

Newsletter

Groupe d'études et de recherche
 en analyse de décisions

GERAD

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25 Years of Discoveries

Can the degree of success of a research centre be characterized by a single measurement? That is the task Georges Zaccour assigned himself for this special issue marking GERAD's 25th anniversary.

Please see **25 Years of Discoveries** on page 2...



GERAD Directors since the centre was founded. Standing left to right, Pierre Hansen (1996-2001), Richard Loulou (1989-92), Alain Haurie (1980-88), François Soumis (1992-96), and in front Georges Zaccour (2001-05).

bulletin@gerad.ca

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In this issue... we celebrate **GERAD's 25th anniversary**...

The first option was simply to do as empires did: measure the surface area controlled. When GERAD was founded it occupied a “four and a half room apartment” on Decelles, now it occupies “four tens and a half” of offices. In itself, that is an eloquent sign of success, but it does not stand up to a second examination for it fails to consider either the high latent demand for office space or the exogenous constraints.

A more conventional option would be to consider indicators such as publications, the number of graduates, grants obtained and more. As I tend to be parsimonious and know that these indicators are very much correlated, I will limit analysis to a single indicator, namely the publications in the series *Les Cahiers du GERAD* (GERAD discussion papers). The series includes 1210 papers, which makes for a lot of theorems, algorithms, and resolved abstract, conceptual, realistic and real problems. This mass of learning suffices to conclude that the group has performed well over the years and has amply earned the slogan *25 years of discoveries* (see article on page 9).


To mark the 25th anniversary, we have planned two flagship events. The first is an international colloquium (May 12-13, 2005) during which plenary speakers will be the four previous GERAD directors, Alain Haurie, Richard Loulou, François Soumis, and Pierre Hansen. The colloquium will also be an opportunity to pay tribute to GERAD's founders. The second project is mind-boggling in scope and consists in publishing 10 volumes by Springer representing our research themes (see box). Some will be GERAD classics, such as energy (see article on page 5). Others will be recent innovations like financial engineering (see article on page 7). This project mobilized 24 editors, who are GERAD members, and resulted in 3218 pages in 116 chapters, written by 250 authors from throughout the world. These publications will be launched on May 11.

List of **commemorative volumes** for GERAD's 25th Anniversary

- *Essays and Surveys in Global Optimization*
C. Audet, P. Hansen, G. Savard
- *Graph Theory and Combinatorial Optimization*
D. Avis, A. Hertz, O. Marcotte
- *Numerical Methods in Finance*
H. Ben-Ameur, M. Breton
- *Analysis, Control and Optimization of Complex Dynamic Systems*
E.K. Boukas, R. Malhamé
- *Column Generation*
G. Desaulniers, J. Desrosiers, M.M. Solomon
- *Statistical Modeling and Analysis for Complex Data Problems*
P. Duchesne, B. Rémillard
- *Performance Evaluation and Planning Methods for the Next Generation Internet*
A. Girard, B. Sansò, F. Vázquez-Abad
- *Dynamic Games: Theory and Applications*
A. Haurie, G. Zaccour
- *Logistics Systems: Design and Optimization*
A. Langevin, D. Riopel
- *Energy and Environment*
R. Loulou, J.-P. Waaub, G. Zaccour

In conclusion, I would like to take the opportunity provided by our celebration to thank all the members of our administrative and technical staff, some of whom, such as Anita Beauchamp, have been with

us for a long time. Thanks to them, we all enjoy a very pleasant work environment.

Long life to GERAD!
Georges Zaccour 

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GERAD founder Alain Haurie gives group a **Collective Accolade**

“It was a very exciting time in my life. The group began when several colleagues decided to work together. Early in the 1980s, we had a dynamic and enthusiastic group of researchers who were also wise enough to join forces and show confidence in each other without fearing that others might take their ideas.”

That is how Alain Haurie, founder of GERAD, describes the spirit behind the group of research professors at HEC Montréal, École Polytechnique, Université de Montréal and McGill who founded the Groupe d'études et de recherche en analyse de décisions (GERAD). Twenty-five years later, he recalls some of the milestones in GERAD's history, and hazards some opinions on the group's future.

