

**Journées de l'optimisation/OPDE 2013**  
***2013 Optimization Days/OPDE***

6, 7 et 8 mai 2013  
*May 6, 7 and 8, 2013*

Programme et résumés  
*Program and abstracts*



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OPDE 2013**

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# Bonjour !

Bienvenue aux Journées de l'Optimisation / OPDE 2013 !

C'est avec joie et honneur que nous vous accueillons à HEC Montréal pour cette conférence internationale qui combine cette année la programmation des Journées de l'Optimisation avec la 4<sup>e</sup> conférence « Des outils pour décider ensemble » (OPDE). Nous vous proposons cinq séances plénières, cinq exposés magistraux, et plus de deux cents présentations sur des sujets variés. De plus, l'année 2013 est aussi celle des « Mathématiques de la Planète Terre », à laquelle le GERAD et la conférence se sont associés. Nous espérons que vous trouverez votre participation des plus enrichissantes du point de vue scientifique.

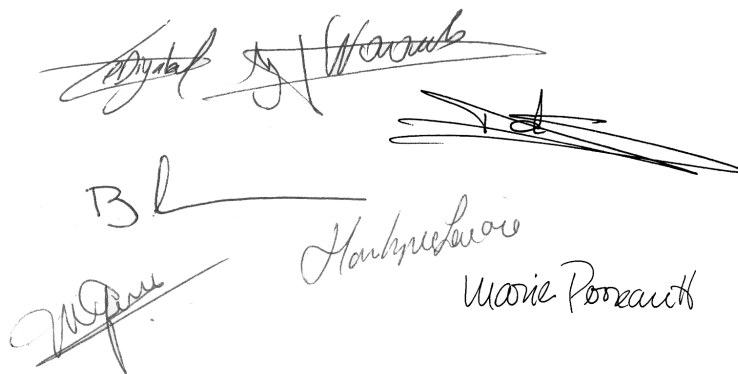
Cette année, en plus du traditionnel « Vins et fromages » du lundi à 17 h 30 où vous pourrez socialiser avec les autres participants, nous vous proposons également un banquet le mardi à 19 h 00 à l'Auberge St-Gabriel. Nous vous y attendons en grand nombre.

# Bonjour !

*Welcome to the 2013 Optimization Days / OPDE !*

*It is with delight and honour that we welcome you at HEC Montréal for this international conference that, this year, combines the Optimization Days with the 4th conference on "Tools for Group Decision" (OPDE). We are offering five plenary sessions, five tutorials and more than two hundred presentations on various subjects. In addition, the year 2013 is the year of the "Mathematics of Planet Earth", which is endorsed by both GERAD and the conference. We wish all participants a very fruitful conference.*

*This year, in addition to the traditional "Wine and Cheese" party on Monday at 5:30pm where you can socialize with other participants, we have also proposed a banquet on Tuesday at 7:00pm at the Auberge St-Gabriel. See you there in large numbers. We hope you will all join us.*

A collection of handwritten signatures in black ink. At the top, there are two long, horizontal signatures. Below them, on the left, is a signature that appears to be 'B.L.' followed by a horizontal line. To the right of this is another signature. Below the 'B.L.' signature is another one. To the right of the 'B.L.' signature is a signature that looks like 'Hankins'. Below that is a signature that looks like 'Marie Perreault'.

## Emplacement des activités / *Activity locations*

HEC Montréal  
3000, ch. de la Côte-Ste-Catherine  
Montréal (Qc) Canada, H3T 2A7  
Tel. : (514) 340-6053  
Fax : (514) 340-5269  
jopt@gerad.ca  
<https://symposia.gerad.ca/jopt2013>

- ◇ Pausas café : salle Investissement Québec (rez-de-jardin)
  - ◇ Courrier électronique : salle Tata communications (rez-de-jardin)
  - ◇ Séances plénières : Amphithéâtre IBM (rez-de-jardin)
  - ◇ Autres séances : 1<sup>er</sup> étage
  - ◇ Vins et fromages : Salon L'Oréal (rez-de-jardin)
- 
- ◇ *Coffee breaks: room Investissement Québec (Garden Level)*
  - ◇ *Email facilities: room Tata communications (Garden Level)*
  - ◇ *Plenary Sessions: Amphithéâtre IBM (Garden Level)*
  - ◇ *Other Sessions: 1<sup>st</sup> floor*
  - ◇ *Wine and Cheese Party: Salon L'Oréal (Garden Level)*

## Comité organisateur / *Organizing Committee*

**Miguel F. Anjos**  
GERAD, Polytechnique Montréal  
**Olivier Bahn**  
GERAD, HEC Montréal  
**Sébastien Le Digabel**  
GERAD, Polytechnique Montréal  
**Dominique Orban**  
GERAD, Polytechnique Montréal

**Jean-Philippe Waaub**  
GERAD, UQAM  
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**Marilyne Lavoie**  
GERAD  
**Marie Perreault**  
GERAD

## Commanditaires / *Sponsors*

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 **McGill**

 **POLYTECHNIQUE  
MONTRÉAL**

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**Math**  


**LAMSADE**  
UMR CNRS 7243  
laboratoire d'analyse et modélisation de systèmes pour l'aide à la décision

  
dépasser les frontières

**DAUPHINE**  
UNIVERSITÉ PARIS

  
**DRM**  
Dauphine Recherches en Management  
CNRS UMR 7088

# Le programme en bref / *Overview of Events*

## Lundi, 6 mai 2013 / *Monday, May 6, 2013*

- 08:45–09:00 Séance d'ouverture / *Opening Session*  
**Jean-Philippe Waaub**, directeur du GERAD / *Director of GERAD*
- 09:00–10:00 Séance plénière MAP / *Plenary Session MAP*  
**Andrew R. Conn**, IBM Research, États-Unis
- 10:00–10:30 Pause café / *Coffee Break*
- 10:30–12:10 Exposé magistral MA1 / *Tutorial MA1*  
**Michèle Breton**, GERAD – HEC Montréal, Canada
- 10:30–12:10 Séances en parallèle MA / *Parallel Sessions MA*
- 12:10–14:00 Déjeuner / *Lunch*
- 14:00–15:00 Séance plénière MBP / *Plenary Session MBP*  
**Fred S. Roberts**, DIMACS, Rutgers University, États-Unis
- 15:00–15:30 Pause café / *Coffee Break*
- 15:30–17:10 Exposé magistral MB1 / *Tutorial MB1*  
**Mathieu Cloutier**, GERAD, Canada
- 15:30–17:10 Séances en parallèle MB / *Parallel Sessions MB*
- 17:30–21:00 Réception “Vins et fromages” / *Wine and Cheese Party*

