

Editorial by Charles Audet

FIVE NEW COLUMNS

In this issue of the *GERAD Newsletter*, we propose five new columns to highlight the contributions, the impact and the strength of our research and of our teams. These columns will be included periodically in future issues of the Newsletter.

- **IMPACT PAPERS.** The GERAD's technical reports (*Les Cahiers du GERAD*) reflect the production of our researchers. In this column, we focus on one such publication that has resulted in a highly cited paper. In this issue, we focus on some aspects of the fertile research of professor Pierre Hansen, and in particular on one of his paper on the variable neighborhood search.
- **COLLABORATIONS.** GERAD favours collaborations between its members. This column highlights various teams in GERAD. In this Newsletter, Roland P. Malhamé describes the synergy that has developed over a decade between various researchers and has led to significant work in Mean field game theory.
- **ACTIONS AND INTERACTIONS.** GERAD is involved in a variety of workshops, conferences and seminars. These activities allow the GERAD exchange with researchers from other communities as well as industry. Here, Odile Marcotte discusses the Problem Solving Workshop, which is CRM-Mprime events that she has organized over the last years. She describes some of the work and spinoffs that resulted from these events.
- **SPOTLIGHTS ON...** In this section we shine the spotlight on one of the GERAD researchers and give an overview of his research. On page 5, we present Roussos Dimitrakopoulos' work on sustainable development of mineral resources.
- **WHERE ARE THEY NOW?** Finally, as the last column we trace former students who attended GERAD, and indicate where they are now.



Charles Audet

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Pierre Hansen: A passion for research

Interview by Arnaud Decroix

We are pleased to announce that Professor Pierre Hansen is the recipient of the 2013 Pierre Laurin Award from HEC Montréal. This grand research prize recognizes the exceptional research contribution of a HEC Montréal full professor during his entire career at the School. It rewards a professor whose research career is a model and an inspiration for his peers. The work of this professor has contributed in an exceptional way to HEC Montréal's scientific renown. Moreover, this award emphasizes the credit of a professor who has developed the research potential of his students throughout his own career.

As a matter of fact, Professor Hansen won the Pierre Laurin Award in 2010 (tied with Gilbert Laporte), 2002 and 1996; this award used to recognized research conducted over the past three years by a full professor of HEC Montréal.



Pierre Hansen
 Department of Management Sciences
 HEC Montréal & GERAD

Pierre Hansen has been the chairholder since 2004 of the Research Chair in Data Mining at HEC Montréal. When this research chair was first launched, HEC Montréal Director Jean-Marie Toulouse introduced Professor Hansen as someone who is interested in everything: "It is no surprise," Toulouse said, "that the methods he has developed apply to more than 15 disciplines." More recently, Pierre Hansen was honoured at the Toulouse Global Optimization Workshop 2010 (TOGO10) in celebration of his 70th birthday. The birthday served as a pretext to honour Hansen, whom the organizers called an "influential scientific personality," who has received numerous academic awards and has written hundreds of articles.

Optimization under constraints

"Scientific research is the central element of my life," Pierre Hansen told us. Even if his interests are varied, his passion for algorithms is still clear. The researcher takes pleasure in presenting the methods he has developed over the years to deal with various issues. Pierre Hansen has developed algorithms for several problems in operational research, data mining and geometry. They are exact or approximate methods (which mean heuristic) for solving problems under constraints with discrete or continuous variables. Exact methods yield globally optimal solution, in a time that we hope moderate; heuristic methods yield in a moderate time locally optimal solutions or globally optimal solutions, but without proof of their global optimality. Each year, several thousand articles propose heuristics for numerous problems. Therefore, we must define general rules for building heuristics, i.e., metaheuristics. Pierre Hansen has worked on tabu search metaheuristics and mostly, with Nenad Mladenović, on variable neighbourhood search metaheuristics.

Professor Hansen has looked attentively at these optimization problems. At GERAD, much work have been devoted to develop the variable neighbourhood search, and several international colloquiums have focused on these issues (EURO Mini Conference XVIII on Variable Neighbourhood Search, Tenerife 2005 and EURO Mini Conference XXVIII on Variable

Neighbourhood Search, Herceg Novi 2012). This work revolves around defining a local optimum and exploring the neighbourhood through increasingly complex movements.

While this approach may seem academic, it has nevertheless had many practical applications, and is therefore applied in a wide range of fields. For example, in the transport sector, these methods improve the management of container carriers by defining the optimal platforms and boat allocations. Similarly, in the area of distribution, these methods help to better locate warehouses and factories, and to define optimal travel routes.

