GERAD

Studing at GERAD

NEWSLETTER

Summary

Editorial by Georges Zaccour

The vitality of a research centre is largely dependent on its students. They bring with them new ideas untainted by the censure of experience, and enthusiasm that spreads to everyone around them.

The *Newsletter* spoke to 13 students doing a MSc. or a Ph.D. under the supervision of one of our members. The students have different academic backgrounds, different research subjects and even different accents, but they all share the same passion for applying mathematics to a wide range of problems that affect society at a micro or international scale. Through these interviews, we discovered that the students also share a strong feeling of belonging to the group, which they almost unanimously described as a "family"– a motely family, one whose diversity they love, and especially, one where it's a pleasure to talk about math problems morning to night (and play cards at lunchtime!)

The *Newsletter* also reports the results of recent research on various topics including farsighted fisheries management (Michèle Breton and Michel Yevenunye Keoula); solving clusterwise regression problems (Réal A. Carbonneau, Gilles Caporossi and Pierre Hansen); the theory of decentralized equilibria for large population of multi-agent dynamical systems (Minyi Huang, Peter Caines and Roland Malhamé); column generation (Guy Desaulniers, Jacques Desrosiers and Simon Spoorendonk); energy development (Maria de L. Vazquez, Jean-Philippe Waaub and Adrian Ilinca); and integrated airline crew scheduling (Mohammed Saddoune, Guy Desaulniers, Issmail Elhallaoui and François Soumis). What do these studies have in common? Each one is the result of a GERAD student's work. ∎

Enjoy your reading!

Georges Zaccour

Interview with Sivan Altinakar

Ph.D. student, École Polytechnique de Montréal, under the supervision of Gilles Caporossi and Alain Hertz

Luck has been scheduled by Véronique Pagé

Sivan Altinakar, a member of GERAD, will shortly complete his PhD. With a bit of luck, he hopes to find a position within an industrial laboratory. Listening to him, however, it quickly becomes clear that he will need little luck: with the networking opportunities he has had at GERAD, Sivan's future looks bright already! Amongst others, Sivan mentions the Montreal Industrial Problem Solving Workshop, organized by the Centre de recherches mathématiques, along with GERAD and the Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation. These workshops have allowed him to offer his expertise to Hydro-Québec's IREQ, before he had even completed his thesis.

This expertise is perhaps wider by now than Sivan might have expected. Indeed, the problem on which his Ph.D. is centred turned out to be surprisingly complex: "Imagine a McDonald's, and employees who must make milkshakes. There's a work station for each step in the recipe, which can be visited in any order. But there cannot be more than one person per station. The problem is to construct a 'schedule' of station for each employee." This simple situation is in fact a classic problem. For his thesis, Sivan studied a variation in which the waiting time for each employee and each machine is minimized. This reflects a realistic, common industrial scenario: a manufacture that uses chemicals which it has no room to store is a good example.

Sivan thought that "two weeks" would be more than enough to develop a tool to find exact solutions for small problems. But weeks turned to... years! This allowed him to explore a wide array of tools, including constraint programming, for example. Add to this that his affiliation with GERAD has kept him in touch with the entire operational research community of Montreal, and you will agree that upon leaving GERAD, Sivan will need no luck to find himself just the position he wishes for! ∎

Interview with Pablo Andrés-Domenech

Postdoctoral researcher, HEC Montréal, under the supervision of Georges Zaccour

Applied enthusiasm by Véronique Pagé

Pablo Andrés-Domenech recently finished his Ph.D., but he still has the bright-eyed enthusiasm of a first-year student. He is as passionate as ever about his research, which focuses on applying game theory to deforestation issues within the context of global warming. "Different economic players evidently have differing interests when it comes to forests." Pablo's research concludes that cooperation between players (typically land owners and emitting countries) can create a situation where all players win. That can only happen, however, if profits are redistributed amongst the players. Asked about the applicability of the conclusions arising from his work he answers with confidence: "I used real data in my work with the hope of reaching realistic and applicable conclusions. I really believe in making research as applicable as possible"

Talking about his desire to work on concrete problems he explains how he arrived to Canada: "I discovered my interest for research during my Master's in Switzerland. I wanted to carry on in this direction and was attracted by the applied way in which research is conducted here in North America."

In 2006, Pablo started a Ph.D. at GERAD under the supervision of Georges Zaccour, the two having first met during Professor Zaccour's sabbatical year at Valladolid University in Spain. Six years after his arrival, Pablo is also still very happy with his choice: "Professor Georges Zaccour has always been very supportive with me and I learnt so many things from him during these years. I am also very grateful for the freedom that he always granted me to lead my research in the directions I preferred."

Pablo's enthusiasm couldn't be stronger than when he talks about the atmosphere he found at GERAD. Soccer, card games, student-led seminars... He loves how dynamic the group is and hopes it is a tradition that will not disappear. As he will soon be leaving GERAD, Pablo has one very important recommendation for future students: "Get involved! You will never regret it!" ∎

Interview with Marilène Cherkesly

Ph.D. student, École Polytechnique de Montréal, under the supervision of Guy Desaulniers and Gilbert Laporte

Fit in exactly and heuristically by Véronique Pagé

Most students see their Master's as an opportunity to familiarize themselves with a research environment. Marilène Cherkesly is not one of them! Until very recently, Marilène was an undergraduate student at HEC Montréal, wondering whether or not she really fitted in. One of her professors, Gilbert Laporte, a GERAD member, thought she might be interested in academic research, but she was rather convinced he was wrong: "I thought researchers spent their days reading books and re-writing old discoveries!" But reading scientific articles rather opened her eyes to what research really was – and do the fact that indeed she might well like it!

Pr Laporte offers to supervise her for a Master's, but also invites her to look around for other projects that might appeal to her. At École Polytechnique de Montréal, she meets with Guy Desaulniers, also a GERAD member, who could also supervise her. Both supervisors accept to co-supervise her. The project that's taking shape, however, is starting to look too ambitious for a Master's... "At this point I already knew I wanted to build an academic career, so I thought, if I am going to do a Ph.D. later on, I might as well do it now." She thus decides to jump in the deep end right away, skipping the Master's altogether!

Since May 2011, then, Marilène has been working very hard indeed. Luckily she joined GERAD before her courses started, spending the summer getting to grips with her project: "I will be working on the vehicle routing problem. Trucks depart at a depot on their way to completing requests. Each truck leaves the depot empty and must come back empty as well, meaning a request will include both pick-ups and deliveries. Each client has already selected a time window in which it wishes to be visited. Lastly we impose a 'last in first out' constraint to make the driver's life a little easier." Marilène will be attempting to solve this problem both exactly and heuristically.

She has finally found a place where she truly fits in: "I have only been at GERAD for a few months, but, strangely enough, I already feel more at home than I have ever felt while an undergraduate. I have a place to work, my own desk, my own computer... I'm happy being here!" ■

Interview with Hadhami Dbira

Ph.D. student, École Polytechnique de Montréal, under the supervision of Brunilde Sansò and André Girard

Perfect balance by Véronique Pagé

Hadhami Dbira was in Tunisia when she first heard of GERAD: "I was studying telecommunications engineering and was looking for a place to undertake my final year project. Mrs. Brunilde Sansò, who is a professor at École Polytechnique de Montréal and who had supervised students from my university, was offering new positions. I submitted my application and was accepted." That was two years ago. The project was meant to last for only 9 months, so why is Hadhami still at GERAD? Well, she did leave GERAD for a short time... a very short time indeed! Going back to Tunisia to defend her Master's, she decided to try working as an engineer in industry. Two months were enough to convince her she was simply never going to like it. She quickly left it all behind and came home to GERAD to start a Ph.D.

But if engineering as a profession does not suit her, the subject that first attracted her to it, telecommunications, remains her passion. Under the supervision of Pr Sansò, still, Hadhami now specializes in service quality. She aims to model and minimize the time between arrivals of successive data packets: "An increase in the inter-arrival time of packets can destroy a Skype conversation, for example. But it is nonetheless never minimized. End-to-end delay or loss rate are generally optimized, but not inter-arrival time. That is because there exists no method for controlling the latter."