## Mardi, 7 mai 2013 / *Tuesday, May 7, 2013*

- 09:00–10:00 Séance plénière TAP / *Plenary Session TAP*  
**Joaquim João Júdice**, Universidade de Coimbra, Portugal
- 10:00–10:30 Pause café / *Coffee Break*
- 10:30–12:10 Exposé magistral TA1 / *Tutorial TA1*  
**Robert Doverspike**, Network Evolution Research, AT&T Labs, États-Unis
- 10:30–12:10 Séances en parallèle TA / *Parallel Sessions TA*
- 12:10–14:00 Déjeuner / *Lunch*
- 14:00–15:00 Séance plénière TBP / *Plenary Sessions TBP*  
**Pierre Gauthier**, Université du Québec à Montréal, Canada
- 15:00–15:30 Pause café / *Coffee Break*
- 15:30–17:10 Exposé magistral TC1 / *Tutorial TC1*  
**Ted Ralphs**, Lehigh University, États-Unis
- 15:30–17:10 Séances en parallèle TC / *Parallel Sessions TC*

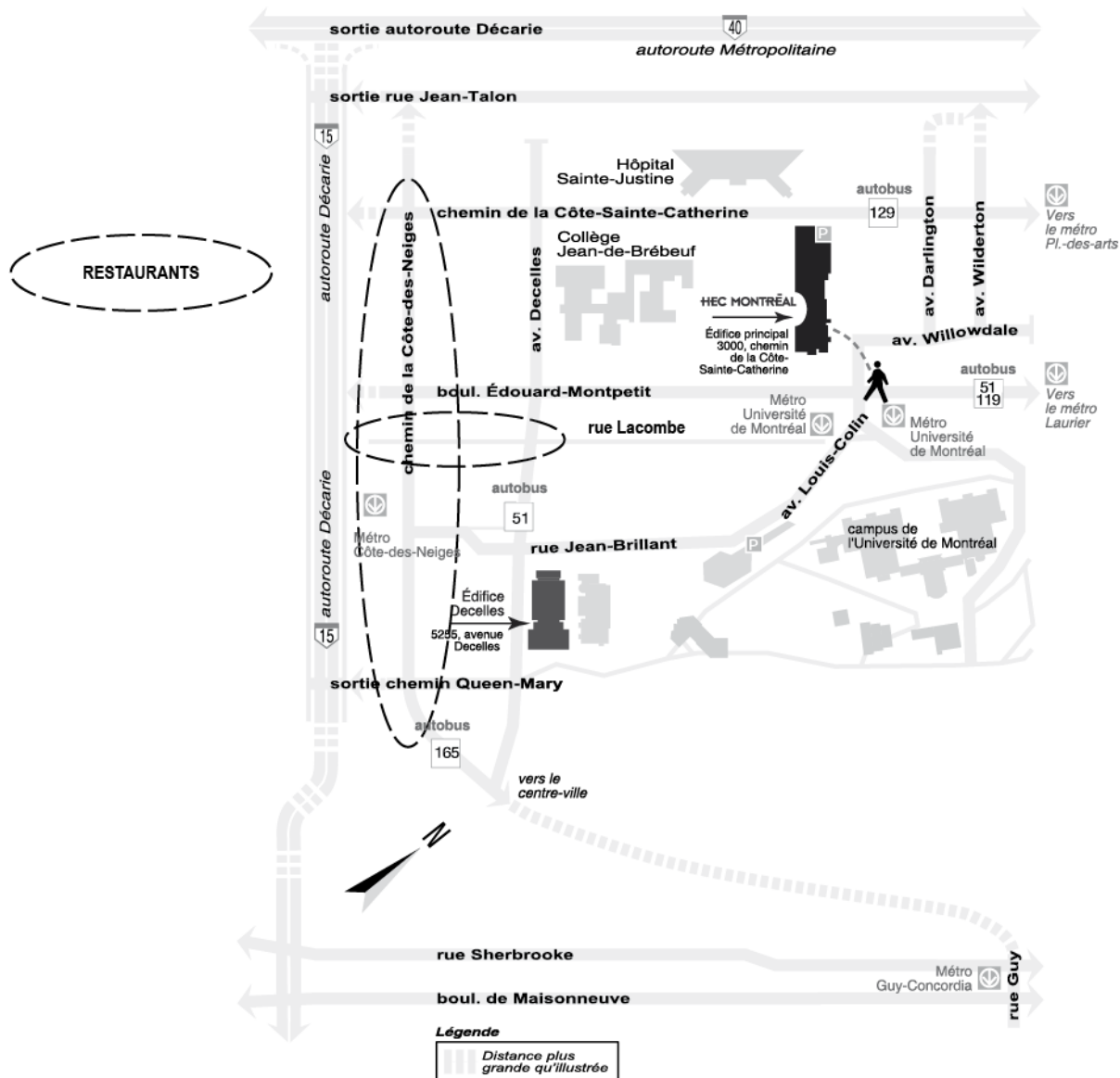
## Mercredi, 8 mai 2013 / *Wednesday, May 8, 2013*

- 09:00–10:00 Séance plénière WAP / *Plenary Session WAP*  
**Robert J. Vanderbei**, Princeton University, États-Unis
- 10:00–10:30 Pause café / *Coffee Break*
- 10:30–12:10 Séances en parallèle WA / *Parallel Sessions WA*
- 12:10–13:30 Déjeuner / *Lunch*
- 13:30–15:10 Exposé magistral WB1 / *Tutorial WB1*  
**Vincent Mousseau**, École Centrale Paris, France
- 13:30–15:10 Séances en parallèle WB / *Parallel Sessions WB*
- 15:10–15:30 Pause café / *Coffee Break*
- 15:30–17:10 Séances en parallèle WC / *Parallel Sessions WC*

# Restaurants

On peut trouver une variété de restaurants sur le chemin de la Côte-des-Neiges et sur la rue Lacombe (entre Decelles et Côte-des-Neiges). On peut également manger au Cercle HEC au 6<sup>e</sup> étage (réservation nécessaire 340-7170) ou à la cafétéria de HEC Montréal (rez-de-jardin).

