment, à la SMC.

Les premiers lauréats furent honorés lors de la réunion d'hiver 1995 à Vancouver aux Donald Coxeter, Nathan Mendelsohn, John Coleman, Maurice L'Abbé et George Duff. Les deuxièmes lauréats, David Borwein et P.G. (Tim) Rooney, furent honorés lors de la réunion d'hiver 1996 à London, Ontario. Les prochains lauréats, Michael Doob et S. Swaminathan, est honorés à la réunion d'été 1999 à St. John's, Terre-Neuve.

La période de mises en candidature est en cours; prière de présenter des dossiers suffisamment détaillés et de les faire parvenir, le **31 mars 2000** au plus tard, à l'adresse ci-dessous.

Selection Committee / Comité de sélection  
Distinguished Service Award / Prix pour service méritoire  
577 King Edward, Suite 109  
C.P./P.O. 450, Succursale / Station A  
Ottawa, Ontario K1N 6N5 Canada

### **THE FIELDS INSTITUTE** FOR RESEARCH IN MATHEMATICAL SCIENCES

Call for nominations and applications for the position of Director, The Fields Institute for Research in the Mathematical Sciences.

The term of office of the Director, Donald A. Dawson, expires as of June 30, 2000. The Institute is now calling for nominations and applications for the position of Director.

The Director is the Chief Executive Officer of the Institute with responsibility for the Institute's scientific leadership and overall operation. The term of office is three to five years, renewable once. Candidates should have a strong international stature in the mathematical sciences as well as proven administrative experience. Nominations and applications should be received by January 15, 2000.

Nominations, and applications including curriculum vitae, should be made, in confidence to:

John Gardner, Chair of the Board of Directors  
The Fields Institute  
222 College Street, 2<sup>nd</sup> Floor  
Toronto, Ontario M5T 3J1 (fax: 416-348-9714)  
Website: [www.fields.utoronto.ca](http://www.fields.utoronto.ca)

For further information, please contact the Directorate Office of the Fields Institute at the above address.



**University of Alberta  
Edmonton**

## Classic Analysis (CA 2000)

### Department of Mathematics

The Department of Mathematics, University of Alberta invites applications for one tenure track position at the Assistant/Associate Level in classical analysis. We are looking for a person with a PhD, a strong record/outstanding potential for research, excellent communication and teaching skills, and leadership potential.

The successful candidate must have a commitment to undergraduate and graduate education. Preference will be given to an individual whose research interests promote contact with other university researchers and/or industry. Current research strengths in the Department include approximation theory, Fourier and harmonic analysis, wavelet analysis, and real function theory.

In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. If suitable Canadian citizens and permanent residents cannot be found, other individuals will be considered. Applications should include a curriculum vitae, a research plan, and a teaching dossier.

Candidates should arrange for at least three confidential letters of reference to be sent to:

**A.H. Rhemtulla, Chair  
Department of Mathematical Sciences  
University of Alberta  
Edmonton, Alberta, Canada T6G 2G1**

The closing date for applications is Friday, January 7, 2000. Early applications are encouraged. For more information about the Department and our University, please visit our web site at [www.math.ualberta.ca](http://www.math.ualberta.ca)

*The University of Alberta is committed to the principle of equity in employment. As an employer, we welcome diversity in the workplace and encourage applications from all qualified women and men, including Aboriginal peoples, persons with disabilities, and members of visible minorities.*

...it makes sense.

UNIVERSITY OF ALBERTA



**University of Alberta  
Edmonton**

## Mathematical Sciences Positions

### Department of Mathematical Sciences

We are anticipating a minimum of ten tenure-track positions over the next four years. At present we have four openings, at the Assistant/Associate Professor level, which are described below. These positions require a PhD. We are looking for applicants with strong record/outstanding potential for research, excellent communication and teaching skills and leadership potential. The successful candidates must have a commitment to undergraduate and graduate education. Preference will be given to individuals whose research interests promote contact with other university researchers and/or industry.

**Actuarial Science (AS 2000):** The position requires a PhD in a mathematical discipline and an Associateship of the Society of Actuaries or equivalent.