Needless to say, improving the quality of real-time applications is likely to be high on the agenda of many businesses. Hadhami expects the results of this work to quickly integrate the market, perhaps within a few short years. This project has offered her the perfect balance between academia and industry, allowing her to work within a university setting on question that is completely in line with the needs of the telecommunications market. ■
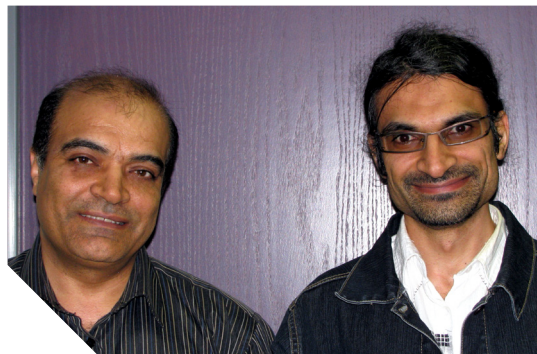
Interview with Ahad & Moshen Dehghani

- Ahad Dehghani, Postdoctoral researcher, École Polytechnique de Montréal, under the supervision of Dominique Orban & Jean-Louis Goffin
- Mohsen Dehghani, MSc. student, École Polytechnique de Montréal, under the supervision of Dominique Orban

Family tradition by Véronique Pagé

Many students say they feel GERAD is like a family. For brothers Mohsen and Ahad Dehghani, it is perhaps more literally the case. When Ahad joined GERAD in 2008, he started a family tradition his brother was only too happy to oblige only a few years later.

A number of years ago, Ahad, the eldest of the Dehghani family, had completed a Master's and was wishing to start a Ph.D. But love has a way of modifying the best laid plans! Married, he decided to leave his Ph.D. project aside and teach at university. In 2004, his children now older, Ahad and his family moved from Iran to Montreal. Ahad started his Ph.D. at McGill University and GERAD, working in non-linear programming. He is adamant such a move was essential: "There really is a stronger focus on more applied problems, here in North America. Moreover moving here allowed me to truly widen my network. GERAD is also very well known in the community of optimization."

Ahad's youngest brother Mohsen, still in Iran and working in a software company, was also starting to dream mathematical dreams. Ahad having opened what he calls the "math path", Mohsen followed. He is now a Master's student at École Polytechnique de Montréal. He is already thinking of doing a Ph.D. Ahad is now a postdoctoral researcher and is hoping to build an academic career. Bringing back their North American vision of applied mathematics to Iran seems to appeal to both brothers, though, as they mention, the community there might be too small to accommodate them.

In the meantime, the brothers share a research group, something they seem to appreciate greatly. They confess to be talking about maths together "all the time!" No one else amongst the Dehghani brothers and sisters has this passion for applied mathematics. Is this the end of the "math path"? Maybe not, as Ahad's teenage daughter has recently decided she wants to become... a mathematician! Has a GERAD dynasty just begun? ■

Interview with Hichem Garbouj

M.Sc. student, HEC Montréal, under the supervision of Olivier Bahn and Jean-Philippe Waaub

Environmental story by Véronique Pagé

Like many Tunisian students in GERAD, Hichem Garbouj first came to the group for his final year project. His move to Montreal in February 2011 therefore not only marked his first encounter with the group, but with North America, academic research, HEC Montréal... Surely a quite overwhelming experience! "Luckily, Montreal is quite European, so not completely unlike my own country. It really helped when it came to understand how things work here!" His project successfully completed, in June 2011, Hichem went back to Tunisia. He was planning on working as an engineer, but finding his country still in the grip of political turmoil, he decided to come back to Montreal. His renewed presence at GERAD, if unplanned, is welcome: "Four months is a very short time. I did not manage during my project to get to know everybody. My Master's is giving me the opportunity to really become part of the group. What I am discovering is a vibrant, multicultural work environment. While people are very serious when it comes to work and research, the atmosphere is relaxed; I like this contrast."

Hichem's career might be only starting, but he already has a clear understanding of his field of research. His work finds its place within the energy and environment axis of GERAD. During his final year project, he used the TIMES model to study the viability of hydrogen as a source of energy. His work leads to the conclusion that hydrogen is relevant as a vector of energy, but not viable as a source. He will carry on using TIMES in his Master's, this time looking at the risks energy transport corridors can face. Transport corridors vary from one type of energy to another, but for electricity, can be for example a power line bringing electricity from a hydro dam in the North to Montreal. The gathering of data turned out to be especially difficult in the case of hydrogen, the technology being still in its infancy. Hichem is hoping that focusing instead on something as "real" as power lines will make his life a little easier, at least as far as data is concerned. If all goes well, he might even stay at GERAD for a Ph.D. Who knows how long his four months visit will really last? ■

Interview with Jean-Bertrand Gauthier

Ph.D. student, HEC Montréal, under the supervision of Jacques Desrosiers

The path through degeneracy by Véronique Pagé

Jean-Bertrand Gauthier might be a typical GERAD student, but the route he followed to become one is not quite so traditional. He did not obtain a degree in applied mathematics or marketing – he trained as an actuary. In fact, Jean-Bertrand, a Ph.D. student at HEC-Montréal under the supervision of Jacques Desrosiers, specializes in tortuous paths: he works on degeneracy.

Jean-Bertrand works with the simplex algorithm, a tool that can find optimal solutions: "The simplex basically goes from one solution to another until it finds an optimal one, as defined by the usual necessary stopping criterion." But in its travels the simplex sometimes hits a major obstacle: degeneracy. Meeting a group of equivalent solutions, it starts going round in circles, pointlessly visiting one equivalent solution after another, wasting time. The works of Jean-Bertrand, his supervisor and their collaborator Marco Lübbecke offer a way out of this. When they observe the simplex starting to stall, they construct and solve a smaller, related problem, which allows them to identify the direction that should be given to the simplex. This guarantees that the simplex will start walking again towards a better solution. This, Jean-Bertrand mentions, is an important question, degeneracy being a common issue that plagues "all network problems, for example".

Jean-Bertrand's professional path was not completely straightforward either. "After my degree, I was not convinced I wanted to work as an actuary. I thought I should try looking at Master's and at HEC Montréal found the Master's in business analytics. I registered as a full-time student." This wasn't yet precisely the right direction: doubting his decision, Jean-Bertrand abandoned a number of courses to spend time searching for a position as an actuary. But he also discovered he liked the theoretical side of his studies! "I decided to work on a dissertation, which wasn't planned. That is how I met Jacques Desrosiers, with whom it clicked." From then, things started falling into place: he finished his Master's, started a Ph.D., and joined GERAD. "I feel like I would have ended here even if I had taken different decisions. In the end, this is where I belong. GERAD is where I find inspiration, resources, where I am with people who share common interests. Here we all speak the same language." Now he can work on solving other, more complicated paths! ■

Interview with Patricia Gillett

Ph.D. student, École Polytechnique de Montréal, under the supervision of Miguel F. Anjos

A nonlinear adventure by Véronique Pagé

Patricia Gillett looks and talks like any mild-mannered GERAD student. But she truly is an adventurer at heart! Her first adventure started a few years ago, when, studying computational mathematics at Waterloo University, she found her interest waning: "I just wanted to be finished with my studies and find a job." Many know the feeling; few take the sort of dramatic steps Patricia did: she went on a year-long exchange to Japan. To help her integrate, her coordinator there gave her an office in his research group. Discovering academic research helped Patricia find her love of mathematics again, and it is with renewed motivation – and the desire to pursue graduate studies - that she came back to Waterloo.

A year later, Patricia was ready to embark on a Masters with Pr Miguel F. Anjos, then a faculty at University of Waterloo, when Pr Anjos was offered a position at École Polytechnique de Montréal. He invited her to follow him. It is worth noting Patricia spoke very little French and had never met Pr Anjos, who had been away to Germany. "I thought it sounded like an adventure..." An adventure she was obviously willing to try!