*Restaurants can be found on Côte-des-Neiges Road and on Lacombe Street (between Decelles and Côte-des-Neiges). Lunch can also be obtained at the Cercle HEC on the 6<sup>th</sup> floor (reservation required 340-7170) or in the HEC Montréal cafeteria (Garden level).*





La langue dans laquelle apparaît le titre sera celle utilisée lors de la présentation.  
*Talks will be given in the language in which the title appears.*

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**Lundi, le 6 mai 2013 / Monday, May 6, 2013**

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>MAP</b>   | <b>Séance plénière I / Plenary Session I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|              | Salle/Room: Amphithéâtre IBM<br>Président/Chairman: Le Digabel, Sebastien                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>09h00</b> | <b>Some Challenging Practical Problems in Optimization</b><br>Conn, Andrew R., IBM Research, <a href="mailto:arconn@us.ibm.com">arconn@us.ibm.com</a><br><br>I will discuss problems I have been involved in at IBM. The aim will be to indicate some of the issues that arise in practice that we tend to not pay much attention to in theory. I will also demonstrate how theoretical results can be motivated by indirect practical issues, including some of "our" failures that I personally find frustrating and some of my prejudices that the audience might find equally frustrating. I hope to include examples that relate to the environment. |
| <b>MA1</b>   | <b>Exposé magistral I / Tutorial I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|              | Salle/Room: Banque Scotia<br>Président/Chairman: Bahn, Olivier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>10h30</b> | <b>Recursive Approaches for the Evaluation of Financial Derivatives</b><br>Breton, Michèle, GERAD - HEC Montréal, <a href="mailto:michele.breton@hec.ca">michele.breton@hec.ca</a><br><br>The evaluation of financial derivatives generally requires the use of numerical procedures. The talk will present the basic concepts of recursive modeling, show how it is the basis of most numerical methods for pricing derivatives, and discuss the relative efficiency of existing procedures. Various applications will be presented to illustrate the flexibility and applicability of recursive approaches.                                             |
| <b>MA2</b>   | <b>OPDE 1 - Outils de la recherche opérationnelle pour décider ensemble / Operational Research Tools for Group Decision</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|              | Salle/Room: TAL<br>Président/Chairman: Mareschal, Bertrand                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>10h30</b> | <b>Game Theory as a Group-Decision-Making Tool</b><br>Barzilai, Jonathan, Dalhousie University, <a href="mailto:Barzilai@dal.ca">Barzilai@dal.ca</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>10h55</b> | <b>An Integrated Approach Based on DEA and AHP</b><br>Pakkar, Mohammad Sadegh, Faculty of Management, Laurentian University, <a href="mailto:ms_pakkar@laurentian.ca">ms_pakkar@laurentian.ca</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>11h20</b> | <b>Portrait du Nord Québécois en utilisant l'approche EABD comme un outil d'aide à la décision pour la gestion des projets du Plan Nord du Québec</b><br>Zaras, Kazimierz, Université du Québec en Abitibi-Témiscamingue, <a href="mailto:kazimierz.zaras@uqat.ca">kazimierz.zaras@uqat.ca</a><br>Boudreau-Trudel, Bryan, Université du Québec en Abitibi-Témiscamingue, <a href="mailto:boudreab@uqat.ca">boudreab@uqat.ca</a><br>Marin, Jean-Charles, Université du Québec en Abitibi-Témiscamingue, <a href="mailto:jean-charles@uqat.ca">jean-charles@uqat.ca</a>                                                                                     |
| <b>11h45</b> | <b>Visual GDSS PROMETHEE</b><br>Mareschal, Bertrand, Université Libre de Bruxelles, <a href="mailto:bmaresc@ulb.ac.be">bmaresc@ulb.ac.be</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## MA3 Tournées de véhicules I / Vehicle Routing Problem I

Salle/Room: St-Hubert

Président/Chairman: Laporte, Gilbert

### 10h30 GRASP with Advanced Starting Point for the VRP with Route Balancing

Løkketangen, Arne, Molde University College, [Arne.Lokketangen@himolde.no](mailto:Arne.Lokketangen@himolde.no)

Oyola, Jorge, Molde University College, [jorge.oyola@himolde.no](mailto:jorge.oyola@himolde.no)

We propose a variant of GRASP (Greedy Randomized Adaptive Search procedure) to solve a bi-objective extension of VRP known as VRPRB – Vehicle Routing Problem with Route Balancing. Computational results will be presented.

### 10h55 The Quadratic Capacitated Vehicle Routing Problem

Martinelli, Rafael, GERAD - Polytechnique Montréal, [rafael.martinelli@gerad.ca](mailto:rafael.martinelli@gerad.ca)

Contardo, Claudio, ESG UQÀM, [claudio.contardo@gerad.ca](mailto:claudio.contardo@gerad.ca)

We introduce the Quadratic Capacitated Vehicle Routing Problem, a problem which arises in practical applications in logistics and transportation. It generalizes the Capacitated Vehicle Routing Problem and the Quadratic Traveling Salesman Problem. We present a formulation and strengthen it with several valid inequalities. We show results for a branch-and-cut algorithm.

### 11h20 Maritime Fleet Deployment with Voyage Separation Requirements

Fagerholt, Kjetil, Norwegian University of Science and Technology, [kjetil.fagerholt@iot.ntnu.no](mailto:kjetil.fagerholt@iot.ntnu.no)

Norstad, Inge, Norwegian University of Science and Technology, [inge.norstad@iot.ntnu.no](mailto:inge.norstad@iot.ntnu.no)

Rakke, Jørgen G., Norwegian University of Science and Technology, [jorgen.rakke@ntnu.no](mailto:jorgen.rakke@ntnu.no)

Eglese, Richard, Lancaster University Management School,

We present a maritime fleet deployment problem in which voyages for the same trade route must be somewhat evenly spread in time. To solve the problem we propose a branch-and-price algorithm, which has been tested on real life instances from a Norwegian bulk shipping company.