Though Alain Haurie left for a Professorship at the University of Geneva in 1988, he never really left the research group that he founded in 1980, then headed until 1988, and to which he still belongs. He sees GERAD as a unique research centre. “There are other important groups, especially in the United States and Europe, but they aren't like GERAD,” says Alain Haurie. “Rarely is the general attitude at other places positive. Often it is bogged down by resistance, caution, and obstacles. People are more suspicious. In Montreal, we had a very keen environment and institutions that were open to new ideas, especially in Quebec.”

In the 1970s, Alain Haurie was a Professor and Head of the Quantitative Methods Department at HEC Montréal, but he also taught at École Polytechnique. At that time he was clearly aware that there were common decision analysis problems and a community of scientific interest in the areas of business management and engineering. The former normally concerned HEC while the latter con-

cerned Polytechnique. This prompted him to propose to his colleagues at HEC and Polytechnique to join forces and put their ideas and research projects together. This collaborative effort resulted, for instance, in the organization of the first Optimization Days, which still take place. Alain Haurie's colleagues at the time included Jacques Gauvin from Polytechnique, Michel Delfour from the Université de Montréal, Gilbert Laporte from HEC and Richard Loulou and Jean-Louis Goffin, professors at the McGill Faculty of Management.

“We simply said to ourselves, why don't we establish a research structure? Basically,

“There are other important groups, especially in the United States and Europe, but they aren't like GERAD, says Alain Haurie. Rarely is the general attitude at other places positive. Often it is bogged down by resistance, caution, and obstacles. People are more suspicious. In Montreal, we had a very keen environment and institutions that were open to new ideas, especially in Quebec.”

GERAD formalized our desire to work together as well as the cooperative initiatives that had already been developing for several years. At first, we had a very light structure. The Administrative Director of HEC provided us with our first offices located on the main floor of a building at the corner of Decelles and Côte-des-Neiges. I moved my office there and we hired a secretary, Anita Beauchamp, who is still with GERAD.” Soon thereafter, GERAD moved to a building at the corner of Côte-des-Neiges and Lacombe. Other professors and teams joined, such as François Soumis and Jacques Desrosiers, along with professional researchers.

Getting professors to work together and establishing a light infrastructure is a fine idea, but that alone does not create an international calibre research centre.



Alain Haurie agrees on this point. “What really transformed our research group was the infrastructure-building research funding program established by the Quebec Government. The five-year program from the FCAR funding body was very successful for GERAD. The grant followed on a request made by Richard Loulou, François Soumis, and me, with the collaboration of Édouard Wagneur, a researcher at HEC Montréal.”

Richard Loulou also insists on the crucial role the infrastructure grant played in the early development of GERAD, but adds that Alain Haurie's role cannot be underestimated. “With the infrastructure grant, we were able to hire research professionals, which was rare in those days. That put us in a position to start up some very significant research work, that and Alain Haurie's drive!”

... Alain Haurie from page 3.



“It is very pleasing for me to see that the first students associated with GERAD, people like Georges Zaccour, Gilles Savard, Pierre L’Écuyer, and Michèle Breton, are now leaders in their fields and the driving forces in GERAD. Their success is outstanding.”

GERAD is distinctive because it is a multi-university centre. It formally took on this status in 1987. Alain Haurie recalls that “delicate” operation of conciliating different institutional interests and habits and salutes in turn the efforts of his colleague Richard Loulou. “He quickly proposed the idea of participating in GERAD to the McGill Board of Governors and successfully saw that it was adopted, even though HEC Montréal and École Polytechnique were hesitating. Once McGill agreed, the others soon stopped hesitating.”

Richard Loulou also remembers that stage. “It was difficult in the beginning, especially at McGill. GERAD was located on the other side of Mount Royal and the work was conducted mostly in French. Habits are hard to change. But at the end of the year, when GERAD publishes its annual report with all the successful sci-

entific work and visibility, everybody is satisfied.”

GERAD’s success and staying power over the past 25 years do not surprise the man who founded it. For Alain Haurie, the quality of researchers has always been outstanding, the group was built on good foundations, it rapidly acquired powerful computational equipment, and there was always a deep desire to work together. He adds that GERAD’s institutional sponsors have contributed by recruiting high-quality research professors and by strengthening their operations research teams. One example of this foresight was the recruitment of Pierre Hansen by HEC Montréal. Professor Hansen headed GERAD from 1996 to 2001.