Patricia has now been in Montreal for over a year and a half. She has followed mathematics lectures in French and joined GERAD. Everything is going so well, in fact, that she has now transferred to a Ph.D., working in semi-definite optimization. She specializes in complementarity problems: "The real world is frequently nonlinear. Complementarity constraints accommodates some of this nonlinearity by letting us model 'if not A, then B' relationships. In particular, you can use complementarity to model electricity markets and determine which power plant sells how much power, and at what price." She calls joining GERAD a "happy accident": "It has become my home. I find it really helpful to be grouped with people who share common research interests rather than just the same academic affiliation."

Patricia's GERAD adventure is thus only beginning. The next one should see her go into industry and work as a mathematician, her long-held dream. In which country will it be? We'll have to wait and see! ■

Interview with Asma Mdimagh

Ph.D. student, École Polytechnique de Montréal, under the supervision of Alain Hertz and Odile Marcotte

The optimal path by Véronique Pagé

Asma Mdimagh came to GERAD in 2009, having just completed a Master's in applied mathematics at the Institut Supérieur de Gestion in Tunis. While her pursuing a Ph.D. at École Polytechnique Montréal is partly due to fortunate encounters, her choice of subject was perhaps more deliberate. Indeed, Asma's interest in graph theory is long-standing: "My Master's focused on Steiner's problem, a well-known problem in graph theory." Steiner's problem is basically that of finding the optimal network for connecting vertexes in a network. While she liked the problem itself, she was not as fond of the fact it was very abstract: "I wanted to carry on in that direction, but also to turn to more concrete questions."

Tangible questions cannot be hard to find at GERAD! Working under the supervision of Alain Hertz, of École Polytechnique de Montréal, and Odile Marcotte, of UQAM, Asma now specializes in optimizing energy networks. More specifically, she minimizes costs in electricity transport networks for renewable energies. The gap between the theoretical question she used to work on and the real-world application she now looks at is clearly now very wide: "Transportation costs are inevitably linked to the path chosen for the network and the length of cable that's required."

Asma, her supervisors and their collaborators have recently submitted a paper for publication, which will be a first for Asma. She has also presented her results at conferences. Her first presentation happened here at GERAD's Optimization Days. She appreciated the opportunity: "It was the perfect setting for a first presentation. Everybody knows everybody here!" Perhaps because of this friendly atmosphere, Asma has enjoyed being part of GERAD: "The research is good and the resources are good." She will soon be completing her Ph.D., upon which she hopes to carry on studying energy transport networks, a subject she finds both "vast and useful". For her future, Asma has clearly found... an optimal path! ∎

Interview with Samuel Rosat

M.Sc. Student, École Polytechnique de Montréal, under the supervision of François Soumis

The GERAD without constraints by Véronique Pagé

Until recently, Samuel Rosat, a new student at École Polytechnique de Montréal, was a student at Polytechnique. In France, that is! He was looking for an internship position when his professors mentioned GERAD: "It was one of a handful of options. There was GERAD, but also Berlin and the US." Students who were coming back from GERAD only had positive comments: "The student network at Polytechnique is very strong. I knew that if things had not gone well at GERAD, these students would have been open about it." But their feedback was far from negative. Add to this that Samuel was already a distant cousin of the GERAD family, having completed an internship at Air France with a supervisor who had himself been through a fourth year internship at GERAD!

So it comes as no wonder that, in September 2011, Samuel moved from Paris to Montreal. François Soumis, his supervisor, had also supervised his former supervisor at Air France. Nothing surprising there: professor Soumis indeed holds the Canadian Research Chair in Large Transportation Network Optimization.

Since his arrival, Samuel has mainly been concerned with lectures and courses. He already has an office in GERAD, though, and is getting to grips with his research subject: airlines schedule constraints and their effect on schedule creation. "Constraints come from all sides: employees must be given holidays, and they might express preferences as to when they want to take them. The airline demands a number of things from its schedule: that there should be a flight towards direction x everyday at a certain time; that all flights between France and Portugal minimally have one French-speaking and one Portuguese-speaking steward on board; and so on. Generating a schedule that respects all these constraints is evidently a very big task." His aim will be to aggregate constraints to simplify the algorithm: "Say there is a Paris-Athens flight immediately followed by a flight between Athens and Istanbul, for example. If you can assign the same pilot to both flights you can effectively consider them as one long flight, which will simplify the solution." Plenty of work for Samuel, then: GERAD's *French connection* is most definitely alive and well! ∎

Interview with Behnaz Saboonchi

Ph.D. student, HEC Montréal, under the supervision of Pierre Hansen and Sylvain Perron

From a language to another by Véronique Pagé

Behind Behnaz Saboonchi smiles there is a quiet strength that can apparently do anything. Today Behnaz spends her days coding in front of her computer, stopping once in a while to chat with colleagues. But none of this would have been possible just four years ago, when Behnaz arrived at GERAD, for she did not know any programming language or any French! "There was a lot of support available. For example Pierre Girard, who is the network administrator here, helped me a lot when I was learning to code." She also credits the friendly atmosphere for helping her to settle in: "When I first arrived I was worried that my not speaking French would be a problem, and I was a little lost. But I received a warm welcome and everyone made an effort to speak to me in English. So I learned French in my own time, not feeling rushed."

Behnaz was completing her Master's at the University of Windsor when she heard about GERAD. She wanted her works to take a more commercial and practical direction. At HEC Montréal, Pierre Hansen, also a GERAD member, accepted to be her supervisor. "M. Hansen has a very open mind as far as research is concerned. Very early on he put me in contact with one of his collaborators in France who works in quantitative marketing, which I'm really interested in. So I was free to choose a subject I'm truly passionate about." Behnaz works on franchise localization. To avoid cannibalism between different franchises of a same company, they must be located far enough from each other. "In graph theory, this type of dispersion problems cannot be exactly solved if they are very large." Behnaz therefore develops heuristic methods to solve the localization problem in situations where there is a large number of franchises.

Now that she has learned a language, learned how to code, that she is completing "three or four papers about [her] results", that she works as a lecturer at HEC Montréal, what is Behnaz dreaming of for her professional future? "I have a year left to my Ph.D., so I have not yet started looking for positions. But, I want to move into industry and work as a quantitative consultant or in data mining." Do not be fooled by her smile and her composure: when she does enter industry in a year's time, she will surely move mountains again! ∎

Interview with Mouna Sebri

Ph.D. student, HEC Montréal, under the supervision of Georges Zaccour

Happiness lies in mathematics by Véronique Pagé

Mouna Sebri was finishing her undergraduate degree in quantitative marketing when she enrolled on a Master's at HEC Montréal. She had one thing in mind: to do more maths! "As much as I like marketing, my master thesis experience made me passionate about managerial context analysis, data mining and modeling to address managerial questions. This is exactly what I'm doing in my research work." Econometric modeling of marketing issues, it turns out, is all Mouna needs to be happy!

Mouna is now a Ph.D. student at GERAD, where for the last three years she has been studying private labels. Private labels are home-branded products offered by supermarkets and which generally offer an alternative to national-brands products. Selling home-brand products alongside national brands inevitably transforms the retailer's relationship with manufacturers, as he becomes both his distributor and competitor. Mouna studies ways in which it would be possible to optimize the whole dis¬tribution channel in this particular context.

Mouna joined GERAD when she was finishing her Master's at HEC Montréal. She was looking for "more application of models using empirical data", but she also wanted to explore the possibility of pursuing a career in academia. By joining GERAD, both of these objectives were possible: "In fact, in GERAD, resources are readily available. It was very easy for me to access important databases, for example. Attending conferences has never been a problem. My supervisor Georges Zaccour encouraged me to attend conferences and offered his unconditional support. The support staff is very efficient and everybody is just lovely!" She had found a research subject she loved and the setting completely suited her: no wonders she decided to stay! In fact, she is now much clearer about her future: upon completion of her Ph.D., she will be looking at academic positions in Canada and elsewhere. Who knew hap-piness could be so easy to find? ∎

Farsightedness in a coalitional Great Fish War

Michèle Breton & Michel Yevenunye Keoula

The paper "Farsightedness in a coalitional Great Fish War" was published in *Environmental and Resource Economics*. It has been written by Michel Yevenunye Keoula, Ph.D. student, and Michèle Breton, professor at the Department of Management Sciences at HEC Montréal and GERAD member.