### 11h45 Unified Metaheuristics and Large Neighborhoods for Multi-Attribute VRPs

Vidal, Thibaut, CIRRELT, Université de Montréal & ICD-LOSI, Université de Technologie de Troyes, [thibaut.vidal@cirrelt.ca](mailto:thibaut.vidal@cirrelt.ca)

Crainic, Teodor Gabriel, Université du Québec à Montréal, [TeodorGabriel.Crainic@cirrelt.ca](mailto:TeodorGabriel.Crainic@cirrelt.ca)

Gendreau, Michel, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)

Prins, Christian, Université de Technologie de Troyes, [christian.prins@utt.fr](mailto:christian.prins@utt.fr)

A recently-proposed unified metaheuristic framework for VRPs, based on attribute-dependent assignment, sequencing and route-evaluation components, is described. We further introduce new route evaluations inspired from bi-directional dynamic programming to explore large neighborhoods with combined assignment and sequencing changes, for VRPs with multiple depots, fleet mix, and prize collection.

## MA4 Applications en génie des mines I / Applications in Mining Engineering I

Salle/Room: Van Houtte

Président/Chairman: Martinelli, Rafael

### 10h30 An Extended Stochastic Optimization Method for Multi-Process Mining Complexes

Montiel, Luis, McGill University, [luis.montiel@mail.mcgill.ca](mailto:luis.montiel@mail.mcgill.ca)

A heuristic method is presented to generate life-of-mine production schedules accounting for geological uncertainty and considering extracting, stockpiling and processing decisions. The method improves an initial solution by swapping periods and destinations of mining blocks. Numerical tests indicate that the proposed method outperforms traditional deterministic approaches in terms of NPV.

10h55

### **Mining Supply Chain Optimization under Geological Uncertainty**

**Goodfellow, Ryan**, McGill University, [ryan.goodfellow@mail.mcgill.ca](mailto:ryan.goodfellow@mail.mcgill.ca)

Mining complexes can be modelled as a supply chain from sources of material through processing streams to a set of products. This presentation proposes a simulation-optimization framework for optimizing mining supply chains and destination policies under geological uncertainty. This method is tested at Vale's Onça Puma nickel laterite mining complex.

11h20

### **Stochastic Network Flow Based Algorithm Applied to the Mine Production Schedule of Multi-Processor Open-Pit Mines.**

**Silva, Mario**, McGill University, [mario.silva@mail.mcgill.ca](mailto:mario.silva@mail.mcgill.ca)

**Dimitrakopoulos, Roussos**, McGill University, [roussos.dimitrakopoulos@mcgill.ca](mailto:roussos.dimitrakopoulos@mcgill.ca)

We explore a new heuristic approach to solve a stochastic version of the mine production scheduling problem accounting for geological uncertainty. The methodology involves generating an initial solution by solving a series of sub-problems using either Branch-and-Cut or a greedy heuristic. Subsequently, this initial solution is improved using a network flow based algorithm.

11h45

### **A Variable Neighborhood Descent Algorithm for the Open-Pit Mine Production Scheduling Problem with Metal Uncertainty**

**Lamghari, Lamina**, McGill University, [amina.lamghari@mail.mcgill.ca](mailto:amina.lamghari@mail.mcgill.ca)

**Dimitrakopoulos, Roussos**, McGill University, [roussos.dimitrakopoulos@mcgill.ca](mailto:roussos.dimitrakopoulos@mcgill.ca)

We consider a stochastic version of the open-pit mine production scheduling problem, where the uncertainty stems from the orebody metal content. We propose a metaheuristic solution method based on variable neighborhood descent. Computational experiments indicate the efficiency of the proposed method in generating near-optimal solutions in reasonable computational times.

MA5

## **Optimisation sans dérivées I / Derivative-Free Optimization I**

**Salle/Room:** CPA du Québec

**Président/Chairman:** Le Digabel, Sebastien

10h30

### **Sequential Design for Constraint Satisfaction in Optimization Problems**

**Gramacy, Robert**, University of Chicago, [rbgramacy@chicagobooth.edu](mailto:rbgramacy@chicagobooth.edu)

**Lee, Herbie**, University of California, Santa Cruz, [herbie@ams.ucsc.edu](mailto:herbie@ams.ucsc.edu)

**Wild, Stefan**, Argonne National Laboratory, [wild@mcs.anl.gov](mailto:wild@mcs.anl.gov)

**Gray, Genetha**, Sandia National Labs, [gagray@sandia.gov](mailto:gagray@sandia.gov)

**Le Digabel, Sebastien**, GERAD - Polytechnique Montréal, [Sebastien.Le.Digabel@gerad.ca](mailto:Sebastien.Le.Digabel@gerad.ca)

The expected improvement (EI) and variants are a popular sequential design heuristics for solving blackbox optimization problems. Although not generally regarded as superior for conventional optimizations - unless function evaluations are very expensive, or have many minima - it does have nice global convergence properties not enjoyed by most alternatives and remains one of a few viable options when the objective function evaluations can only be observed with noise. In this talk we discuss the far greater potential for statistical approaches to constrained blackbox optimization, a far more common and much harder engineering problem. We observe that modern nonparametric classification models represent a largely untapped resource in the mapping of constraint satisfaction regions. However appropriate sequential design heuristics remain illusive especially when the solution is likely to lie on the boundary of the valid region. As an illustration we consider a hydrology problem where, even with a simple linear objective function, learning a nontrivial valid region complicates the search for a global minimum.

10h55

### **Optimization in Decomposition-based System Design**

**Kokkolaras, Michael**, McGill University, [michael.kokkolaras@mcgill.ca](mailto:michael.kokkolaras@mcgill.ca)

Engineering system design problems are often decomposed to manage complexity and size. The resulting sub-problems are distributed to different design teams according to expertise for effective use of analysis

tools and optimization algorithms. Interactions among these separate design activities must be taken into consideration to ensure system integration and optimality. In this talk we present optimization-based approaches to coordinate the solution of such decomposed and distributed design problems. We begin with hierarchical decompositions and proceed to non-hierarchical formulations that enable the solution of general multidisciplinary design optimization problems. Vehicle and aircraft design examples are used to illustrate the presented methodologies.