“GERAD’s success corresponds very much to what I hoped and expected to happen. It is the largest concentration of research-

ers in operations research in Canada. When I was a member of the NSERC Selection Committee, I learned what GERAD’s name and reputation meant.”

Many of Alain Haurie’s students have become professors or researchers. “It is very pleasing for me to see that the first students associated with GERAD, people like Georges Zaccour, Gilles Savard, Pierre L’Écuyer, and Michèle Breton, are now leaders in their fields and the driving forces in GERAD. Their success is outstanding.”

A quarter century after founding GERAD, Alain Haurie is convinced the group will be called on to continue for another 25 years. “The quality of the upcoming generation will determine future success. Decision-making has always been a complicated matter and the need for researchers in this field will become increasingly critical in the future. The amount of data and money to take into account is growing steadily, as is the number of variables at play. Take Kyoto, for example. The problems are extremely complex, decisions can greatly impact the economy, the financial world, and the environment. What’s more, the complexity of risk management is mind-boggling. GERAD researchers will continue to make a contribution to the science of decision-making.”

Alain Haurie remains a firm believer in team work. People can brainstorm freely, share equipment, hire topnotch professional researchers, and attain a critical mass that industry and public funding agencies must take into account. His experience with GERAD has shown that everybody stands to benefit.

As founder of GERAD, Alain Haurie does not hesitate to grant the organization a Collective Accolade. 

Energy and environment at GERAD or the art of being in the right place at the right time

It would be a mistake to celebrate GERAD's 25th anniversary without saluting the group's historic energy/environment team that is also about to mark its 25th year? The man who has led the group from the beginning, and who was with Alain Haurie when GERAD was founded, is **Richard Loulou**, Professor Emeritus at the McGill University Faculty of Management.

"Alain Haurie and I were somewhat opportunists when we created the energy/environment team in 1980 or 81," recalls Richard Loulou with a smile. "Following the second oil crisis in 1979, that really upset governments, we began taking an interest in energy. It was just the right time to do research on energy and feed policy decision-making in that area."

As a rule, researchers start from a scientific interest or theory and then develop a model. The energy and environment team, however, took the existing model MARKAL, which partly belonged to Canada through the International Energy Agency, and revamped it thoroughly. The model was free because Canada was one of the countries that had funded its development through the Energy Technology Systems Analysis Program (ETSAP), under the auspices of the International Energy Agency. At that time however, the Canadian version of the model was in an abysmal state, recalls Professor Loulou.

MARKAL is now a world reference. It has been improved more than 20 times, and GERAD researchers have been responsible for a large portion of the improvements. More than 50 countries use it now, some officially, such as Indonesia, the United States, and many countries in Europe, while others in a semi-official manner. Its broad diffusion was facilitated because ETSAP released the model

freely to the public domain.

"The model deals with the long term, 20, 30, even 50 years," notes Richard Loulou. "The starting point is not demand for electricity or other forms of energy, but rather demand for services, economic demand, the trends in housing construction, industrial development, transportation, in short, everything that drives economic growth. With all this fully integrated information, the model determines what the energy system must do so as to meet economic growth intelligently, by minimizing total cost for society over 50 years, for example. It takes the standpoint of the whole society and is not limited only to that of energy producers or of consumers. Operations research methods drive the model."

MARKAL was very poorly applied to Canada in the beginning, mainly because it ignored regional differences. The model therefore had to be regionalized. Moreover, it is also a glutton for data, and requires an enormous effort to gather data that are specific to provinces or regions. "Through grants obtained, we were able to gather the data and build very serious models, first for Quebec and then for all the other provinces and territories."

The GERAD team's success story could have ended as quickly as the oil crisis in the mid 1980s were it not for energy's twin sister, the environment. The team's studies first helped in the fight against acid rain. After that, people in scientific circles like GERAD began to study the issue of greenhouse gases, recalls Richard Loulou. But the problem remained limited to academic circles until the Summit in Rio in 1992. Interest in the issue then started growing, especially in Europe.

The recent history of the Kyoto protocol illustrates how relevant it is to have a centre that is devoted to studying and



analysing decisions with a comprehensive approach to issues such as energy. Richard Loulou remembers how Kyoto hit Canada like a sledge hammer, but how GERAD was in an excellent position to help. "Our Environment Minister went to Kyoto in 1997 not thinking for a moment that Vice President Gore of the United States would sign the protocol. Canada felt obliged to sign on too, yet not a single study had been conducted! Signing of the agreement therefore prompted a mini-revolution in the Canadian Government. A massive study program was initiated and our researchers were entrusted with a considerable portion of those studies."