The foundations for these neighbourhood search methods were proposed in the G-96-49 GERAD technical report (*Les Cahiers du GERAD*), and then published in the *Computers & Operations Research* journal. To date, the article Mladenovic, N. and Hansen, P., *Variable Neighbourhood Search*, *Computers & Operations Research*, 24(11), 1097-1100, 1997 has been cited 662 times, according to Web of Knowledge¹ and 1745 times as per Google Scholar.

Concrete applications

For Pierre Hansen, mathematical research must also extend outside the lab. He emphasizes that from this basic research, several start-ups in Montreal were created with the help of M.Sc. and Ph.D. students. According to Hansen, it is important to keep in mind that "we work for businesses and for the progress of science." Companies certainly often have specific problems, but it is necessary to refine their models to find realistic and efficient solutions. In most cases, this is done by creating models to minimize production costs and maximize profits. Economics are introduced into existing mathematical models, especially to integrate a price definition.

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Mean Field Games Theory at GERAD

Roland P. Malhamé

In 2003, for the first time, two GERAD researchers, Peter Caines and Roland Malhamé, along with their very talented doctoral student Minyi Huang, lay the foundations of what the scientific community would later designate as *mean field games theory*.

As is often the case in science, when a general theory is born, its birth is primarily the result of an effort to solve a very concrete problem. In this case, the problem was developing *decentralized control* algorithms (locally calculated decisions) for the management of cellphone transmission power. Within a given service area, or cell, all telephones communicate with one common base station, which relays the phone conversations to the outside world. Conversations are coded to give them the best possible chance of being detected at the station level. However, despite the relative advantage each conversation gets from this coding, collectively these conversations act like noise that can submerge any one cellphone conversation. Transmitting at a higher power level gives a cellphone more chances of its message being detected correctly by the base. However, this can also have two negative impacts: (i) the cellphone battery drains more quickly; and, (ii) it creates more noise for the other cellphones, which then need to increase their transmission power—this is known as the "cocktail party effect." Individual cellphones are then in a "game" situation with the other cellphones: unless they collaborate in a centralized way, they will seek a Nash equilibrium. In an ideal scenario, this equilibrium should allow them to maximize their battery life while also having their conversations detected accurately. It turns out that analyzing the resulting game is much easier when one considers the limit, where the number of cellphones grows to infinity, as compared to the finite population case. The impact of all cellular phones taken together on one individual phone is then similar to what physicists in statistical mechanics call a *mean field*. In short, mean field games theory results from the intersection of a mathematical theory, namely, game theory, and of a physics theory that studies the dynamics of large-scale particle systems, namely, statistical mechanics.

This methodology was rediscovered independently in 2006 by two French mathematicians, Jean-Michel Lasry and Pierre-Louis Lions (Fields Medalist), who coined the term "mean field games theory." Interest in this theory is currently on the rise within the community of control engineers, economists and mathematicians. As a result, in December 2009, Peter Caines had the honour of being the recipient of the prestigious Bode Lecture Prize from the Control Systems Society of the IEEE (Institute of Electrical

and Electronic Engineers). In his lecture, titled "Mean Field Stochastic Control," he presented the work of the whole team, including students. Minyi Huang has since taken a position as a professor at the School of Mathematics and Statistics at Carleton University, and is an associate member of GERAD. Peter Caines and Roland Malhamé have also jointly supervised two other doctoral students, Zhongjing Ma and Mojtaba Nourian, in the area of mean field games. After a postdoctoral period at the University of Michigan, Ma is now a professor at the Beijing Institute of Technology, while Nourian is a postdoctoral researcher in Australia.

Peter Caines, along with former GERAD member Shie Mannor also trained another PhD student: Arman Kizilkale; he is now a postdoctoral researcher within a large-scale project whose principal investigator is Roland Malhamé, and which involves among other team members, Professors Brunilde Sansò and Miguel Anjos, from GERAD. The aim of this project, which is funded by Energy, Mines and Resources Canada, is to apply the mean field control methodology in order to best exploit the potential of energy storage is naturally present in an electrical network (ex. electrical water heaters, electrical space heaters, electric vehicle batteries, etc.); this is in an effort to smooth the variability resulting from an increasing reliance on highly fluctuating renewable energy sources such as solar and wind power. Professors François Bouffard and Peter Caines, both GERAD members, are interested in the potential of mean field game theory in analyzing pricing issues in electric power systems. Lastly, Mean Field Games is an area in which two GERAD teams are increasingly interested: the game theory team, headed by Professors Michèle Breton and Georges Zaccour; and the Energy and Environment at GERAD (E2G) team, led by Professors Olivier Bahn and Jean-Philippe Waaub, in collaboration with an actively retired GERAD member, to whom GERAD owes its very foundation, Professor Alain Haurie. The two teams are interested in environmental management and in the environmental impact of the energy choices of a given society.