Fisheries are a crucial source of livelihood for hundreds of millions of people around the world. According to the Food and Agriculture Organization of the United Nations, there is an increasing trend in the proportion of overexploited, depleted or recovering fish stocks, which increased from 10 percent in 1974 to 32 percent in 2008. This depletion of the world fish stocks has been related to the well-known "Tragedy of the commons" described by the ecologist Garrett Hardin in 1968: individual rationality predicts that multiple individuals acting independently will ultimately deplete a shared resource, even when it is clear that it is not in anyone's long-term interest for this to happen.

One possible avenue to avoid this over-exploitation is coordination among users, in order to exploit the resource in a sustainable way. Indeed, a large number of regional fishery management organizations, typically including many countries, are presently involved in the management and coordination of international fisheries. In the case of the high seas, because of their open access nature, the existence of an agreement among a group a countries to preserve the fish stock (that we call a *coalition*) does not preclude any other interested country to have access to the fisheries. Our paper analyzes the profitability and stability of such coalitions in a non-cooperative game theory setting, assuming that members can freely access or leave the organization and that they act in their own best interest.

A coalition is profitable if players in the coalition are better-off than if no agreement existed. It is stable if no member has an interest in leaving the coalition, and no non-member has an interest in joining it. In general, stability of coalitions for the management of common resources is difficult to achieve, and additional features are needed to explain the actually observed level of participation, for instance, monetary transfers, punishments, or leadership. However, these features entail institutional arrangements that are often difficult to achieve for international fisheries.

In this paper, we rather explore the implications of conjectures by players about the impact of their eventual defection from an agreement. Most non-cooperative models use *Nash conjectures* as a stability concept: a country contemplating a deviation supposes that this deviation will have no impact on the decision of others to join or to leave the coalition. Rational conjectures imply that the country takes into account the impact of its deviation on the size of the coalition: thus, a country contemplating a deviation knows that this may trigger others to do the same, so that the size of the coalition may change by more than one player. For example, a Nash player contemplating leaving a coalition asks: Would I be better-off inside or outside this coalition? while a rational player asks: Would I be better-off inside this coalition, or outside the much smaller one that will result if I leave?

We study coalition stability in the stylized Great Fish Wars model, where fishery owners are characterized by their discount factor, and the fish stock is characterized by its growth potential.

> Our paper analyzes the profitability and stability of such coalitions in a non-cooperative game theory setting, assuming that members can freely access or leave the organization and that they act in their own best interest.

While with Nash conjectures, the maximum coalition that can be achieved in that model is of size 2, and this can only happen for very high discount factor and low growth potential, with rational conjectures we find stable coalitions of large size for an important range of parameter values. The farsightedness of players, or their ability to foresee the consequences of their decisions on the coalition structure, may explain the formation of large regional fisheries organization. We find that this is also true in models where deviations are not immediately detected and in models where the coalition has a first-mover advantage. ∎

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An exact algorithm for solving clusterwise regression problems

Réal A. Carbonneau, Gilles Caporossi & Pierre Hansen

The paper "Extensions to the repetitive branch and bound algorithm for globally optimal clusterwise regression" was published in *Computers and Operations Research*. It has been written by Réal A. Carbonneau, Ph.D. student, Gilles Caporossi and Pierre Hansen (co-directors), both professors at the Department of Management Sciences at HEC Montréal and GERAD members. Moreover, this paper received the Esdras Minville price 2012 for the best student paper at HEC Montréal.

Clustering helps researchers understand the core information underlying data by grouping observations in clusters according to some criterion. These criteria usually aim at grouping observations that are similar (homogeneity criterion) or to separate those which are different (separation criterion). In both cases, the criteria are usually based upon the concept of distance between observations.

However, clustering may also be used to find patterns in data and group observations that share a similar pattern. The clusterwise linear regression belongs to this category.

Clusterwise regression separates observations into k clusters and associates a linear regression model to each of them. Each observation is associated to the cluster whose regression model fits best and while simultaneously fitting at least squares regression model for each cluster computed from its observations. As opposed to regression, the goal of clusterwise regression is not to find a model that could be used for prediction, but to identify some patterns in the data and to group observations according to the patterns that characterizes them.

One special property of clusterwise regression is that very different observations (in term of

distance) may belong to the same cluster as long as a same linear model fits them all. Since the linear models of various clusters may differ widely according to their observations, the assignment of two observations to the same cluster often depends more on other observations than their own similitude. For this reason, the optimization model underlying clusterwise regression yields a large number of local optima. Its resolution is very difficult and heuristics often perform very poorly, therefore it is a good benchmark for optimization algorithms.

As opposed to regression, the goal of clusterwise regression is not to find a model that could be used for prediction, but to identify some patterns in the data and to group observations according to the patterns that characterizes them.

Even for very small datasets, no optimal algorithm existed until very recently and the previous resolution approach (by the same authors) was only able to handle very small problems.

A much more efficient algorithm based upon Brusco's repetitive branch and bound algorithm (RBBA) is now proposed.

The resolution strategy involves three key features which are iterative heuristic optimization, new ways of observation sequencing, and branch and bound optimization of a limited number of ending subsets. These three key features are combined together and lead to significantly faster optimization of the problem. The proposed strategy is generic and may extend beyond clusterwise regression to a wide variety of clustering criterion.

Additionally, an efficient implementation of incremental calculations within the branch and bound search algorithm eliminates most of the redundant ones. Experiments using both real and synthetic data compare the various features of the proposed optimization algorithm and contrasts them against the previous resolution strategy that was based upon a mixed logical-quadratic programming formulation optimized by CPLEX. The results indicate that all components of the proposed algorithm provide an important reduction of the processing times, and, when combined, generally provide the best performance, significantly outperforming the previous optimization strategy. ∎

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Pierre Hansen
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The Theory of Decentralized Cooperative and Non-cooperative Equilibria for Large Population Multi-agent Dynamical Systems

Minyi Huang, Peter Caines & Roland P. Malhamé

The paper "Social Optima in Mean Field LQG Control: Centralized and Decentralized Strategies" written by Minyi Huang, Peter E. Caines and Roland P. Malhamé, will appear in *IEEE Transactions on Automatic Control*.

Minyi Haung is currently professor in applied probability in the School of Mathematics and Statistics of the Carleton University. The research about this article began when he was a Ph.D. student at McGill University under the supervision of Peter E. Caines and Roland Malhamé.

For several years, the GERAD researchers Peter Caines and Roland Malhamé, together with their collaborator Minyi Hunag of Carleton University, Ottawa, and their students, have been working on a mean field theory formulation of the analysis and control of classes of very large population dynamical systems.

The systems under study involve *large populations of agents* each of which acts via a *state dependent feedback* control strategy utilizing the minimal amount of information on the past and current system behaviour necessary for various classes of control decision problems; a characteristic feature of such systems is that each agent becomes *asymptotically negligible* in the overall system behaviour as the population size tends to infinity and, moreover, the influence of the system on any given agent is in terms of the statistical properties of the whole population (e.g. the state population mean, population variance, and, more generally, the empirical distribution of the entire population); it is this which leads to the use of the statistical mechanics terminology of a *mean field* system.

There are many concrete case where the mean field formalism is applicable, in particular those where each agent pursues an individual objective but in so

> There are many concrete case where the mean field formalism is applicable, in particular those where each agent pursues an individual objective but in so doing needs to position itself either close to, or on the other hand, far from, the mass of the group.

doing needs to position itself either close to, or on the other hand, far from, the mass of the group. This situation arises in an *economic context* where the price of an article results from the aggregation of a large number of offers and bids; in this case each agent (equipped with its own utility function) will typically have an interest in making offers or bids which do not deviate significantly from the global mean. The large population model is also relevant in the case of *navigation* by large groups

of agents where each has limited communication abilities (as arises for micro-robots or flocking birds) and in that of the *panic behaviour* of crowds escaping a dangerous environment, where, in contrast to the previous cases, the interest of each agent is in reaching an emergency exit while distancing itself from the rest of the population as much as possible.