**Statistics (S 2000):** The position requires a PhD in statistics. Current research strengths in the Department include design of experiments, multivariate analysis, biostatistics and spatial statistics.

**Differential Equations (DE 2000) – Deterministic or Stochastic:** Current research strengths in the Department include stochastic differential equations, partial differential equations, dynamical systems and applications in areas of finance, signal processing, scientific computation and mathematical biology.

**Classical Analysis (CA 2000):** Current interests in the Department include approximation theory, Fourier or harmonic analysis, wavelet analysis, and real function theory.

In accordance with Canadian Immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. If suitable Canadian citizens and permanent residents cannot be found, other individuals will be considered.

Applications should include a curriculum vitae, a research plan, and teaching dossier. Candidates should arrange for at least three confidential letters reference to be sent to: A.H. Rhemtulla, Chair, Department of Mathematical Sciences, University of Alberta, Edmonton, Alberta, T6G 2G1, Canada.

The closing date for applications in Classical Analysis and Differential Equations is Friday, January 7, 2000. The closing date for applications in Actuarial Science and Statistics is Friday, January 28, 2000. Early applications are encouraged.

For more information about the Department and our University, please visit our web site at [www.math.ualberta.ca](http://www.math.ualberta.ca)

*The University of Alberta is committed to the principle of equity in employment. As an employer, we welcome diversity in the workplace and encourage applications from all qualified women and men, including Aboriginal peoples, persons with disabilities, and members of visible minorities.*

...it makes sense.

UNIVERSITY OF ALBERTA

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**UNIVERSITY OF WATERLOO – WATERLOO, ONTARIO  
DEPARTMENT OF PURE MATHEMATICS**

The Department of Pure Mathematics at the University of Waterloo expects one or more tenure-track positions starting July 1, 2000. For one position, the Department is particularly interested in candidates whose research interests are related to Algebra or Number Theory, including their computational aspects. However candidates in any area of Pure Mathematics will be considered.

In order to be considered for a position, a Ph.D. is required. Postdoctoral experience is preferred. An appointment will be offered only to someone with very strong research and teaching qualifications. The closing date for receipt of applications is **January 14, 2000**. Applicants should submit their curriculum vitae, together with the names of at least three referees, and should arrange for letters of reference to be sent directly from the referees.

In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents. The University of Waterloo encourages applications from all qualified individuals, including women, members of visible minorities, native peoples, and persons with disabilities.

This appointment is subject to the availability of funds. Please send applications to:

**Dr. B. Forrest, Chair,  
Department of Pure Mathematics,  
University of Waterloo,  
Waterloo, Ontario, Canada N2L 3G1  
The department's Web page is at:  
[http://math.uwaterloo.ca/PM\\_Dept/homepage.html/](http://math.uwaterloo.ca/PM_Dept/homepage.html/)**

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

Applications are being invited for one or more tenure-track faculty positions at the rank of Assistant Professor. Applications will be considered from persons in any of the Department's main research areas: algebraic combinatorics, combinatorial optimization, continuous optimization, cryptography, and graph theory. A Ph.D. and proven ability, or the potential, for excellent research and 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 appointments: July 1, 2000. These appointments are subject to the availability of funds. 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, up to four selected reprints/preprints and the names, addresses, and email addresses 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  
email: [combopt@math.uwaterloo.ca](mailto:combopt@math.uwaterloo.ca)  
phone: (519) 888-4567 ext. 2411  
fax: (519) 725-5441  
[http://math.uwaterloo.ca/CandO\\_Dept/homepage.html](http://math.uwaterloo.ca/CandO_Dept/homepage.html)**

Closing date for receipt of applications is **January 31, 2000**.

**UNIVERSITY OF TORONTO – TORONTO, ONTARIO**  
**DEPARTMENT OF MATHEMATICS**  
**Tenure-Stream Appointment in Analysis or Applied Mathematics**

The University of Toronto solicits applications for a tenure-stream appointment in Analysis or Applied Mathematics.