Canada maintained the pace in studies until 2002. This led Richard Loulou to interrupt his university teaching career, but not his research nor his work with GERAD, and to devote his time to research and consultation with the energy and environmental modeling company HALOA, established in 1987. Canada then stopped commissioning studies in 2002 and adopted a political approach to greenhouse gas emissions reduction. This story, of course, is still being written.

... Richard Loulou from page 5.

Though Canada has been wavering on this issue, GERAD researchers, who continue to be the MARKAL model enhancers and the experts on the mathematic and economic aspects, have not been slowed down. The United States Department of Energy has adopted the MARKAL approach to develop a world model (SAGE) so as to produce an annual 20-year forecast known as the International Energy Outlook. “This is a whole new level that has launched us into new areas of research. ETSAP also decided to build its own world model, focusing more on the study of energy and climate policy than on forecasting. We have contributed to both projects. More recently, the 25 European Union countries decided to build a European model.”

Unlike the GENCOL team whose research resulted in the foundation of the spin-off company AD OPT and commercialization of software for large aeronautical companies, GERAD energy and environment researchers perfect a model that does not belong to anybody and they work mainly for public agencies, governments or international bodies. “Our colleagues François Soumis and Jacques Desrosiers took another route and founded a parallel company,” notes Richard Loulou. “However, we haven’t commercialized the MARKAL model, for which there is no copyright, patent, or royalties. But the universities and GERAD have still benefited tremendously from it, both financially and scientifically.”

Richard Loulou, like his friend and colleague Alan Haurie, is an unbending fan of team work. The energy/environment team includes Jean-Philippe Waaub, Professor of Geography at UQAM and a former student of Richard Loulou’s. Professor Waaub is mainly interested in the environment, in impact studies, and in the Multicriterion Decision Analysis method (MCDA). Amit Kanudia, Senior Research Associate at McGill University, is “our IT genius,” says Richard Loulou. “Amit’s contribution is enormous. Without him, we would have a very hard




After 25 years with GERAD, including four years as director (1989-1992), Richard Loulou is particularly happy that the group has never become a “kind of impersonal machine”.

time implementing everything we want to with the MARKAL model.” The other very active researchers are Kathleen Vaillancourt and Maryse Labriet, both postdoctoral students at GERAD.

After 25 years with GERAD, including four years as director (1989-1992), Richard Loulou is particularly happy that the group has never become a “kind of impersonal machine. From the beginning, the spirit has been to put self-interest aside and to work in cooperation, as a team. That is essential. Every one of us was glad to be here, and that is still the case. It’s remarkable! I’ve seen other centres where everything is measured and quantified. At GERAD, we are guided by enthusiasm, not by calculated gain. Young people enjoy it here because the “older ones” don’t try to dominate them. GERAD has become a worldwide reference in operations research. That is what makes this centre so attractive.”

Richard Loulou predicts a promising future for GERAD. One reason is the way it

operates. “GERAD is a multi-university centre, but it has always insisted on being headed by its members. The Director is chosen by its members, even though the official appointment comes from above. It is not kept alive by its participating universities; inspiration and grants come from below, from GERAD’s researchers and its teams. Moreover, there is a real and pressing need for operations research in our society, be it fundamental or applied.”

Professor Loulou concludes with a note of praise for the current Director of GERAD, Georges Zaccour, a former student at the centre. “Georges Zaccour is the first representative of the second generation to head GERAD. He managed to obtain Quebec’s recognition as an international calibre centre and quadruple our funding. He has also inspired new areas of research and attracted new highly qualified members.” 

Michèle Breton wants to solve problems, be they financial or not

Not everybody can talk about operations research and financial engineering in the same breath. Even fewer are specialized in both fields. Michèle Breton, a GERAD member and Professor in the HEC Montreal Department of Management Sciences, and other GERAD researchers in mathematical finance are in this select group. Their secret is to be eclectic in research and to drive to find applications.