In conclusion, one can safely declare that, starting with the efforts of the GERAD Caines-Malhamé GERAD team morphed since into the Caines-Huang-Malhamé team, Mean Field Games is now an area of strong interest at GERAD and where it is rapidly becoming a unifying research theme, among others of course, within our community of researchers. ■

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GERAD and the Montreal Problem Solving Workshops

Odile Marcotte

The Centre de recherches mathématiques (CRM), located one floor above GERAD in the André-Aisenstadt Pavilion, organized recently the *Fifth Montreal Problem Solving Workshop* - A CRM-Mprime Event. Before describing the involvement of GERAD members in the Montreal Problem Solving Workshops, I would like to say a few words about the history and format of Problem Solving Workshops, also known as "study groups" in England (where they originated). In 1968, Professors Alan Tayler and Leslie Fox, both from the University of Oxford, decided to invite a group of industrial researchers to a workshop in which they would present to applied mathematicians working in universities some problems that could be modelled and solved through quantitative methods.

A Problem Solving Workshop starts with a plenary session in which each industrial representative describes a problem. During the next two or three days the participants work in teams, each team addressing one of the problems presented during the plenary session. The workshop concludes with a plenary session in which each team presents the work carried out during the week. Thanks to the energy and enthusiasm of Professor John Ockendon (also from the University of Oxford), Problem Solving Workshops have spread all across the world and are now found from Australia to Denmark and in such countries as the United States, Canada, and Portugal (among others). The workshops have many advantages for both the participating companies and the university researchers. They allow companies or other institutions to work with experts in mathematical modelling, to be introduced to well-trained and very motivated students, and to increase their visibility in universities. The participating researchers have the opportunity to model new problems and to initiate fruitful collaborations with industrial partners.

In 2007 the CRM director, François Lalonde, decided to organize an Industrial Problem Solving Workshop in Montreal. The PIMS Institute, in the West, had been organizing such workshops for around ten years and the two other Canadian mathematics institutes (the CRM and the Fields Institute) had decided to do so as well. Although the Organizing Committee had only eight months to prepare the workshop, it was able to find seven problems, which were addressed by around 60 participants distributed among seven teams. Many people liked the workshop format so much that they wanted another workshop to take place in 2008, and the latter was followed by workshops in 2009, 2011, and 2013.

To a large extent the success of the five workshops was due to the support and involvement of the Montreal operations research community, especially the researchers working at GERAD.

One of the characteristics of the Montreal workshops is their high proportion of problems connected to (linear or nonlinear) optimization and operations research, compared to the proportion of such problems in other cities or countries. Indeed the mathematicians who initiated Problem Solving Workshops (or study groups) were applied mathematicians in the "traditional" sense, i.e., their field of study was so-called continuous mathematics. Note that the companies or institutions that took part in more than one workshop (FPInnovations, GIRO, Hydro-Québec, Matrox, and Natural Resources Canada) have proposed problems that can be tackled by operations research methods. Among GERAD members who participated in at least one workshop (either as coordinators or researchers), let us mention Charles Audet, Pierre Baptiste, Gilles Caporossi, Claudio Contardo, Alain Hertz, Odile Marcotte, Dominique Orban, Sylvain Perron, and Jean-François Plante. Of course CIRRELT members also played an important role, especially Fabian Bastin, Michel Gendreau, Bernard Gendron, Nadia Lahrichi, and Louis-Martin Rousseau.

The work carried out during workshops by teams (for instance the teams coordinated by Dominique Orban in 2007 and 2011, respectively) often leads to the publication of articles. It can also be the starting point of a long-term collaboration with a company or institution, such as the collaboration between IREQ and the team led by Charles Audet (which also included the publication of an article and the research project of a master's student). In 2013 the workshop content was slightly different from that of the previous workshops. The 2013 workshop consisted of two sections: the first one (organized in collaboration with Svetlana Komarova, from McGill University, and Nilima Nigam, from Simon Fraser University) featured six problems from connective tissue physiology and the second one featured four problems (one from obstetrics and three optimization problems). Since mathematics has been applied to the understanding of natural phenomena long before it was applied to the study of industrial processes, it is appropriate to include into Problem Solving Workshops problems provided by researchers in the natural sciences or medicine. In Britain several "Medical Study Groups" have been organized.