The appointment is at the University of Toronto at Mississauga, Erindale College at the level of Assistant Professor, to begin July 1, 2000. Candidates are expected to have at least three years experience in teaching and research after the Ph.D. and to be able to demonstrate excellence in each. In particular, a candidate's research should show clearly the ability to make significant original and independent contributions to Mathematics. Salary commensurate with qualifications and experience.

Applicants should send their complete C.V. including a list of publications, a short statement describing their research programme, and all appropriate material about their teaching.

They should also arrange to have at least four letters of reference sent directly to:

**Professor R.-O. Buchweitz,**  
**Associate Chair,**  
**Department of Mathematics,**  
**University of Toronto,**  
**Toronto, Canada M5S 3G3**

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

In addition, it is recommended that applicants submit the electronic application form at <http://www.math.toronto.edu/jobs>.

To ensure full consideration, this information should be received by **January 31, 2000**.

In accordance with Canadian immigration requirements, this advertisement is directed to Canadian citizens and permanent residents of Canada. In accordance with its Employment Equity Policy, the University of Toronto encourages applications from qualified women or men, members of visible minorities, aboriginal peoples and persons.

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**UNIVERSITY OF TORONTO – TORONTO, ONTARIO**  
**DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING**  
**Joint Tenure-Stream Appointment in Mathematics, and Electrical and Computer Engineering**

The Department of Electrical and Computer Engineering and the Department of Mathematics at the University of Toronto invite applications for a joint tenure-stream Assistant Professor position to build on the collaboration between the two departments in research and teaching.

The successful candidate will have a demonstrated ability as a researcher in mathematics and in the application of mathematics in electrical and computer engineering. Areas of interest include but are not limited to applied probability, stochastic differential equations and computational partial differential equations, and their application in communications, image and signal processing, network modelling or real-time systems.

The position involves teaching and research in Electrical Engineering, Computer Engineering, and Mathematics. Candidates must have a doctoral degree, an outstanding academic record and an effective teaching ability.

Additional information can be found on the Web pages at: <http://www.ece.toronto.edu> and <http://www.math.toronto.edu>

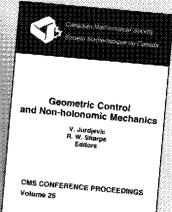
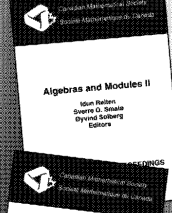
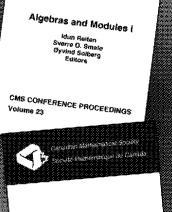
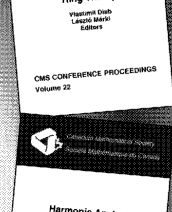
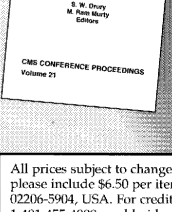
Applicants should send a curriculum vitae, including a statement about teaching and research interests. They should also arrange for at least three reference letters about their research and teaching abilities to be sent to:

**Professor Safwat G. Zaky, Chair**  
**Department of Electrical and Computer Engineering**  
**University of Toronto**  
**10 King's College Road, Room 1024**  
**Toronto, Ontario M5S 3G4, Canada**

To ensure consideration, please send the application material by **January 31 2000**.

In accordance with Canadian Immigration requirements, priority will be given to Canadian citizens and permanent residents. The University of Toronto is committed to employment equity and encourages applications from women, visible minorities, and physically challenged persons.

**AMERICAN MATHEMATICAL SOCIETY**

## Conference Proceedings, Canadian Mathematical Society

This series is published for the Canadian Mathematical Society by the AMS. It consists of the proceedings of internationally attended conferences on pure and applied mathematics sponsored by the CMS. **CMS members may order at the AMS member prices.** (ISSN 0731-1036) Softcover.

### Geometric Control and Non-holonomic Mechanics

**V. Jurdjevic and R. W. Sharpe**, *University of Toronto, ON, Canada*, Editors

Control theory, a synthesis of geometric theory of differential equations enriched with variational principles and the associated symplectic geometry, emerges as a new mathematical subject of interest to engineers, mathematicians, and physicists. This collection focuses on several distinctive research directions having origins in mechanics and differential geometry, but driven by modern control theory.