“We called what we’re doing *Financial Engineering* almost for marketing purposes, but we are really involved in mathematical finance,” specifies Michèle Breton, who along with a colleague in finance founded HEC Montréal’s Masters’ program in Financial Engineering. “Financial engineers develop financial products to meet specific needs, but to do so they need tools such as methods for solving partial derivative equations, dynamic programming, stochastic optimization, or time series estimation.” In other words, GERAD researchers in mathematical finance are to financial engineers what precision tool designers are to master craftsmen.

Necessity is said to be the mother of invention. In fact, necessity best explains why the terms *operations research* and *financial engineering* were coined. These twentieth century words simply helped define the evolution of decision-making methods as well as the resultant action and products. The demands of war were responsible for the initial launch of the former term *operations research*. The latter, *financial engineering*, borrowed from the Japanese term *zaiteku* or *zaitech*, represented new approaches to solving increasingly complex financial problems. Though both qualify as new twentieth cen-

tury words, their career in the twenty-first century is booming. And though both describe apparently abstract fields of work, they have the common mission of solving concrete problems.

Michèle Breton embodies the drive to find applications, be it as a researcher, as a professor or as an administrator – in addition to being a GERAD member, she heads the Centre for Research on e-finance (CReF). “I enjoy applied research. What interests me is finding all the possible applications of mathematics. I work in environment, energy, finance, game theory, marketing, economics, and more. Modeling is also stimulating, but not to the stage of developing marketable tools. That part takes a lot of time and should be done by professionals.”

She attributes her drive to find applications to her undergraduate and graduate training as an engineer at École Polytechnique de Montréal. It pleases her when private companies support research projects and thereby enable her students to work on specific projects. Students often make interesting discoveries when they are conducting research within the framework established to meet the company’s goals.

Michèle Breton has been with HEC Montréal since 1977, first as a lecturer then as a professor. She explains that she became interested in finance when the financial engineering program was created so as to “find ways to apply operations research methods to portfolio management and risk management. Once a financial product is developed, it still has to be priced to determine its value. For very liquid products, the law of the market will establish an equilibrium price. However, we are often asked to evaluate new products or exotic derivatives that are traded through negotiation and mutual agreement.”

By definition, GERAD researchers analyze decision-making. It is not surprising therefore that they are very concerned by the issues of the day. The Kyoto Protocol is a case in point considering the impacts its application is predicted to have on all sectors of activity. GERAD’s mathematical finance researches are no exception. For example, Michèle Breton plans to develop a research focus on pollution permits or carbon emissions credits that need to be evaluated. “We are becoming increasingly interested in climatic and energy derivatives.”

Michèle Breton’s research is by no means limited to mathematical finance. For example, together with Saeb Hachem, a researcher with Hydro-Québec, she oversaw the work of a PhD student who developed hydroelectric turbine management models using dynamic programming methods. These models are now used in all of Hydro-Québec’s generating stations. Another project conducted by the same research team, this time for Alcan, focused on optimizing hydroelectric generation in a situation of uncertainty. Other


...Michèle Breton from page 7.

projects have dealt with exploration for, and production and refining of, petroleum products.

With such diversity in research subjects, one wonders where Michèle Breton finds time to administrate the CReF and to teach so much, both in the MBA energy profile and at the doctorate level, where she oversees some ten students. “I teach a lot and enjoy teaching as much as I do research. Teaching takes time but it’s less overwhelming.” She claims she devotes half her time to research and half to teaching, but it seems that she devotes 100 percent of her time to both, as well as another 100 percent to administration.

Having been among the first students at GERAD in the early 1980s, Michèle Breton recognizes the role Alain Haurie played as a sort of “spiritual leader”. “Alain Haurie proposed that I do a doctorate and suggested it could be on game theory, an area I knew very little about. Since then, game theory has never ceased to intrigue me. Emulation is an important aspect in research. An active centre like GERAD attracts students to operations research, and also attracts students to Montreal who wish to specialize in it.”

One of GERAD’s major assets is its multidisciplinary nature, adds Michèle Breton. “It is even more important now than in 1980 for professors to do multidisciplinary research. People with different experience and knowledge are brought together and they complement each other. But there is always a common denominator, namely operations research, which has been multidisciplinary since its inception, and a common goal, solving problems.”

“Isn’t that a good thing to have people trying to solve problems?” concludes Michèle Breton with a smile. 