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A few words



Roussos Dimitrakopoulos
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Roussos Dimitrakopoulos' research focusses on building a new framework for mine planning and production scheduling through new technological advances founded upon stochastic models and optimization. His new framework supports strategic and operational decisions in the presence of uncertainty, including the ability of orebodies to supply raw

materials, operational mining uncertainties, fluctuating market demand for raw materials and metals, commodity prices, and exchange rates. M. Dimitrakopoulos' shift from the conventional paradigm has allowed him to focus on developing the stochastic global optimization of mining complexes or mineral supply chains from mines to markets.

Since 2005, he has held the Canada Research Chair (Tier I) in "Sustainable Mineral Resource Development and Optimization under Uncertainty" in the Department of Mining and Materials Engineering at McGill University. Prior to that, he was a Professor and Director of the Bryan Research Centre, University of Queensland, Brisbane, Australia; a senior geostatistician at Newmont Mining in Denver, Colorado; and worked at Geostat Systems International in Montreal after obtaining his Ph.D. from Polytechnique Montréal.

Interested in the sustainable development and utilization of mineral resources and reserves, an area of critical importance to society, especially given the fast growth and demand of new emerging economies and environmental and social concerns, M. Dimitrakopoulos undertook the ambitious project of creating COSMO, a Stochastic Mine Planning Laboratory at McGill University, in partnership with six of the largest international mining companies, namely, AngloGold Ashanti, Barrick Gold, BHP Billiton, De Beers, Newmont Mining and Vale. With additional support from NSERC, the Canada Research Chair (CRC) Program and the Canada Foundation for Innovation (CFI), the lab has developed new ideas and methods in support of a new technical-scientific paradigm to support sustainable mineral development.

This work has received several awards, including the NSERC Synergy Award for Innovation awarded by the Governor General of Canada



in February 2012 and a prestigious award from the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) in 2013.

Currently, his COSMO lab has twelve graduate students and six research staff, an administrator, and several collaborating professors, while the lab's activities span five continents. Students and staff are funded through competitive grants and the COSMO mining industry consortium. Since 2013, M. Dimitrakopoulos' last initiative is a program called "Academics without Borders" run with the generous support of the members of the COSMO consortium. This initiative aims to educate academics in developing countries along with their students, and enable them to adopt the most current practices in the field. To date, researchers from universities in South Africa, Brazil and Chile are participating.

A GERAD member since the end of 2012, M. Dimitrakopoulos sees the centre as an attractive, supportive and advanced research environment where a wealth of new mathematical models for decision analysis and support are developed. The links and benefits to his own work seem natural, while research diversity at the centre provides a new pool of concepts, challenges and ideas for further research. ■

¹ http://www.nserc-crsng.gc.ca/Media-Media/2minutes-2minutes/Roussos-Roussos_eng.asp

² <http://www.aimehq.org/programs/award/bio/roussos-dimitrakopoulos>



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Supervised by: Brigitte Jaumard (Concordia University) and Pierre Hansen (HEC Montréal)



Les Cahiers du GERAD – Technical Reports

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- G-2009-37 **Le Digabel, S., Tribes, C., Audet, C.**
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Revision: April 2013
- G-2010-33 **Cabo, F., Martín-Herrán, G., Martínez-García, M.P.**
Fully Endogenous Growth with Increasing Returns and Exhaustible Resources: Existence and Stability
Revision: May 2013
- G-2011-51 **Vukicevic, D., Caporossi, G.**
Network Descriptors Based on Betweenness Centrality and Transmission and their Extremal Values
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- G-2012-13 **Fertel, C., Bahn, O., Vaillancourt, K., Waaub, J.-Ph.**
Canadian Energy and Climate Policies: A SWOT Analysis in Search for Federal/Provincial Coherence
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- G-2012-83 **Groiez, M., Desaulniers, G., Hadjar, A., Marcotte, O.**
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- G-2012-93 **Bolouki, S., Malhamé, R.P.**
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- G-2013-01 **Bahn, O., Marcy, M., Vaillancourt, K., Waaub, J.-Ph.**
Electrification of the Canadian Road Transportation Sector: A 2050 Outlook with TIMES-Canada
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- G-2013-19 **Alcocer, Y., Bahn, O., Fertel, C., Vaillancourt, K., Waaub, J.-Ph.**
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Revision: November 2013