The first of these directions deals with the singularities of small balls for problems of sub-Riemannian geometry and provides a generic classification of singularities for two-dimensional distributions of contact type in a three-dimensional ambient space.

The second direction deals with invariant optimal problems on Lie groups exemplified through the problem of Dublins extended to symmetric spaces, the elastic problem of Kirchhoff and its relation to the heavy top. The results described in the book are explicit and demonstrate convincingly the power of geometric formalism.

The remaining directions deal with the geometric nature of feedback analyzed through the language of fiber bundles, and the connections of geometric control to non-holonomic problems in mechanics, as exemplified through the motions of a sphere on surfaces of revolution.

This book provides quick access to new research directions and also demonstrates the effectiveness of new insights and methods that control theory brings to mechanics and geometry.

**Conference Proceedings, Canadian Mathematical Society.**  
Volume 25; 1998; 239 pages; Softcover; ISBN 0-8218-0795-1; List \$49;  
Individual member \$29; Order code CMSAMS/25CMS99

### Algebras and Modules I

**Idun Reiten, Sverre O. Smalø, and Øyvind Solberg**, *Norwegian University of Science and Technology, Trondheim*, Editors

This volume contains recent results on geometric aspects of representations of algebras, a thorough treatment of the theory of quasitilted algebras, new developments on infinite dimensional representations of finite dimensional algebras, a bridge between representation of algebraic groups and representation theory of finite dimensional algebras, and recent discoveries on modular representation theory. In addition, the volume contains two papers devoted to some of Maurice Auslander's many contributions both in the representation theory of finite dimensional algebras and in commutative ring theory.

A general background in noncommutative algebra including rings, modules and homological algebra is required. Given that, parts of this volume would be suitable as a textbook for an advanced graduate course in algebra.

**Volume 23; 1998; 198 pages; Softcover; ISBN 0-8218-0850-8; List \$39;  
Individual member \$23; Order code CMSAMS/23CMS99**

### Algebras and Modules II

**Idun Reiten, Sverre O. Smalø, and Øyvind Solberg**, *Norwegian University of Science and Technology, Trondheim*, Editors

This volume contains 43 research papers based on results presented at the Eighth International Conference on Representations of Algebras (ICRA VIII) held in Geiranger, Norway. The papers, written by experts in the field, cover the most recent developments in the representation theory of artin algebras and related topics.

**Features:**

- a unique source for the developments in the representation theory of finite dimensional and artin algebras and related topics
- a wide variety of important papers by leading researchers in the field, with references to earlier developments in the field

**Volume 24; 1998; 569 pages; Softcover; ISBN 0-8218-1076-6; List \$99;  
Individual member \$59; Order code CMSAMS/24CMS99**

### Trends in Ring Theory

**Vlastimil Dlab**, *Carleton University, Ottawa, ON*, and **László Márki**, *Hungarian Academy of Sciences, Budapest*, Editors

The Ring Theory Conference (University of Miskolc, Hungary) successfully accomplished its two goals: 1) to reflect contemporary trends in the subject area and 2) to offer a meeting place for a large number of Eastern European algebraists and their colleagues from around the world. Particular emphasis was placed on recent developments in the following four areas: representation theory, group algebras, PI algebras, and general ring theory. This book presents 13 of the invited lectures.

**Volume 22; 1998; 239 pages; Softcover; ISBN 0-8218-0849-4; List \$49;  
Individual member \$29; Order code CMSAMS/22CMS99**


### Harmonic Analysis and Number Theory

**Papers in Honour of Carl S. Herz**

**S. W. Drury**, *McGill University, Montreal, PQ*, and **M. Ram Murty**, *Queen's University, Kingston, ON*, Editors

This volume presents the proceedings of a conference held at McGill University (Montreal). The papers are dedicated to the memory of Carl Herz, who had deep interests in both harmonic analysis and number theory. These two disciplines have a symbiotic relationship that is reflected in the papers in this book.