GERAD researchers in mathematical finance are to financial engineers what precision tool designers are to master craftsmen.

GERAD’s Financial Engineering Team

Hatem Ben Ameur:	stochastic processes, simulation, dynamic programming, derivatives
Michèle Breton:	dynamic programming, game theory, derivative pricing, portfolio optimization
Michel Denault:	Variational inequalities, risk management
Geneviève Gauthier:	Stochastic calculus, stochastic processes, derivatives, financial modelling
Pierre l’Écuyer:	Simulation, dynamic programming, derivative pricing
Bruno Rémillard:	Stochastic volatility, time series, estimation
Felisa Vázquez-Abad:	Stochastic models, stochastic optimization, simulation

The History of *Les Cahiers du GERAD* in a few figures



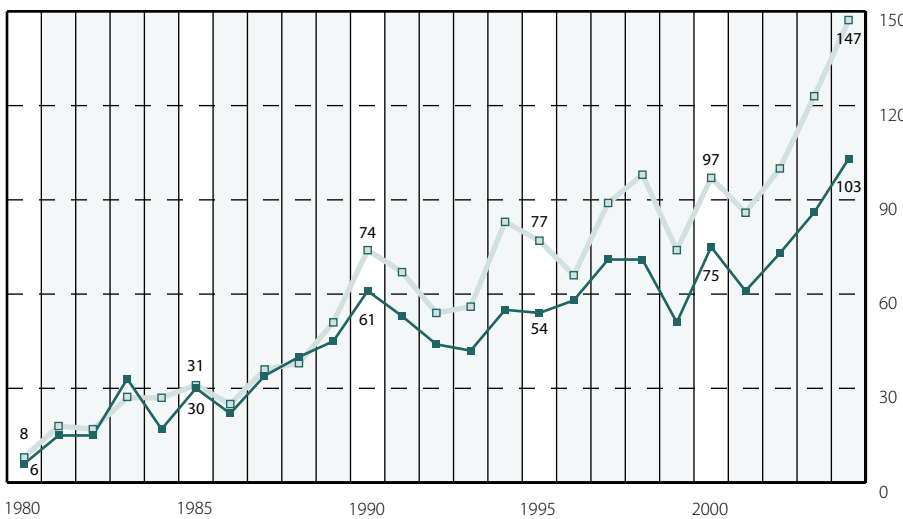
When GERAD was created, it was decided to publish *Les cahiers du GERAD* instead of inserting them in an existing publication, such as the HEC Montréal’s research department publication. The first *Cahier* or discussion paper, written by the main founder of GERAD, Alain Haurie, along with his doctoral student, Pierre L’Écuyer, bore the title *Optimal and suboptimal Strategies for Group Preventive Replacement* and appeared in November 1980. Since then, 1209 discussion papers have followed suit. **Georges Zaccour** presents a brief look at the results of a study underway on the history of the *Les cahiers du GERAD*.¹



The graph below traces the evolution of the number of publications each year. Despite highs and lows, a phenomenon known as the publication cycle, the trend shows steady growth. En 2004 with 103 papers published, GERAD went past the 100 papers a year milestone. A linear adjustment of the cluster of points shows an R^2 coefficient of determination of 0.86. If the trend continues, GERAD will publish 164 papers in its 50th year in 2030, or a little more than three papers a week, holidays included.

These papers were written by 679 different authors. The vast majority of them have contributed to one or two publications. Among the most prolific, 10 people have published between 30 and 59 papers, four have published from 60 to 90, and four others have published

more than 100 papers. The graph below also provides the number of different authors a year. This curve tends to follow the curve representing the number of publications.



■ Number of GERAD papers per year □ Number of authors per year

Table 1 provides the list of the 10 most frequent key words as supplied by the authors. They have been counted mechanically with no attempt to group or qualify them (the words in brackets are examples of the words following the “very general” initial term). Further research will soon be conducted to characterize the themes of the 1210 *Cahiers*. The results will be published in a future *Cahier du GERAD*, of course!