In these examples the spectrum of behaviour evidently extends from extreme competitiveness to complete cooperation where the equilibria in these contrasting situations are captured in game theory by the notions of a *Nash equilibrium* (in which an agent can gain nothing from a unilateral move) and that of a *Pareto equilibrium* (in which there is no collectively agreed move of all the agents which can improve the returns for every agent). In the case of Nash equilibria an important simplification occurs as the population tends to infinity; this is because, in the population limit a single agent has no impact upon the mass but must react with its optimal response (called a best response in game theory) to the mass behaviour. As a result a necessary condition for the existence of a Nash equilibrium is that the posited mass behaviour is *reproduced by the entire set of individual agent best responses* to that mass behaviour. This is the underlying principle which leads to the mathematical theory of what are now called (Nash) Mean Field Games in the writings of the three authors and those of other researchers. In the important special case of *linear quadratic games* the necessary conditions characterizing the mass behaviour and best response actions consist of a set of low dimensional linear differential equations. An important aspect of these limiting (infinite population) control actions is that they are completely decentralized and hence minimal in terms of the exchange of information; more specifically,

the form of the linear quadratic games control laws is that of a feedback of the individual agent's state plus a control depending upon the precomputable mass behaviour (given the initial mass state distribution); moreover, as in all Mean Field Games, when applied in the finite population case they give rise to a deviation from the Nash equilibrium which tends to zero as the population size tends to infinity.

Despite the fact that Nash equilibria are relatively stable with respect to attempts by individuals to make gains over the rest of the group, these equilibria can correspond to situations which are significantly less favorable for each agent than those which arise from collective action. The difference between the return per agent in a given Nash equilibrium and that in a feasible *cooperative equilibrium* is sometimes termed the *cost of anarchy*. A difficulty which arises in the analysis of cooperative equilibria which is not present in the competitive case is that, no matter how small their relative weight, the actions of each agent appears in the utility function of all the other agents and hence in their sum. Consequently one does not have a conceptually evident decoupling between the individual and mass as one does in the competitive large population Nash equilibrium case. Nevertheless, in the cited article, the authors show that for *linear quadratic cooperative games*, asymptotically in population size, there exists a limiting decentralized control law which achieves the social optimum and which has a simple form analogous to that found in the competitive case; the authors are then able to calculate the cost of anarchy in a set of numerical examples. ∎

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Cutting Planes for Branch-and-Price

Guy Desaulniers, Jacques Desrosiers & Simon Spoorendonk

Simon Spoorendonk is currently employed by the Technical University of Denmark, DTU Management Engineering. Through his doctoral and post-doctoral studies, he has been several times at GERAD where he worked under the supervision of two GERAD members, Guy Desaulniers, professor at the Department of Mathematics and Industrial Engineering of École Polytechnique de Montréal, and Jacques Desrosiers, professor at the Department of Management Sciences of HEC Montréal. The paper "Cutting Planes for Branch-and-Price Algorithms", published in *Networks*, is the result of one of these collaborations.

Branch-and-price, that is, column generation embedded into a branch-and-bound scheme, is already established as one of the leading solution methodologies for many large-scale integer programs. At GERAD, it has been particularly successful at solving problems with an underlying network structure such as vehicle routing and crew scheduling problems. For a majority of these problems, the reformulation leads to a set partitioning master problem and constrained shortest path problems as subproblems.

Decompositions and reformulations of integer programs are classical approaches for obtaining strong linear programming relaxations. These often entail the dynamic addition of variables (columns) and/or constraints (cutting planes) to the model. When the linear relaxation in each node

> The augmented subproblem indirectly indicates that there exists an augmented original formulation that includes these new variables and constraints.

of a branch-and-bound tree is solved by column generation, one speaks of branch-and-price. Optionally, as in standard branch-and-bound, cutting planes can be added to strengthen the linear relaxation, in which case the method is then called branch-price-and-cut.

The use of cutting planes (or valid inequalities) in branch-and-price has recently received increasing attention but has mostly been limited to specialized implementations. On the one hand, within a Dantzig-Wolfe reformulation process, there are many examples of inequalities defined on the variables of the original formulation, among these, the classical subtour elimination constraints and the two-path cuts for vehicle routing applications. On the other hand, one can find an early example of cutting planes defined on the master problem variables for solving the edge coloring problem. The treatment of these inequalities complexifies the subproblem which is then solved by branch-and-bound. Other examples can be found for various cutting stock problems and vehicle routing problems with time windows.

The main contribution of this paper is the introduction of a generic framework for dealing with cutting planes in branch-and-price algorithms. In particular, it unifies the treatment of cuts defined on the column generation master problem variables. Indeed, valid inequalities can be derived using the variables of an equivalent original formulation (i.e., those already present in the subproblem) or the variables of the master problem. The way to manage the first case is rather simple. It suffices to define the inequalities on the original formulation and to reapply the reformulation process on the modified formulation. In the second

case, cutting planes defined on the variables of the integer master problem are more difficult. These inequalities give rise to new variables and constraints within the subproblem. The augmented subproblem indirectly indicates that there exists an augmented original formulation that includes these new variables and constraints. The introduction of new variables and possibly nonlinear functions in the subproblem may increase its computational complexity, and one will always have to evaluate the trade-off between the quality of the linear relaxation bound and the effort taken to achieve it.

Three examples on how to apply and interpret the framework are presented. In the first one (the vehicle routing problem with time windows), both types of cuts are considered, that is, cuts using the arc-flow variables and the path-flow variables. In the second application (the edge coloring problem), the master problem matching variables are used to construct the odd circuit cuts. Finally, in the cutting stock problem, we describe inequalities using the cutting pattern variables. ■

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Territorial Intelligence Modeling for Energy Development (TIMED)
A Case Study for the Baie-des-Sables (Canada) Wind Farm

Maria de L. Vazquez , Jean-Philippe Waaub & Adrian Ilinca

The paper "Territorial Intelligence Modeling for Energy Development (TIMED) – A Case Study for the Baie-des-Sables (Canada) Wind Far", written by Maria de L. Vazquez , Jean-Philippe Waaub and Adrian Ilinca, will appear in *International Journal of Multicriteria Decision Making*.

Maria de Lourdes Vazquez Rascon is a Ph.D. student in Environmental Science at UQAR. She is under the supervision of the Professors Adrian Ilinca (Department of Mathematics, Computer Science and Engineering at UQAR and Director the LREE (Laboratoire de recherche en énergie éolienne)) and Jean-Philippe Waaub (Department of Geography, UQAM and Director of GERAD).

This paper presents the application of a new approach, Territorial Intelligence Modeling for Energy Development (TIMED), developed in response to growing concerns about the social acceptance of wind farms. Project development is based on procedure transparency and involvement of all stakeholders. TIMED approach was presented at the 70th Meeting of the European Working Group on "Multiple Criteria Decision Aiding," in Moncton, Canada, in September 2009 and at the First Intercontinental Conference on Territorial Intelligence, at Gatineau, Canada, in October 2011.

This approach provides decision makers with a set of conditions for a transparent and participatory process during the implementation of wind farms. TIMED put in place four modules: MCDA (Multi-criteria Decision Aid), participatory and collaborative GIS (Geographic Information System), contributory stakeholder involvement (CSI) and scientific knowledge / local knowledge (SK-LK). Moreover, to be closer to reality, these four modules are articulated with scenario modeling postulates as well as decisional weighting for every stakeholder involved in the decision-making process.

The purpose of MCDA is to assess the preference systems of the stakeholders on a multicriteria basis. These preference systems, which are generally conflicting, are analyzed in a process which makes it possible to structure them (Roy and Bouyssou, 1993). The participatory and collaborative GIS module is used to analyze the geo-referenced variables involved to design the scenarios and then to perform their strategic assessment according to the MCDA module. The Contributive Stakeholder Involvement module (CSI) identifies four categories of stakeholders: civil society, public sector, private sector and experts (Prades, Loulou and Waaub, 1998). The

scientific knowledge/local knowledge module (SK-LK) makes it possible to build a justification framework with a cognitive basis that also takes into account the stakeholders and their values.