#### 11h20 **Multi-Objective Takeoff Optimization with NOMAD**

**Talgorn, Bastien**, GERAD - Université de Montréal, [bastientalgorn@yahoo.fr](mailto:bastientalgorn@yahoo.fr)

**Le Digabel, Sebastien**, GERAD - Polytechnique Montréal, [Sebastien.Le.Digabel@gerad.ca](mailto:Sebastien.Le.Digabel@gerad.ca)

During takeoff, consumption, noise and pollution can be minimized through a multi-objective optimization of the vertical profile of the trajectory which is defined by a reduced set of speeds and altitudes that must be reached. The problem is solved using MADS algorithm, implemented in the NOMAD library.

#### 11h45 **Simultaneous and Sequential Approaches to Optimizing Well Placement and Control**

**Humphries, Thomas**, Memorial University of Newfoundland, [thumphries@mun.ca](mailto:thumphries@mun.ca)

**Haynes, Ronald**, Memorial University of Newfoundland, [rhaynes@mun.ca](mailto:rhaynes@mun.ca)

**James, Lesley**, Memorial University of Newfoundland, [ljames@mun.ca](mailto:ljames@mun.ca)

We investigate approaches to maximizing oilfield production by hybridizing global (PSO) and local (pattern search) optimization techniques. The decision variables are the locations and bottom hole pressures of injection and production wells, and the objective function is computed using a reservoir simulator. We present the results of several numerical experiments.

### MA6 **Problèmes d'horaires de grandes tailles / Large-Scale Scheduling Problems**

**Salle/Room:** Mary Husny

**Président/Chairman:** Soumis, François

#### 10h30 **Personalized Crew Pairing and Crew Assignment Problem**

**Kasirzadeh, Atoosa**, GERAD - Polytechnique Montréal, [atoosa.kasirzadeh@gerad.ca](mailto:atoosa.kasirzadeh@gerad.ca)

**Saddoune, Mohammed**, Polytechnique Montréal, [mohammed.saddoune@polymtl.ca](mailto:mohammed.saddoune@polymtl.ca)

**Soumis, François**, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)

We present a set-covering formulation and a solution approach based on column generation for the personalized airline cabin crew scheduling problem in which the objective is optimizing the costs and the crew's preferences. The computational results are provided based on a major US carrier data set.

#### 10h55 **Taking Advantage of Degeneracy in Mathematical Programming**

**Soumis, François**, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)

**Desrosiers, Jacques**, GERAD - HEC Montréal, [jacques.desrosiers@hec.ca](mailto:jacques.desrosiers@hec.ca)

**Elhallaoui, Issmail**, GERAD - Polytechnique Montréal, [issmail.elhallaoui@gerad.ca](mailto:issmail.elhallaoui@gerad.ca)

**Desaulniers, Guy**, GERAD - Polytechnique Montréal, [Guy.Desaulniers@gerad.ca](mailto:Guy.Desaulniers@gerad.ca)

I will introduce the basics concepts used by the presentations in the two following sessions. The Improved Primal Simplex and the integral simplex use a reduced master problem obtained by removing degenerated constraints and degenerated variables and a subproblem identifying non degenerated improving directions obtained by combining many degenerated variables

#### 11h20 **A New Formulation of the Integral Simplex Using Decomposition with Cutting-Planes Algorithm**

**Rosat, Samuel**, GERAD, [samuel.rosat@gerad.ca](mailto:samuel.rosat@gerad.ca)

**Elhallaoui, Issmail**, GERAD - Polytechnique Montréal, [issmail.elhallaoui@gerad.ca](mailto:issmail.elhallaoui@gerad.ca)

**Soumis, François**, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)

We present a new formulation of the integral simplex using decomposition for the set-partitioning problem. This formulation is based on a geometrical approach of the decomposition, yielding an innovative cutting-plane algorithm. Numerical results will be shown for aircrew and bus-drivers scheduling.

11h45

### Integral Simplex and Additional Constraints

Delorme, Matthieu, GERAD, [delorme.matt@gmail.com](mailto:delorme.matt@gmail.com)

Soumis, François, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)

We adapt the integral simplex algorithm of Zaghroui and al to solve problems where besides the set partitioning constraints there are others constraints which do not have any particular structure. We use Lagrangian relaxation techniques to treat those constraints and present our results along with those of CPLEX.

12h10

### Integral Simplex Using Decomposition for the Set Partitioning Problem

Zaghroui, Abdelouahab, GERAD - Polytechnique Montréal, [Abdelouahab.Zaghroui@gerad.ca](mailto:Abdelouahab.Zaghroui@gerad.ca)

Soumis, François, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)

Elhallaoui, Issmail, GERAD - Polytechnique Montréal, [issmail.elhallaoui@gerad.ca](mailto:issmail.elhallaoui@gerad.ca)

The decomposition algorithm efficiently deals with the degenerate nature of Set Partitioning Problems. It's a constructive method that uses sub-problems to find compatible variables that improve an integer solution by only using normal simplex pivots. Optimal solutions are often obtained, for large-scale problems (up to 500000 variables), without any branching.

MA7

## Énergie et environnement I / Energy and Environment I

Salle/Room: Hélène-Desmarais

Président/Chairman: Gendreau, Michel

10h30

### A L-Shaped Method for Mid-Term Hydro Scheduling Under Uncertainty

Carpentier, Pierre-Luc, Polytechnique Montréal, [pierre-luc.carpentier@polymtl.ca](mailto:pierre-luc.carpentier@polymtl.ca)

Gendreau, Michel, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)

Bastin, Fabian, Université de Montréal, [bastin@iro.umontreal.ca](mailto:bastin@iro.umontreal.ca)

We propose a new approach for solving the hydrothermal generation scheduling problem (HGSP) under uncertainty. The aim of this problem is to coordinate hydroelectric generation, thermal generation and market transactions while minimizing the expected net operating cost. We consider the mid-term planning horizon which typically cover 6-60 months with weekly or monthly time steps. We partition the set of time periods in two consecutive stages. Each stage typically corresponds to several months. We assume that random parameters are driven by a time- and space-correlated stochastic process which loses memory of previous realizations at the end of the first stage. We exploit the special structure of the resulting stochastic program using a Benders decomposition method. We apply this method on Hydro-Québec's power system over a two-year horizon.