Awards, honours and contributions

- Last March, during the 9th International Conference on Design of Reliable Communication Networks DRCN 2013, Minh Bui, **Brigitte Jaumard**, Cicek Cavdar and Biswanath Mukherjee won the Best Paper Award for *Design of a survivable VPN topology over a service provider network*.
- On the recommendation of the OIQ Executive Committee, **Diane Riopel** (Polytechnique Montréal) was awarded, at the Gala de l'excellence 2013, the title of Fellow by Engineers Canada, a privilege reserved for those who have made a remarkable contribution to the engineering profession. Ms. Riopel received the honour for, among other achievements, her support for women in engineering.
- On April 17th, **Lê Nguyễn Hoàng**, co-supervised by François Soumis (Polytechnique Montréal) and Georges Zaccour (HEC Montréal), won the 1st prize of the internal competition at Polytechnique Montréal in order to represent the University on May 8 during the ACFAS contest "Votre soutenance en 180 secondes".
- On June 1st, **Miguel F. Anjos** (Polytechnique Montréal) has been promoted full professor from the Department of Mathematics and Industrial Engineering of Polytechnique Montréal. **Geneviève Gauthier** (HEC Montréal) started as the new director of Department of Management Sciences of HEC Montréal. Finally, **Michèle Breton** (HEC Montréal) was named director in the Office of the Academic Programs Director at HEC Montréal for a three years term.
- Three GERAD' students were finalists for the HEC Montréal Mercure Award for the best doctoral thesis of 2012, which are: **Diego Amaya**, supervised by Geneviève Gauthier (HEC Montréal), **Pablo Andrés-Domenech**, co-supervised by Georges Zaccour (HEC Montréal) and Guiomar Martín-Herrán (Universidad de Valladolid, Spain), and **Leandro C. Coelho**, cosupervised by Jean-François Cordeau (HEC Montréal) and Gilbert Laporte (HEC Montréal).
- A former Ph.D. student of Georges Zaccour (HEC Montréal), **Olivier Rubel**, now professor at the Graduate School of Management, University of California, Davis, received the 2013 teacher of the year Award in recognition of his Distinguished teaching contribution to the School.
- **Nadir Amaïoua**, **Georges Baydoun**, **Romain Montagné**, **Dominique Cartier**, **Frédéric Quesnel**, **Koukla Azeuli-Nkamegni** and **Abderrazak Moutassim**, supervised by Sébastien Le Digabel (Polytechnique Montréal), won the first place at the 4th contest Jeux Mathématiques as well as a 200 Euros grant. These games, organized by the Fédération Française des Jeux Mathématiques, Société de Calcul Mathématique SA and Fire Brigade of Paris, is to solve a social problem.
- On July 1st, **Tamer Boyaci** has been promoted Full Professor.
- **Bruno Remillard** (HEC Montréal) has published a new book entitled Statistical Methods for Financial Engineering, published by CRC Press. The book is intended to guide practitioners in applying the most common stochastic models in financial engineering.
- **Jean-François Bégin**, supervised by Geneviève Gauthier (HEC Montréal), received an Alexander Graham Bell Canada Graduate Scholarship from the Natural Sciences and Engineering Research Council of Canada (NSERC), worth \$35,000 per year and renewable for three years as well as a doctoral scholarship from the Fonds de recherche du Québec – Nature et technologies (FRQNT).
- **Hugo Lamarre**, supervised by Debbie Dupuis (HEC Montréal), awarded a doctoral scholarship from the Institut de finance mathématique Montréal (IFM2).
- **Erik Frenette**, co-supervised by Olivier Bahn (HEC Montréal) and Jean-Philippe Waaub (UQAM), obtained a Joseph-Armand Bombardier CGS Doctoral Scholarship. This scholarship will help him pursue his Ph.D. studies in economics at the University of Toronto.
- In an interview given for the La Presse newspaper on August 14, **Miguel F. Anjos** (Polytechnique Montréal), newly Interim Director of the Trottier Energy Institute, explained what have been added to the Specialized Master's Degree in Energy Engineering at Polytechnique Montréal.
- On September 6, **Jean-François Cordeau** (HEC Montréal) presented, in a few minutes on YouTube, his current researches in logistics.
- On September 10 and 24, **Luc-Alain Giraldeau** (UQAM) was Sophie-Andrée Blondin's guest at the "Bien dans son assiette" broadcast. During his first interview, he explained the evolutionary and cultural strangeness of our milk consumption. In the second one, he talked about the omnivore's dilemma. Also, on September 14, he was a speaker at TEDxMontréal where he shared his perspectives and ideas on his field of research.
- During an interview given for bulletins-electroniques.com, **Gilles Savard** (Polytechnique Montréal) gives an update on the massive online courses (MOOC).
- **Roussos Dimitrakopoulos** (McGill University) presents his research in 2 minutes in a NSERC video.
- **Pierre Hansen** (HEC Montréal) is the recipient of the 2013 Pierre Laurin Award from HEC Montréal.