Voluntary and upstream use of the proposed TIMED approach provides the ability to analyze alternative scenarios and build consensus in decision-making that eventually produce an acceptable if not optimal plan for the stakeholders.

In Quebec, between 1997 and 2011, the Office of Public Hearings in Environment (BAPE – Bureau d'audiences publiques sur l'environnement) identified 15 wind farm plans that were submitted to public hearings. Since 2010, the conclusions of the BAPE reports are showing increasing problems of social acceptability that require further studies and the development of appropriate solutions to be implemented. Specific aspects that should be considered are the perceived and real psychosocial impacts of wind farms and the deterioration of relations between supporters and opponents. Voluntary and upstream use of the proposed TIMED approach provides the ability to analyze alternative scenarios and build consensus in decision-making that eventually produce an acceptable if not optimal plan for the stakeholders.

The model was tested in the Baie-des-Sables wind farm plan located in Quebec, Canada. This was done as an academic research and did not impact the current operation of the farm, which started back in November 2006. If this approach requires more efforts from the wind farm developer at the preparation stage it has the advantages of reducing the risks and overall duration of the infrastructure launching. ∎

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Integrated airline crew scheduling

Mohammed Saddoune, Guy Desaulniers, Issmail Elhallaoui & François Soumis

The papers "Integrated Airline Crew Pairing and Crew Assignment by Dynamic Constraint Aggregation" published in *Transportation Science* and "Integrated airline crew scheduling: A bi-dynamic constraint aggregation method using neighborhoods" published in *EJOR*, are the results of the doctoral studies of Mohammed Saddoune and Issmail Elhallaoui. They are now respectively professor at Université Hassan II – Mohammedia Casablanca, Morocco and professor at École Polytechnique de Montréal. They both did their Ph.Ds at École Polytechnique de Montréal under the supervision of François Soumis and Guy Desaulniers, Professors in the Department of Mathematics and Industrial Engineering at École Polytechnique de Montréal.

Traditionally, the airline crew scheduling problem has been decomposed into a crew pairing problem and a crew assignment problem, both of which are solved sequentially. The first consists of generating a set of least-cost crew pairings (sequences of flights starting and ending at the same crew base) that cover all flights. The second aims at finding monthly schedules (sequences of pairings) for crew members that cover all pairings previously built. Pairing and schedule construction must respect all safety and collective agreement rules. In this paper, we focus on the pilot crew scheduling problem in a bidline context where anonymous schedules must be built for pilots and high fixed costs are considered to minimize the number of scheduled pilots. We propose a model that completely integrates the crew pairing and crew assignment problems, and we develop a combined column generation/dynamic constraint aggregation method for solving them.

Computational results on real-life data show that integrating crew pairing and crew assignment can yield significant savings—on average, 3.37% on the total cost and 5.54% on the number of schedules for the 7 tested instances. The integrated approach, presented in the first paper however, requires computational times than was 6.8 time higher the sequential approach.

The second paper enhances this method to obtain lower computational times. In fact, we develop a bi-dynamic constraint aggregation method that exploits a neighborhood structure when generating columns (schedules) in the column generation method. The subproblem generating columns works in a subnetwork in the neighborhood of the actual solution. The neighborhood is modified dynamically using reduced cost information to include arcs with the potential to improve the solution.

On the same set of seven instances, this method allows to reduce the computational times by an average factor of 2.3, while improving the quality of the computed solutions. Savings of 4.76% on the total cost and 5.85% on the number of schedules were achieved with this new solution method which requires only an average computational time than was 3 time higher the sequential approach. This integrated approach has a big commercial potential knowing than a saving of 1% on crew cost corresponds to more than 10 millions dollars per year in a large company. ■

> This integrated approach has a big commercial potential knowing than a saving of 1% on crew cost corresponds to more than 10 millions dollars per year in a large company.

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Les Cahiers du GERAD – GERAD Technical Reports

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G-2011-60   The Effect of Proactive Adaptation on Green Investment
       Bahn, O., Chesney, M., Gheyssens, J.

G-2011-61   Review of Models and Actors in Energy Mix Optimization – Can we align Leader Visions and Decisions with Optimum Strategies for our Future Energy Systems?
       Weijermars, R., Taylor, P., Bahn, O., Ranjan Das, S., Wei, Y.-M.

G-2011-62   Comment on "Evolutionary Method for Finding Communities in Bipartite Networks"
       Costa, A., Hansen, P.

G-2011-63   On the Impact of Symmetry-Breaking Constraints on Spatial Branch-and-Bound for Circle Packing in a Square
       Costa, A., Hansen, P., Liberti, L.

G-2011-64   An Algorithm for Parametric Communities Detection in Networks
       Bettinelli, A., Hansen, P., Liberti, L.

G-2011-65   A Branch-Price-and-Cut Algorithm for the Min-Max k-Vehicle Windy Rural Postman Problem
       Benavent, E., Corberan, A., Desaulniers, G., Lessard, F., Plana, I., Sanchis, J.M.

G-2011-66   Improved Column Generation for Highly Degenerate Master Problems
       Desrosiers, J., Gauthier, J.-B., Lubbecke, M.E.

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       Jans, R., Desrosiers, J.

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       Costanzo, G.T., Zhu, G., Anjos, M.F., Savard, G.

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       Rémillard, B.

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       Ben Guedria, S., Sansò, B., Frigon, J.-F.

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G-2011-81   A Branch-Price-and-Cut Algorithm for the Workover Rig Routing Problem
       Ribeiro, G.M., Desaulniers, G., Desrosiers, J.

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             Azarfar, A., Frigon, J.-F., Sansò, B.

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             Hungerländer, P., Anjos, M.F.

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             Carlsson, J.G., Delage, E.

G-2012-05   The Value of Stochastic Modeling in Two-Stage Stochastic Programs with Cost Uncertainty
             Delage, E., Arroyo, S., Ye, Y.

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             Angers, J.-F., MacGibbon, B.

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             Larumbe, F, Sansò, B.

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G-2012-12   A Primal-Dual Regularized Interior-Point Method for Semidefinite Programming
             Dehghani, A., Goffin, J.-L., Orban, D.

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             Fertel, C., Bahn, O., Vaillancourt, K., Waaub, J.-Ph.

G-2012-14   Formulations and Branch-and-Cut Algorithms for Multi-Vehicle Production and Inventory Routing Problems
             Adulyasak, Y., Cordeau, J.-F., Jans, R.

G-2012-15   Engineering Branch-and-Cut Algorithms for the Equicut Problem
             Anjos, M.F., Liers, F, Pardella, G., Schmutzer, A.

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             Costanzo, G.T., Kosek, A.M., Zhu, G., Ferrarini, L., Anjos, M.F., Savard, G.

G-2012-17   Branch-Price-and-Cut for Creating an Annual Delivery Program of Multi-Product Liquefied Natural Gas
             Rakke, J.G., Andersson, H., Christiansen, M., Desaulniers, G.