10h55

### The Role of Hydrological Variable in Stochastic Dynamic Programming Apply to Hydropower Reservoir Operation

Côté, Pascal, Rio Tinto Alcan, [pascal.cote@riotinto.com](mailto:pascal.cote@riotinto.com)

Desreumaux, Quentin, Université de Sherbrooke, [desreumauxq@gmail.com](mailto:desreumauxq@gmail.com)

Leconte, Robert, Université de Sherbrooke, [robert.leconte@usherbrooke.ca](mailto:robert.leconte@usherbrooke.ca)

We study the impact of the hydrological variable in Stochastic Dynamic Programming (SDP) to solve optimization problems of managing a Hydropower System in British Columbia. We will demonstrate that using a real-time snow water data as the variable in SDP management policies proves to be of best effective, safer management, compared to a Markov or order p autoregressive model.

11h20

### Adaptive Monitoring of the Progressive Hedging Penalty Parameter in the Context of Reservoir Systems Management

Zéphy, Luckny, Université Laval, [luckny.zephyr.1@ulaval.ca](mailto:luckny.zephyr.1@ulaval.ca)

Lang, Pascal, Université Laval, [pascal.lang@fsa.ulaval.ca](mailto:pascal.lang@fsa.ulaval.ca)

Lamond, Bernard, Université Laval, [bernard.lamond@fsa.ulaval.ca](mailto:bernard.lamond@fsa.ulaval.ca)

Reservoir systems operations problems are in essence stochastic. This leads to very large stochastic models that may not be easy to handle numerically. We revisit the decomposition method developed by Rockafellar and Wets (1991) by proposing new heuristics to initialize and dynamically adjust the penalty parameter of the augmented Lagrangian function. Numerical experiments are realized to compare our heuristics to the traditional strategy of setting the parameter to a fixed value.

|            |                                                                                                                   |
|------------|-------------------------------------------------------------------------------------------------------------------|
| <b>MA8</b> | <b>Santé: planification d'horaires de patients et de ressources / Healthcare: Patient and Resource Scheduling</b> |
|------------|-------------------------------------------------------------------------------------------------------------------|

**Salle/Room:** Demers Beaulne  
**Président/Chairman:** Legrain, Antoine

|              |                                                                                                      |
|--------------|------------------------------------------------------------------------------------------------------|
| <b>10h30</b> | <b>Physician Scheduling Problem in Emergency Rooms, Application at Maisonneuve-Rosemont Hospital</b> |
|--------------|------------------------------------------------------------------------------------------------------|

**Jacquemet, Léonard**, Polytechnique Montréal, [leonard.jacquemet@polymtl.ca](mailto:leonard.jacquemet@polymtl.ca)

At Maisonneuve-Rosemont Hospital's emergencies department, the physician schedule is handled manually by its director Dr Gagnon. Physician scheduling is a strategical and time consuming task for him. The development of a linear model handling coverage and ergonomic constraints permits to give realistic solution to the problem and may open to other applications in the department.

|              |                                                                                                       |
|--------------|-------------------------------------------------------------------------------------------------------|
| <b>10h55</b> | <b>Nurse Assignment to Endoscopy Unit Rooms at the Centre Hospitalier Universitaire de Sherbrooke</b> |
|--------------|-------------------------------------------------------------------------------------------------------|

**Brazeau, Mélisende**, GERAD - Polytechnique Montréal, [melisende.brazeau@polymtl.ca](mailto:melisende.brazeau@polymtl.ca)  
**Hertz, Alain**, GERAD - Polytechnique Montréal, [alain.hertz@gerad.ca](mailto:alain.hertz@gerad.ca)  
**Audet, Charles**, GERAD - Polytechnique Montréal, [Charles.Audet@gerad.ca](mailto:Charles.Audet@gerad.ca)

In the endoscopy unit at the Centre hospitalier universitaire de Sherbrooke, the assistant head nurse must assign each nurse to a specific room in order to make a monthly schedule. A mixed integer programming model is developed and solved with a free solver, the COIN Branch and Cut. This method is less time consuming than the manual method and provides a better schedule.

|              |                                                                       |
|--------------|-----------------------------------------------------------------------|
| <b>11h20</b> | <b>Online Stochastic Optimization of Radiotherapy Patient Booking</b> |
|--------------|-----------------------------------------------------------------------|

**Legrain, Antoine**, GERAD - Polytechnique Montréal, [antoine.legrain@gerad.ca](mailto:antoine.legrain@gerad.ca)  
**Lahrichi, Nadia**, Polytechnique Montréal, [nadia.lahrichi@polymtl.ca](mailto:nadia.lahrichi@polymtl.ca)  
**Rousseau, Louis-Martin**, Polytechnique Montréal, [louis-martin.rousseau@polymtl.ca](mailto:louis-martin.rousseau@polymtl.ca)  
**Fortin, Marie-Andrée**, Hôpital de la Cité de la Santé, [mfortin.csssl@ssss.gouv.qc.ca](mailto:mfortin.csssl@ssss.gouv.qc.ca)

Effective management of cancer treatment facility for radiation therapy depends mainly on optimizing the utilization of linear accelerators. In this project, we are scheduling patients on those machines while taking into account their priority for treatment, the maximum waiting time before the first treatment and the duration of treatment. We collaborate with the Centre Intégré de Cancérologie de Laval to determine the best scheduling policy. Furthermore, we integrate the uncertainty related to the arrival of patients at the center. We develop an hybrid method combining stochastic optimization and online optimization to better meet the needs of central planning. Therefore, we use the information of future arrivals of patients to capture the most accurate picture of the expected utilization of resources. Results based on real data show that our method outperforms strategies typically used in such treatment centers.

|              |                                                                                                            |
|--------------|------------------------------------------------------------------------------------------------------------|
| <b>11h45</b> | <b>An Agent Base Simulation Model of an Operating Theaters System: Waiting Lists and Social Life Index</b> |
|--------------|------------------------------------------------------------------------------------------------------------|

**Popp, Alexandru**, Polytechnique Montréal, [alexandre.popp@mail.mcgill.ca](mailto:alexandre.popp@mail.mcgill.ca)  
**Grain, Lucas**, Polytechnique Montréal, [lucas.garin@etu.emse.fr](mailto:lucas.garin@etu.emse.fr)

Patients' positioning on surgical waiting lists involves complex interactions between hospital capacities and patients' demands. Using an agent based simulation model that incorporates the patients' medical and social life indices, a comparison between a fixed-state model versus a more dynamic scheduling model (having different time horizons) is provided and analyzed.