Thesis defences

- **Thibault Barbier**, co-supervised by Gilles Savard (Polytechnique Montréal) and Miguel F. Anjos (Polytechnique Montréal)
Master Thesis: Optimisation de la stratégie et du dimensionnement des systèmes hybrides éoliens, diesel, batterie pour sites isolés
- **Tarek Ben Rhouma**, supervised by Georges Zaccour (HEC Montréal)
Doctoral Thesis: Three Essays in Quantitative Marketing Models
- **Guillaume Blanchet**, supervised by Alain Hertz (Polytechnique Montréal)
Master Thesis: Optimisation de la conception de parcs éoliens par recherche locale
- **Ali Boudhina**, supervised by Michèle Breton (HEC Montréal)
Doctoral Thesis: Trois essais sur l'évaluation d'options exotiques : options américaines, fonds distincts, et options sur l'électricité
- **Jean Collard**, supervised by Michel Gamache (Polytechnique Montréal)
Master Thesis: Planification stratégique d'une mine souterraine avec teneur de coupure variable
- **Mohsen Dehghani**, supervised by Dominique Orban (Polytechnique Montréal)
Master Thesis: A Regularized Interior-Point Method for Constrained Linear Least Squares
- **Ariane Duchesne**, supervised by Michel Gamache (Polytechnique Montréal) and Robert Pellerin (Polytechnique Montréal)
Master Thesis: Ordonnancement de projets avec contraintes de ressources dans un contexte incertain
- **Rzieh Faraji**, supervised by Michel Gamache (Polytechnique Montréal) and Pierre Baptiste (Polytechnique Montréal)
Master Thesis: A Comparison Between Linear Programming and Simulating Models for a Dispatching System in Open Pit Mine
- **Mounira Groiez**, co-supervised by Guy Desaulniers (Polytechnique Montréal) and Odile Marcotte (UQAM)
Doctoral Thesis: Étude et séparation des inégalités valides pour des problèmes de partitionnement et de couverture
- **Mohammad Javad Keshtkar**, co-supervised by Michel Perrier (Polytechnique Montréal) and Jean Paris (Polytechnique Montréal)
Doctoral Thesis: Steam and Water Combined Analysis, Integration, and Efficiency Enhancement in Kraft Pulp Mill
- **Federico Larumbe**, supervised by Brunilde Sansò (Polytechnique Montréal) and André Girard (INRS)
Doctoral Thesis: Planning and management of cloud computing network
- **Nahid Masoudi**, supervised by Georges Zaccour (HEC Montréal)
Doctoral Thesis: Essays on Economics of Pollution Control
- **Alessandro Navarra**, co-supervised by Gilles Savard (Polytechnique Montréal) and Frank Ajersch (Polytechnique Montréal)
Doctoral Thesis: Mathematical Programming of Peirce-Smith Converting
- **Behnaz Saboonchi**, co-supervised by Pierre Hansen (HEC Montréal) and Sylvain Perron (HEC Montréal)
Doctoral Thesis: Variable Neighborhood Search Methods for the Dispersion Graph Problems, with Application to Franchise Location Problems
- **Saad Serghini Idrissi**, co-supervised by Michèle Breton (HEC Montréal) and Javier de Frutos (Universidad de Valladolid, Spain)
Doctoral Thesis: Une approche pour l'évaluation de dérivés financiers de type bermudien
- **Shadi Sharif Azadeh**, co-supervised by Gilles Savard (Polytechnique Montréal), Patrice Marcotte (Université de Montréal) and Richard Labib (Polytechnique Montréal)
Doctoral Thesis: Demand Forecasting in Revenue Management Systems
- **Mehdi Towhidi**, supervised by Dominique Orban (Polytechnique Montréal)
Doctoral Thesis: Treatment of Degeneracy in Linear and Quadratic Programming
- **Xiaoxi Xu**, co-supervised by Michel Gamache (Polytechnique Montréal) and Miguel F. Anjos (Polytechnique Montréal)
Master Thesis: Modélisation et analyse du fonctionnement d'un système de stockage intégré au réseau électrique
- **Mohammad Yousef Maknoon**, co-supervised by Pierre Baptiste (Polytechnique Montréal) and François Soumis (Polytechnique Montréal)
Doctoral Thesis: Scheduling Material Handling in Cross-Docking Terminals

GERAD's Grant

Winners of the 2nd call of the Sixth GERAD Undergraduate foreign trainees' competition are **Alice Dupuy**, sponsored by Brigitte Jaumard and **Adil Tahir**, sponsored by Issmail El Hallaoui.