Revisions

G-2009-24   A Learning Optimization Algorithm in Graph Theory. Versatile Search for Extremal Graphs Using a Learning Algorithm
Caporossi, G., Hansen, P.
Revision: January 2012

G-2009-37   NOMAD user guide. version 3.5.1
Le Digabel, S., Tribes, C.
Revision: March 2012

G-2010-74   A Survey of Nordhaus-Gaddum Type Relations
Aouchiche, M., Hansen, P.
Revision: December 2011

G-2011-08   An Interior-Point Algorithm with Selective Addition of Inequalities for Solving Doubly Non-Negative Relaxations of Maximum-Stable-Set and Maximum-Clique Problems
Engau, A., Anjos, M.F., Bomze, I.
Revision: November 2011

G-2011-38   The Poisson Maximum Entropy Model for Homogeneous Poisson Processes
Khribi, L., Fredette, M., MacGibbon, B.
Revision: February 2012

G-2011-79   Optimizing the Design of a Wing Farm Collection Network
Hertz, A., Marcotte, O., Mdimagh, A., Carreau, M., Welt, F.
Revision: April 2012

GERAD Scholarships

- Postdoctoral fellowship: **Émile Simon**, supervised by Charles Audet and Sébastien Le Digabel

- Postdoctoral fellowship: **Mojtaba Nourian**, supervised by Peter Caines and Roland Malhamé

- Visiting first cycle internship scholarships: Ms **Dounia Lakhmiri**, MM. **Jean-Paul Ahouassou, Yoann Couble**, **Oussama Marzouk** and **Yvann Nzengue**

Thesis Defences

- **Diego Amaya**, supervised by Geneviève Gauthier
  Doctoral Thesis: Trois essais en méthodes numériques appliquées à la finance

- **Pablo Andrés-Domenech**, cosupervised by Georges Zaccour and Guiomar Martín-Herrán
  Doctoral Thesis: Three Essays on Sustainable Forest Management

- **Réal A. Carbonneau**, supervised by Gilles Caporossi and Pierre Hansen
  Doctoral Thesis: Data Mining for Commerce Problems: Global Optimization of Clusterwise Regression and Neural Networks Applied to Electronic Negotiations

Awards, honours and contributions

- **Erick Delage** (Professor, Department of Management Sciences, HEC Montréal) has win the "Jeune chercheur" Prize. This prize, awarded by HEC Montréal, recognizes research production, done in the last three years.

- The Canadian Transportation Research Forum (CTRF) has presented the 2010-2011 Jim Davey Award for the best doctoral paper by a student in Canada to **Julie Paquette** (Professor, Department of Logistics and Operations Management, HEC Montréal) (Ph.D. 2010), for her article entitled "Mesure de la qualité de service et développement d'un outil d'aide à la décision multicritère en transport adapté : le cas de la ville de Longueuil." The article summarizes her thesis, co-directed by Jean-François Cordeau and Gilbert Laporte.

- The INFORMS Simulation Society was pleased to recognize **Pierre L'Ecuyer** (Professor, Department of Computer Science and Operations Research, Université de Montréal) with its "Distinguished Service Award" during the opening ceremonies of the 2011 Winter Simulation Conference, held in Phoenix, Arizona on December 11, 2011.

- The Université de Moncton saluted the remarkable career of **Debbie J. Dupuis** (Professor, Management Sciences, HEC Montréal) by awarding her "Le Prisme" on February 27. The award is presented every year to a Science Faculty graduate or student who has distinguished himself or herself in the sciences.

- **Gilbert Laporte**, (Professor, Department of Management Sciences, HEC Montréal) is Canada's third most influential researcher in the field of business, according to HiBAR, the Hirsch-Index Benchmarking of Academic Research. The first Canadian version of the index was recently published in The Globe and Mail.

Trainees

September 13 to December 31, 2011
Thibault Lehouillier
Grenoble INP-Ensimag, Université de Grenoble, France

October 27 to December 8, 2011
Alberto Costa
École Polytechnique de Palaiseau, France

November 1st to December 1st, 2011
Weiguang Yang
University of California, San Diego, U.S.A.

November 2, 2011 to February 2, 2012
Romain Absil
Université de Mons, Belgium

November 7-17, 2011
Jørgen Glomvik Rakke
Norwegian University of Science and Technology, Norway

November 13-25, 2011 and
February 2, 2012 to February 2, 2013
Luca Gianoli
Politecnico Di Milano, Italy

December 2, 2011 to December 2, 2012
Fabien Ngendakuriyo
Université catholique de Louvain, Belgium

January 11, 2011 to January 11, 2012
Camille Fertel
UQÀM, Canada

January 16-20, 2012
Vincent Martinet
Institut national de la recherche agronomique-Économie publique (INRA), France

February 13 to June 9, 2012
Walid Majdoub
École Polytechnique de Tunisie, Tunisia

February 15 to June 15, 2012
Wiem Ben Dhia
École Polytechnique de Tunisie, Tunisia

February 15 to June 15, 2012
Kaouthar Fehri
École Polytechnique de Tunisie, Tunisia

February 15 to June 15, 2012
Salma Nachi
École Polytechnique de Tunisie, Tunisia

February 20, 2012 to February 19, 2013
Puduru Viswanadha Reddy

March 1st to August 7, 2012
Illyas Himmich
Institut National de Statistique et d'Économie Appliquée (INSEA), Morocco

March 1st to August 7, 2012
Younes Skandrani
ENSIAS, Morocco

Trainees *(continued)*

March 5 to August 24, 2012
Régis Bardet
ENSTA Paris Tech, France

March 19 to October 31, 2012
Carmelo Cascone
Politecnico di Milano, Italy

April 4 to September 3, 2012
Mehdi Boutrif
ISIMA, France

April 9 to August 31, 2012
André Linhares
ENSTA Paris Tech, France

April 10 to August 31, 2012
Théophile Lohier
ISIMA, France

April 10 to August 31, 2012
Bénérice Petit-Romec
ISIMA, France

April 16 to June 8, 2012
Nathalie Turin
Haute École de Gestion de Genève, Switzerland

Visitors

October 4 to November 30, 2011
Jordan Ninin
Institut de recherche en informatique de Toulouse, IRIT, France

November 10-30, 2011
Ekaterina Shevkoplyas
St-Petersburg State University, Russia

November 16 to December 1, 2011
Fabien Prieur
LAMETA-INRA, Université Montpellier I, France

November 21-25, 2011
Antonio Capone
Politecnico di Milano, Italy

November 21-25, 2011
Ilario Filippini
Politecnico di Milano, Italy

November 21-30, 2011 and April 16 to Mai 13, 2012
Alain Jean-Marie
INRIA, Montpellier, France

November 21-30, 2011 and April 16 to Mai 13, 2012
Mabel Tidball
LAMETA, INRIA, Montpellier, France

November 23-25, 2011
Vladimir Mazalov
Karelian Research Center, Russia

November 24-29, 2011
Agnieszka Wiszniewska-Matyszkiel
Warsaw University, Poland

November 24-30, 2011
Frédéric Messine
ENSEEIHT-Institut de recherche en informatique de Toulouse, France

January 9-13, 2012
Nawel Amrouche
Long Island University, U.S.A.

January 10-16, 2012
Yuya Higashikawa
Kyoto University, Japan

January 10-16, 2012
Yushi Miyata
Kyoto University, Japan

January 10-16, 2012
Atsushi Takizawa
Kyoto University, Japan

January 12 to February 12, 2012
Mohammed Saddoune
Faculté des Sciences et Technologies Mohammedia, Morocco

January 25-30, 2012
Christophe Duhamel
ISIMA, France

February 1-3, 2012
Marcelo Eduardo Vieira Segatto
Universidade Federal do Espírito Santo, Brazil

February 1st to April 15, 2012
Sandrine Mouysset
Institut de recherche en informatique de Toulouse (ENSEEIHT), France

Visitors *(continued)*

February 14-22, 2012
Charles Ingene
The University of Mississippi, U.S.A.

March 1-7, 2012
Andrew R. Conn
IBM T.J. Watson Research Center, U.S.A.