## MA9 Applications de l'optimisation robuste / Applications of Robust Optimization

**Salle/Room:** Dutilier International

**Président/Chairman:** Delage, Erick

### 10h30 Robust Minimum-Cost Flow Problem with Nonlinear Cost Functions

**Gianoli, Luca Giovanni**, Polytechnique Montréal, [luca-giovanni.gianoli@polymtl.ca](mailto:luca-giovanni.gianoli@polymtl.ca)

**Delage, Erick**, GERAD - HEC Montréal, [erick.delage@hec.ca](mailto:erick.delage@hec.ca)

We propose a tractable formulation to address the robust minimum-cost multicommodity flow problem with nonlinear cost functions known only to be bounded above and below by two convex functions. The conservatism of our approach is limited by a budget that prevents too many functions to take on the most pessimistic value. A minimal average transfer time traffic routing problem will be discussed.

### 10h55 Price of Robustness in Inventory Problems

**Ardestani-Jaafari, Amir**, GERAD - HEC Montréal, [amir.ardestani-jaafari@hec.ca](mailto:amir.ardestani-jaafari@hec.ca)

**Delage, Erick**, GERAD - HEC Montréal, [erick.delage@hec.ca](mailto:erick.delage@hec.ca)

This research addresses multi-period inventory problem under budgeted demand uncertainty. We propose polynomial time approximation that has valuable theoretical properties. An empirical study also suggests that it performs better than currently available approximation methods for this problem.

### 11h20 Robust Optimization of Radiation Treatment in the Presence of Spatiotemporal Uncertainties

**Nohadani, Omid**, Purdue University, [nohadani@purdue.edu](mailto:nohadani@purdue.edu)

The treatment of cancerous tumors with external radiation is planned based on initial data, resulting in strategies that do not vary over the course of the treatment. However, various properties of the tissue change over time. This is the case for spatial information, such as location and size, as well as tissue's response to ionizing radiation over time, particularly when chemotherapeutic agents are combined. Based on clinical cases, we demonstrate that robust plans account for temporal changes and are intrinsically insensitive to deviations from the assumed evolution path.

### 11h45 Accounting for Risk Measure Ambiguity when Optimizing Financial Positions

**Delage, Erick**, GERAD - HEC Montréal, [erick.delage@hec.ca](mailto:erick.delage@hec.ca)

**Li, Jonathan Y.**, HEC Montréal, [jonathan.li@hec.ca](mailto:jonathan.li@hec.ca)

Since the financial crisis of 2007-2009, there has been a renewed interest towards quantifying more appropriately the risks involved in financial positions. In this work, we show that one can account precisely for (neither more nor less than) what we know of the risk preferences of an investor/policy maker when comparing and optimizing financial positions.

## MA10 Algèbre linéaire en optimisation / The Linear Algebra of Optimization

**Salle/Room:** Nancy et Michel-Gaucher

**Président/Chairman:** Dehghani, Ahad

### 10h30 Linearizing the Method of Conjugate Gradients

**Titley-Peloquin, David**, CERFACS, Toulouse, [titleypelo@cerfacs.fr](mailto:titleypelo@cerfacs.fr)

**Gratton, Serge**, CERFACS et ENSEEIHT, Toulouse, [gratton@cerfacs.fr](mailto:gratton@cerfacs.fr)

**Toint, Philippe L.**, University of Namur, [philippe.toint@fundp.ac.be](mailto:philippe.toint@fundp.ac.be)

**Tshimanga, Jean**, ENSEEIHT, [jean.tshimanga@enseeiht.fr](mailto:jean.tshimanga@enseeiht.fr)

The method of conjugate gradients (CG) is widely used for the iterative solution of large sparse systems of equations  $Ax=b$ , where  $A$  is symmetric positive definite. We present an expression for the Jacobian matrix of a CG iterate with respect to  $b$ . We discuss data assimilation applications in which these ideas are used for first-order propagation of covariance matrices.

10h55

### **A Primal-Dual Regularized Interior-Point Method for Semidefinite Programming**

Dehghani, Ahad, GERAD - McGill University, [ahad.dehghani@mcgill.ca](mailto:ahad.dehghani@mcgill.ca)

Orban, Dominique, GERAD - Polytechnique Montréal, [dominique.orban@gerad.ca](mailto:dominique.orban@gerad.ca)

Goffin, Jean-Louis, GERAD - McGill University, [jean-louis.goffin@mcgill.ca](mailto:jean-louis.goffin@mcgill.ca)

Interior-point methods in semidefinite programming (SDP) require the solution of a sequence of linear systems which are used to derive the search directions. Safeguards are typically required in order to handle rank-deficient Jacobians and free variables. We show that it is possible to recover an optimal solution of the original primal-dual pair via inaccurate solves of a sequence of regularized SDPs for both the NT and dual HKM directions. Benefits of our approach include increased robustness and a simpler implementation. Our method does not require the constraints to be linearly independent and does not assume that Slater's condition holds. We report numerical experience on standard problems that illustrate our findings.