**Volume 21; 1997; 227 pages; Softcover; ISBN 0-8218-0794-3; List \$49;  
Individual member \$29; Order code CMSAMS/21CMS99**



**AMS**  
AMERICAN MATHEMATICAL SOCIETY

All prices subject to change. Charges for delivery are \$3.00 per order. For optional air delivery outside of the continental U. S., please include \$6.50 per item. *Prepayment required.* Order from: **American Mathematical Society**, P. O. Box 5904, Boston, MA 02206-5904, USA. For credit card orders, fax 1-401-455-4046 or call toll free 1-800-321-4AMS (4267) in the U. S. and Canada, 1-401-455-4000 worldwide. Or place your order through the AMS bookstore at [www.ams.org/bookstore/](http://www.ams.org/bookstore/). Residents of Canada, please include 7% GST.

## NEWS FROM DEPARTMENTS

### Brock University, St. Catharines, ON

Appointments: Stephen Anco (Assistant Professor, mathematical physics), Hichem Ben-El-Machiekh (Chair, July 1999).

Retirement: Kris Srivastava (June 1999).

### Concordia University, Montreal, PQ

Appointment: D. Korotkin (Assistant Professor, January 2000, mathematical physics).

Promotions: H. Proppe (Professor, June 1999), T. N. Srivas-

tava (Professor, June 1999).

Visitors: OktaÀ (Turkey, mathematics education, September 1999 - August 2000), P. Olivares (Cuba, statistics, January - April 2000), R. Tiwari (India, statistics, September - December 1999).

### University of Saskatchewan, Saskatoon, SK

Appointments: Franz-Viktor Kuhlmann (Associate Professor, July 1999), Murray Marshall (Acting Head, 1999-00).

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## THE UNIVERSITY OF WESTERN ONTARIO – LONDON, ONTARIO DEPARTMENT OF MATHEMATICS

Applications are invited for a tenure track position at the Assistant or Associate Professor level.

The successful candidate will have an outstanding record of research and publication in a field related to one of the existing areas of research strength of the Department in algebra, analysis and topology, and will be expected to maintain an ongoing vigorous research program. The candidate will also have a commitment to and demonstrated aptitude for teaching, and will be expected to teach at the undergraduate and graduate levels and to supervise graduate theses.

Those interested in applying for this position should forward a curriculum vitae and have at least three letters of reference sent to:

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

At least one letter of reference should include a detailed comment on the teaching abilities of the applicant. We also welcome e-mail inquiries and submissions, to be sent to the address: [math-pos@julian.uwo.ca](mailto:math-pos@julian.uwo.ca). Our web address is <http://www.math.uwo.ca>.

Application materials should arrive no later than **January 15, 2000**. The appointment is scheduled to begin on July 1, 2000.

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

## CALENDAR OF EVENTS / CALENDRIER DES ÉVÉNEMENTS

### JANUARY 2000

**7–15** NZMRI Mathematics Workshop (Kaikoura, New Zealand)

*Rod Downey: [rod.downey@vuw.ac.nz](mailto:rod.downey@vuw.ac.nz)*

**14–16** Workshop on Operator Theory (University of New Brunswick – Fredericton)

*Dan Kucеровsky: [dan@math.unb.ca](mailto:dan@math.unb.ca)*

**19–22** Joint Mathematics Meetings, including the 106th Annual Meeting of the AMS (Washington DC), a WMY2000 event [www.ams.org/meetings/](http://www.ams.org/meetings/)

### MARCH 2000

**6–10** Fourth International Conference on Operations Research (Havana, Cuba) *[lorch@mathstat.yorku.ca](mailto:lorch@mathstat.yorku.ca)*

### MAY 2000

**5–7** Unified Congress of Mathematical Associations and Groups of Quebec (Université Laval), a WMY2000 event *[pallascio.richard@uqam.ca](mailto:pallascio.richard@uqam.ca)*

### JUNE 2000

Canadian Mathematics Education Study Group Meeting (UQAM, Montreal) *Dates to be announced*