March 18-23, 2012
Peter M. Kort
Tilburg University, The Netherlands

April 9 to June 30, 2012
Paolo Caravani
Université de L'Aquila, Italy

April 12 to May 12, 2012
Joseph Abdou
Université Paris 1 Panthéon-Sorbonne-Économie, France

April 16-20, 2012
Ross Cressman
Wilfrid Laurier University, Canada

April 16-20, 2012
Vlastimil Krivan
Academy of Sciences of the Czech Republic, Czech Republic

April 22-27, 2012
Lina Mallozzi
Università Degli Studi Di Napoli Federico II, Italy

April 23 to May 11, 2012
Stefano Gagliardo
Università Degli Studi Di Genova, Italy

Activities

Workshops

November 25-26, 2011
Third Workshop on Dynamic Games in Management Science

GERAD Seminars

April 23, 2012
Aditya Mahajan (McGill University, Canada)
Optimal decentralized stochastic control: A common information approach

April 5, 2012
Pierre-Henri Bombenger (Université Laval, Canada)
Médiation décisionnelle des outils SIG/AMCD pour la planification des communes rurales

February 14, 2012 (Séminaire conjoint GERAD/McGill ISS)
Zhongjing Ma (Beijing Institute of Technology, China)
Arman C. Kizilkale (Université McGill, Canada)
Talks on systems and control for smart grids

January 27, 2012
Jean-Claude Vansnick (Université de Mons, Belgium)
Nouveaux développements de l'approche MACBETH dans le cadre de la pondération des critères

Activities

GERAD/Mprime Seminars

March 29, 2012
Marina Epelman (University of Michigan, U.S.A.)
A column generation-based algorithm for Volumetric Modulated Arc Therapy (VMAT) treatment plan optimization

March 22, 2012
Xiao-Wen Chang (McGill University, Canada)
Lattice reduction and integer least squares problems

March 15, 2012
Richard Caron (Windsor University, Canada)
Optimization of the accumulating priority queue with an application to emergency department service targets

March 12, 2012
Oleksandr Romanko (McMaster University, Canada)
Multiobjective and robust optimization in finance and risk management

March 1st, 2012
Andrew R. Conn (T.J. Watson Research Center, U.S.A.)
Simulation and optimization in an industrial research environment

February 22, 2012
Andreas Grothey (University of Edinburgh, UK)
Interior point warmstarts and stochastic programming

February 16, 2012
Julio César Góez (Lehigh University, U.S.A.)
Conic representation of the convex hull of disjunctive sets and conic cuts for integer second order cone optimization

February 9, 2012
Marco Cuturi (Kyoto University, Japan)
Ground metric learning

January 26, 2012
Christophe Duhamel (ISIMA, France)
An efficient hybrid heuristic for the routing and wavelength assignment problem

January 19, 2012
Michael C. Ferris (University of Wisconsin, U.S.A.)
MOPEC: Multiple optimization problems with equilibrium constraints

January 12, 2012
Atsushi Takizawa (Kyoto University, Japan)
Mathematical models for evacuation planning

December 1st, 2011
François Bouffard (McGill University, Canada)
Identification of umbrella contingencies in electricity networks

November 24, 2011
Henry Wolkowicz (University of Waterloo, Canada)
Robust algorithms for linear and semidefinite programming

November 17, 2011
Weiguang Yang (University of California, U.S.A.)
A Y-graft design for the Fontan procedure using computational fluid dynamics and derivative-free optimization

November 10, 2011
David Bremner (University of New Brunswick, Canada)
Orbitwise polyhedral representation conversion

November 3, 2011
Joaquim R.M.M. Martins (University of Michigan, U.S.A.)
Multidisciplinary design optimization: An introduction for applied mathematicians

Activities

GERAD Seminars cofunded by Fondation HEC and the Data Mining Chair

February 22, 2012
Sandrine Mouysset (ENSEEIHT-Institut de recherche en informatique de Toulouse, France)
Classification spectrale : interprétation, parallélisation et applications

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

April 27, 2012
Joseph Abdou (Université Paris I, France)
Stability and stability index of political mechanisms

April 23, 2012
Lina Mallozzi (Università degli Studi di Napoli Federico II, Italy)
Hierarchical models for aggregative games with supermodularity

April 19, 2012
Ross Cressman (Wilfrid Laurier University, Canada)
The single-species habitat selection game

April 19, 2012
Vlastimil Krivan (Academy of Sciences of the Czech Republic, Czech Republic)
On Lotka-Volterra population games

March 21, 2012
Peter M. Kort (Tilberg University, The Netherlands)
The Deterministic impulse control maximum principle in operations research: Necessary and sufficient optimality conditions

November 28, 2011
Agnieszka Wiszniewska-Matyszkiel (Warsaw University, Poland)
Open and closed loop Nash equilibria in games with continuum of players

November 23, 2011
Fabien Prieur (INRA et Université Montpellier I, France)
Technological vs ecological switch and the environmental Kuznets curve

November 18, 2011
Ekaterina Shevkoplyas (St. Petersburg State University, Russia)
Differential games with random time horizon

Activities

"Meet a GERAD researcher!" Seminars

May 3, 2012
Mohammad E. Nikoofal (McGill University, Canada)
How to (and how not to) manage supplier's process improvement: Delegation, incentives, or audit

April 26, 2012
Mehmet Gumus (McGill University, Canada)
With or without information sharing: Competition and credibility under information asymmetry

April 11, 2012
Hélène-Sarah Bécotte-Boutin (HEC Montréal, Canada)
Lobster, caterpillar, spider and other trees

April 4, 2012
Gilles Caporossi (HEC Montréal, Canada)
AutoGraphiX III - Description of the new generation of AGX

March 26, 2012
Patricia Gillett (École Polytechnique de Montréal, Canada)
Semidefinite programming approaches for a class of complementarity problems

March 19, 2012
Miguel F. Anjos (École Polytechnique de Montréal, Canada)
Optimisation SDP : Quoi, comment, pourquoi?

February 23, 2012
Asma Mdimagh (École Polytechnique de Montréal, Canada)
Implantation et généralisation d'un modèle de collecte d'énergie éolienne

February 16, 2012
Odile Marcotte (UQÀM, Canada)
Un modèle pour la collecte d'énergie éolienne

January 26, 2012
Camille Fertel (UQÀM, Canada)
Modéliser la sécurité des corridors dans TIMES-Canada : « Une approche multicritères »

January 19, 2012
Olivier Bahn (HEC Montréal, Canada)
Kathleen Vaillancourt (UQÀM, Canada)
Modèles d'aide à la décision au sein de l'Équipe Énergie du GERAD (E2G)

November 17, 2011
Mohammad Afshar (UQÀM, Canada)
From producer-scrounger game in behavioral ecology to market problem in economy: A reinforcement learning model for decision making in frequency-dependent situation

November 10, 2011
Luc-Alain Giraldeau (UQÀM, Canada)
La décision de l'agent dans un contexte de jeu exploré en observant des volées d'oiseaux engagées dans un jeu Producteur-chapardeur

Activities

Séminaires pas ordinaires

March 27, 2012
Marilène Cherkesly (École Polytechnique de Montréal, Canada)
Application du problème du voyageur de commerce à la livraison de prescriptions dans une pharmacie de Montréal

February 2, 2012
Claire Lucas (HEC Montréal, Canada)
Symmetries in integer linear programs

January 19, 2012
Pablo Andrés Domenech (HEC Montréal, Canada)
Viability theory in a nutshell

December 7, 2011
Federico Larumbe (École Polytechnique de Montréal, Canada)
Network design in the Cloud Computing context

November 30, 2011
Lê Nguyên Hoang (École Polytechnique de Montréal, Canada)
Game optimization

November 16, 2011
Richard Kidwingira (HEC Montréal, Canada)
Introduction to game theory and applications

CRM-ISM-GERAD Statistics Colloquium

April 13, 2012
Longhai Li (University of Saskatchewan, Canada)
High-dimensional feature selection using hierarchical bayesian logistic regression with heavy-tailed priors

April 13, 2012
Sunil Rao (University of Miami, U.S.A.)
Best predictive estimation for linear mixed models with applications to small area estimation

March 9, 2012
Mori Jamshidian (California State University, U.S.A.)
Using tests of homoscedasticity to test missing completely at random

March 9, 2012
Hugh Chipman (Acadia University, Canada)
Sequential optimization of a computer model and other "active learning" problems

February 10, 2012
Jochen Blath (Technological University Berlin, Germany)
Longterm properties of the symbiotic branching model

February 10, 2012
Windried Stute (Justus Liebig University Giessen, Germany)
Principal component analysis of the Poisson Process

January 13, 2012
Yulei He (Harvard School of Public Health, U.S.A.)
Bayesian approaches to evidence synthesis in clinical practice guideline development

December 9, 2012
Giles Hooker (Cornell University, U.S.A.)
Detecting evolution in experimental ecology: Diagnostics for missing state variables

November 11, 2011
Ana-Maria Staicu (North Carolina State University, U.S.A.)
Skewed functional processes and their applications

November 11, 2011
Hélène Guérin (Université Rennes 1, France)
An ergodic variant of the telegraph process for a toy model of bacterial chemotaxis