Table 1: List of 10 most frequent key words

Key word	Number of papers
Programming (mathematical, dynamic, bi level, etc.)	222
Problem (routing, scheduling, etc.)	197
Optimization (quadratic, linear, etc.)	151
Linear	142
Algorithm	123
Research (operations, variable neighbourhood, etc.)	99
Networks	97
Games	96
System	92
Heuristic	89

Over and above quantitative considerations, the question remains: what has come of these 1210 papers? Table 2 shows that 909 papers have been published or accepted for publication, mainly in scientific journals (about 800), colloquia proceedings, or book chapters. Eighty papers have not been published, and 53 are now being reviewed. The category of untraced discussion papers, technical reports, theses, etc. will soon be refined.

Table 2: Publishing breakdown of GERAD papers, from 1980 to the end of 2004

Breakdown, Cahiers du GERAD	
Papers published	821
Accepted Papers	88
Papers submitted	53
Unpublished papers	80
Untraced papers, technical reports, theses, etc.	168
Total	1210

Table 3 lists the journals that have published at least five papers. These journals account for 418 articles.

This list is by no means surprising. It mainly includes journals presented in the *Journal of Citation Report*, under the headings *Operations Research & Management Science*, *Applied Mathematics* and *Automation & Control Systems*. The relatively strong presence in the major journals (*Mathematical Programming*, *Operations Research*, *Automatica*, *SIAM*, *IEEE Transactions on Automatic Control*, *Mathematics of Operations Research*, *Transportation Science*, etc.) bears witness to the quality of research carried out at the centre... and the quality of *Les Cahiers du GERAD*.

Georges Zaccour

¹ I would like to thank Caroline Peika and Adil Allilat for their help and Francine Benoit, who is responsible for editing *Les Cahiers du GERAD*.

Table 3: Journals that have published or will publish GERAD discussion papers

European Journal of Operational Research	45
Journal of Optimization Theory and Applications	31
Operations Research	27
Mathematical Programming	26
Computers and Operations Research	22
Discrete Applied Mathematics	20
Transportation Science	19
Annals of Operations Research	15
Journal of the Operational Research Society	14
INFOR	14
Operations Research Letters	14
Discrete Mathematics	13
Journal of Classification	13
IEEE Transactions on Automatic Control	12
Journal of Global Optimization	11
RAIRO	11
Networks	11
Management Science	10
Journal of Chemical Information and Computer Sciences	9
Journal of Economic Dynamics and Control	9
YUJOR	8
Automatica	8
SIAM Journal on Optimization	7
Congressus Numerantium	7
Mathematics of Operations Research	7
Transportation Research	6
International Journal of Flexible Manufacturing Systems	6
Annals of the International Society of Dynamic Games	6
International Journal of Production Research	6
Discrete Mathematics and Theoretical Computer Science	6
IIE Transactions	5
Optimal Control Applications and Methods	5
Naval Research Logistics	5

2nd WORKSHOP OON 2005 – OPTIMIZATION OF OPTICAL NETWORKS

An important workshop on optimization of optical networks was held on April 14 and 15 at the Université de Montréal. The goal was to bring together researchers from the academic and industrial worlds in order to discuss the future of optical networks.

More than 80 researchers, mainly from North America but also from Europe, took part in the workshop that was organized jointly by Brigitte Jaumard, Professor at Université de Montréal, a GERAD member, and head of the Canada Research Chair on Optimization of Communications Networks, and Alain Houle, Professor in the Computer and Electrical Engineering Department at the Université de Sherbrooke.

Main speakers at the workshop were Michel Bélanger from NORTEL, André Girard from EXFO Electro-Optical Engineering Inc, Wayne D. Grover from TRILabs and the University of Alberta, Arie Koster from Konrad Zuse Zentrum für Informationstechnik, Berlin, Germany, Hussein Mouftah, Professor and head of the Canada Research Chair on Optical Networks at the University of Ottawa, and Biswanath Mukherjee, Professor, Department of Computer Science, University of California.

UPCOMING EVENTS

Game Theory in Marketing

An international workshop organized by GERAD

June 3-4, 2005
HEC Montréal

The objective of this international workshop is to provide a forum to discuss recent advances in the applications of game theory to marketing problems. Topics include pricing, advertising and promotion strategies as well as conflicts and cooperation in marketing channels. To maximize interaction among participants, no parallel sessions are planned.

See website:
www.gerad.ca/colloques/gtm

Fifth International ISDG Workshop

GERAD will cosponsor this workshop of the International Society of Dynamic Games

September 21-24, 2005
Segovia, Spain

See website: www.gerad.ca/isdg