**4–7** Annual Meeting of the Statistical Society of Canada (Ottawa, Ontario) *André Dabrowski: [adrsg@uottawa.ca](mailto:adrsg@uottawa.ca)*

### JANVIER 2000

**4–8** Canadian Annual Operator Algebra Symposium (Fields Institute, Toronto, Ontario) *[elliott@math.utoronto.ca](mailto:elliott@math.utoronto.ca); [choi@math.utoronto.ca](mailto:choi@math.utoronto.ca)*

**8–9** Symposium on the Legacy of John Charles Fields (The Royal Ontario Museum, Toronto); a WMY2000 event [www.fields.utoronto.ca](http://www.fields.utoronto.ca)

**10–13 MATH 2000 (McMaster University, Hamilton, Ontario)**

Participating Societies include the Canadian Mathematical Society (CMS), the Canadian Applied and Industrial Mathematics Society (CAIMS), the Canadian Operational Research Society (CORS), the Canadian Symposium on Fluid Dynamics (CSFD), the Canadian Society for the History and Philosophy of Mathematics (CSHPM) and the Canadian Undergraduates Mathematics Conference (CUMC). A WMY2000 event

*Monique Bouchard: [meetings@cms.math.ca](mailto:meetings@cms.math.ca)  
[www.camel.math.ca/CMS/Events/math2000](http://www.camel.math.ca/CMS/Events/math2000)*

**12–15** Integral Methods in Science and Engineering (Banff, Alberta) *[Peter.Schiavone@ualberta.ca](mailto:Peter.Schiavone@ualberta.ca)*

### JULY 2000

**10–14** Third European Congress of Mathematics (Barcelona) *[3ecm@iec.es](mailto:3ecm@iec.es); <http://www.iec.es/3ecm/info.htm>*

**11–25** 41st International Mathematical Olympiad (Korea)

### JUILLET 2000

**31–Aug 7** International Congress on the Teaching of Mathematics (ICME-9)(Tokyo/Makuhara)

<http://www.ma.kagu.sut.ac.jp/icme9/>

**AUGUST 2000**

**AOÛT 2000**

**7–12** AMS Meeting (Los Angeles); a WMY2000 event

[www.ams.org/meetings/](http://www.ams.org/meetings/)

**SEPTEMBER 2000**

**SEPTEMBRE 2000**

**22–24** American Mathematical Society Central Section Meetings (University of Toronto)

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

**DECEMBER 2000**

**DÉCEMBRE 2000**

**10–12** CMS Winter Meeting / Réunion d'hiver de la SMC (University of British Columbia, Vancouver, B. C.)

Monique Bouchard: [meetings@cms.math.ca](mailto:meetings@cms.math.ca)

**JUNE 2001**

**JUIN 2001**

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

Monique Bouchard: [meetings@cms.math.ca](mailto:meetings@cms.math.ca)

Canadian Mathematics Education Study Group Meeting (University of Alberta, Edmonton)

Annual Meeting of the Statistical Society of Canada (Vancouver, British Columbia)

**DECEMBER 2001**

**DECEMBRE 2001**

**CMS Winter Meeting / Réunion d'hiver de la SMC** (York University, Toronto, Ontario)

Monique Bouchard: [meetings@cms.math.ca](mailto:meetings@cms.math.ca)

**JUNE 2002**

**JUIN 2002**

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Monique Bouchard: [meetings@cms.math.ca](mailto:meetings@cms.math.ca)

**AUGUST 2002**

**AOÛT 2002**

**20–28** International Congress of Mathematicians, (Beijing, China)

[cms@math08.math.ac.cn](mailto:cms@math08.math.ac.cn); <http://icm2002.org.cn/>

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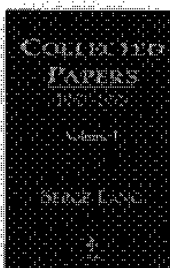
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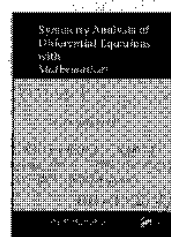
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