Sabbatical leaves

- **Guy Desaulniers** (Polytechnique Montréal) will be on sabbatical leave from June 15, 2013 to June 14, 2014.
- **Michel Denault** (HEC Montréal) et **Denis Larocque** (HEC Montréal) will be on sabbatical leave from June 1, 2013 to May 31, 2014.

Visitors

May 2013

Andrew Conn (IBM T.J. Watson Research Center, USA)

May/June 2013

Alejandro Caparros (Consejo Superior de Investigaciones Científicas, Spain)

June 2013

Jean Bigeon (CNRS, Université de Grenoble, France)

Peter Kort (Tilburg University, The Netherland)

Christophe Leblay (University of Turku, Finland)

July 2013

Denis Alamargot (Université Paris-Est Créteil, France)

Antonio Capone (Politecnico di Milano, Italy)

August 2013

Jules Dégila (University of Abomey-Calavi, Benin)

August/September 2013

Hela Miniaoui (University of Wollongong, United Arab Emirates)

Mohammed Saddoune (Université Hassan II de Casablanca, Morocco)

September 2013

Maria Battarra (University of Southampton, United Kingdom)

Santiago Rubio (University of Valencia, Spain)

Wei Yang (University of Strathclyde Glasgow, United Kingdom)

September/October 2013

Mirjana Cangalovic (University of Belgrade, Serbia)

Herbert Dawid (Bielefeld University, Germany)

October 2013

Charles Figuières (INRA Montpellier, France)

Stéphane Tchong-Ming (IFP Energie nouvelles, France)

Stefan Wrzaczek (University of Vienna, Austria)

October/November 2013

Alain Jean-Marie (LIRMM, Université Sciences et Techniques du Languedoc, Montpellier II, France)

Mabel Tidball (LAMETA, France)

November 2013

Ernesto Estrada (University of Strathclyde, United Kingdom)

Leo Liberti (LIX, École Polytechnique, France)

Trainees

April/October 2013

Bastien Talgorn, postdoctoral trainee, (France)

May/July 2013

Thomas Fagart (Université de Paris I, France)

May/August 2013

Zeinab Atoui (HEC Montréal, Canada)

Shamsorrahman Faissal (ESIEE Paris, France)

Cem Ünlübayrak (École Polytechnique Paris, France)

May 2013

Taibi Boumedyen (University of Saïda, Algeria)

Victor Zakharov (St.Petersburg State University, Russia)

July 2013/January 2014

Mustapha Boushaba (Polytechnique Montréal, Canada)

August/December 2013

Dorien Meijer Cluwen (University of Twente, The Netherlands)

October 2013

Claire Bernard, postdoctoral trainee, (GERAD, HEC Montréal, Canada)

Activities

Workshops | Schools | Congresses

March 10-14, 2014

School on Column Generation, Paris, France

GERAD Seminars

June 25, 2013

Jean Bigeon (CNRS, Université de Grenoble, France)

Utilisation des méthodes d'optimisation en dimensionnement de produit

July 18, 2013

Denis Alamargot (Université Paris-Est Créteil, France)

Quartet: An Algorithm for Qualifying Eye Movements During Handwriting

August 6, 2013

Nicolas Zufferey (GERAD, HEC – University of Geneva, Switzerland)

Metaheuristics for a Truck Loading Problem Proposed by the Car Manufacturer Renault

October 1, 2013

Mirjana Cangalovic (University of Belgrade, Serbia)

The Metric Dimension of Hypercubes

November 13, 2013

Hatem Ben-Ameur (GERAD, HEC Montréal, Canada)

A Dynamic Program for Valuing Corporate Securities

November 14, 2013

Marie-Christine Costa (ENSTA-Paristech, Paris, France)

A Robust Approach to Solve Mixed Integer Linear Optimization Problems with Uncertain Data

November 19, 2013

Bastien Talgorn (GERAD, Polytechnique Montréal, Canada)

Surrogate-Based Optimization of Constrained Blackbox

November 20, 2013

Michael A. Kouritzin (University of Alberta, Canada)

Graph Theoretic Approach to Random Field Simulation

“Meet a GERAD researcher!” Seminars

May 16, 2013

Brunilde Sansò (Polytechnique Montréal, Canada)

Optimisation des réseaux verts de télécommunications

May 23, 2013

Federico Larumbe and **Luca Gianoli**

(Polytechnique Montréal, Canada)

Optimisation des réseaux verts de télécommunications II

September 12, 2013

Geneviève Gauthier (HEC Montréal, Canada)

Le risque de recouvrement et les écarts de crédit dans un contexte de modélisation hybride du risque de crédit

September 19, 2013

Frédéric Godin (GERAD, HEC Montréal, Canada)

Couverture optimale lorsque le sous-jacent suit un processus de Markov à changements de régimes

October 24, 2013

Jean-François Plante (HEC Montréal, Canada)

Utilisation de BIRCH pour le calcul des statistiques de rang approximatives sur des jeux de données massifs

October 31, 2013

Jean-Baptiste Débordès (HEC Montréal, Canada)

Combiner des courbes ROC à l'aide des poids EQMIM

GERAD/CRC-ONDI Optimization Seminars

October 31, 2013

Jacques Desrosiers (HEC Montréal, Canada)

Vector space decomposition for linear programming

November 14, 2013

Derek Wang (McGill University, Canada)

Energy Storage Operations under Price Uncertainty and Physical Constraints

November 21, 2013

Stéphane Alarie (Hydro-Québec, Canada)

Determining the optimal number of spare parts for major substation equipment

Canada Research Chair in
Discrete Nonlinear Optimization in
Engineering



Activities

GERAD Seminars cofunded by Fondation HEC Montréal and the Chair in Game Theory and Management

April 29, 2013

Michael Grothe (Bielefeld University, Germany)
Profitability and Sustainability of Social Responsible Investment Strategies

May 22, 2013

Jesús Marín-Solano (Universitat de Barcelona, Spain)
Time-Consistent Equilibria and Differential Games with Time Inconsistent Preferences

May 23, 2013

Bruno Nkuiya (Université Laval, Canada)
Open Access to the Resource of Antibiotic Treatment Efficacy Subject to Bacterial Resistance

May 24, 2013

Victor V. Zakharov (Saint Petersburg State University, Russia)
Time Consistent Collaboration in Cargo Transportation

May 31, 2013

Alejandro Caparrós (Consejo Superior de Investigaciones Científicas, Spain)
Endogenous Gradual Coalition Formation and International Negotiations

June 7, 2013

Thomas Fagart (Paris School of Economics, Université Paris I, France)
Markovian Equilibria in a Model of Investment under Imperfect Competition

Peter Kort (Tilburg University, The Netherlands)
Strategic Capacity Investment under Uncertainty

September 23, 2013

Dario Bauso (Università degli Studi di Palermo, Italy)
Introduction to Mean Field Games

September 25, 2013

Wei Yang (University of Strathclyde Glasgow, United Kingdom)
Mean Field Games and Applications

September 26, 2013

Dario Bauso (Università degli Studi di Palermo, Italy)
Attainability in Repeated Games with Vector Payoffs

September 30, 2013

Herbert Dawid (Bielefeld University, Germany)
Strategic Location Choice under Dynamic Oligopolistic Competition and Spillovers

October 11, 2013

Claire Bernard (GERAD)
Viability Theory for Sustainable Development in the Rain-Forest of Madagascar

October 29, 2013

Stefan Wrzaczek (University of Vienna, Austria)
Some Ideas on a Dynamic Model on Closed- or Open-Source Software

October 30, 2013

Charles Figuères (INRA Montpellier, France)
Axiomatic Characterizations of Some Indirect Nash Mechanisms to Solve the Free-Rider Problem

Fondation
HEC MONTRÉAL

HEC MONTRÉAL
CHAIR IN GAME THEORY
AND MANAGEMENT

GERAD Seminars cofunded by Fondation HEC Montréal and the Data Mining Chair

November 26, 2013

Ernesto Estrada (University of Strathclyde, United Kingdom)
Path Laplacians in Graphs and Networks. Theory and Applications

November 28, 2013

Leo Liberti (LIX, École Polytechnique, France)
Symmetry in Mathematical Programming

Fondation
HEC MONTRÉAL

HEC MONTRÉAL
DATA MINING CHAIR

GERAD Seminar cofunded by the Canada Research Chair in Distribution Management

September 11, 2013

Maria Battarra (University of Southampton, United Kingdom)
Modeling Uncertainty in Pre-Positioning of Emergency Supplies

Activities

Séminaires pas ordinaires

September 11, 2013

Lê Nguyễn Hoang (Polytechnique Montréal, Canada)

More Hiking in Modern Math World

CRM/ISM/GERAD Statistics Colloquium

September 27, 2013

Len Stefanski (North Carolina State University, USA)

Measurement Error and Variable Selection in Parametric and Nonparametric Models

October 25, 2013

Luke Bornn (Harvard University, USA)

Towards the Derandomization of Markov chain Monte Carlo for Bayesian Inference

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