11h20

### **A Regularized Interior-Point Method for Constrained Linear Least Squares**

Dehghani, Ahad, GERAD - McGill University, [ahad.dehghani@mcgill.ca](mailto:ahad.dehghani@mcgill.ca)

Orban, Dominique, GERAD - Polytechnique Montréal, [dominique.orban@gerad.ca](mailto:dominique.orban@gerad.ca)

We propose an infeasible interior-point algorithm for constrained linear least-squares problems based on the primal-dual regularization of convex programs of Friedlander and Orban (2012). At each iteration, the sparse LDL factorization of a symmetric quasi-definite matrix is computed. This coefficient matrix is shown to be uniformly bounded and nonsingular. We establish conditions under which a solution of the original problem is recovered. The regularization allows us to dispense with the assumption that the active gradients are linearly independent. Although the implementation described here is factorization based, it paves the way to a matrix-free implementation in which a regularized unconstrained linear least-squares problem is solved at each iteration. We report on computational experience and illustrate the potential advantages of our approach.

11h45

### **Projected Krylov Methods for Saddle-Point Systems**

Gould, Nick, Rutherford Appleton Laboratory, [nick.gould@stfc.ac.uk](mailto:nick.gould@stfc.ac.uk)

Orban, Dominique, GERAD - Polytechnique Montréal, [dominique.orban@gerad.ca](mailto:dominique.orban@gerad.ca)

Rees, Tyrone, Rutherford Appleton Laboratory, [tyrone.rees@stfc.ac.uk](mailto:tyrone.rees@stfc.ac.uk)

Projected Krylov methods are full-space formulations of Krylov methods that take place in a nullspace. Provided projections into the nullspace can be computed accurately, those methods only require products between an operator and vectors lying in the nullspace. In the symmetric case, their convergence is thus entirely described by the spectrum of the (preconditioned) operator restricted to the nullspace. We provide systematic principles for obtaining the projected form of any well-defined Krylov method. Equivalence properties between projected Krylov methods and standard Krylov methods applied to a saddle-point operator with a constraint preconditioner allow us to show that, contrary to common belief, certain known methods such as MINRES and SYMMLQ are well defined in the presence of an indefinite preconditioner.

**MA11**

## **Applications en foresterie / Applications in Forestry**

Salle/Room: Gérard Parizeau

Président/Chairman: Gendron, Bernard

10h30

### **A Transportation-Based Formulation for Annual Harvest Planning**

Rix, Greg, Polytechnique Montréal, [greg.rix@polymtl.ca](mailto:greg.rix@polymtl.ca)

Rousseau, Louis-Martin, Polytechnique Montréal, [louis-martin.rousseau@polymtl.ca](mailto:louis-martin.rousseau@polymtl.ca)

Pesant, Gilles, Polytechnique Montréal, [Gilles.Pesant@polymtl.ca](mailto:Gilles.Pesant@polymtl.ca)

Due to the importance of maximizing driver satisfaction when doing annual planning, the harvest sequencing of the forest units has been identified as more flexible in order to satisfy driver schedules. We derive a mixed integer formulation for this problem, and a branch-and-price based heuristic that quickly generates feasible solutions.



10h55

### **A Column Generation Approach for Demand-Driven Harvest Scheduling**

**Gemieux, Géraldine**, Université de Montréal, [geraldine.gemieux@umontreal.ca](mailto:geraldine.gemieux@umontreal.ca)

**Gendron, Bernard**, Université de Montréal, [bernard.gendron@cirrelt.ca](mailto:bernard.gendron@cirrelt.ca)

**Ferland, Jacques**, Université de Montréal, [ferland@iro.umontreal.ca](mailto:ferland@iro.umontreal.ca)

We present a solution method based on column generation, to plan annual harvest activities driven by mills demands, integrating transportation and inventory management. The problem is separated in two parts: creating meaningful harvest schedules and choosing appropriate ones to induce a satisfying harvest production at minimum cost. Computational results are on actual large-scale instances from the context of the Eastern Canadian forest.

11h20

### **Real-Time Transportation and Logistics Systems Planning and Control**

**Amrouss, Amine**, Université de Montréal, [amrouss.amine@gmail.com](mailto:amrouss.amine@gmail.com)

**Gendron, Bernard**, Université de Montréal, [bernard.gendron@cirrelt.ca](mailto:bernard.gendron@cirrelt.ca)

**Gendreau, Michel**, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)

This project aims at developing methods for choosing, in real time, alternative itineraries for trucks transporting wood from forest areas to plants that face unforeseen events revealed while performing the trip. Currently, we draw up a list of unforeseen events and of possible recourse actions for each event.

11h45

### **Solving and Integrated Multi-Period Wood Procurement Problem**

**Dems, Amira**, Polytechnique Montréal, [amira.dems@polymtl.ca](mailto:amira.dems@polymtl.ca)

**Rousseau, Louis-Martin**, Polytechnique Montréal, [louis-martin.rousseau@polymtl.ca](mailto:louis-martin.rousseau@polymtl.ca)

**Frayret, Jean-Marc**, Polytechnique Montréal, [jean-marc.frayret@polymtl.ca](mailto:jean-marc.frayret@polymtl.ca)

The problem we consider is a practical multiple period wood procurement planning problem from the perspective of Eastern Canadian context. Within this context, forest cut blocks are large, heterogeneous and have different densities, and diameter class of trees. The total planning horizon considered is one year, divided into 12 time periods (months). This forest management problem is difficult to solve since it integrates two inter-related problems: the forest bucking problem using a cut-to-length (CTL) bucking system and the multi-facility supply planning problem. In fact, the choice of areas to harvest in each period and how to harvest it, affects the amount of different assortments provided to mills. The main decisions deal with which areas to harvest during each period so that orders from various wood-processing facilities, located in distant places are satisfied. Moreover, the model provides decision support with respect to how to harvest the different cut blocks according to the bucking priority list used, and in what quantities harvested logs from each block should be transported to sawmill. Also, the model was used to compare the current planning procedure to a new planning one. The new strategy presents a centralized inventory management policy. In this paper, we extend the procurement model presented in DEMS et al. (2013) in order to consider a more detailed multiple period planning. We develop a mixed integer linear model describing the problem (MIP). Computational results from an Eastern Canadian forest company are presented.

**MBP**

## **Séance plénière II / Plenary Session II**

**Salle/Room:** Amphithéâtre IBM

**Président/Chairman:** Waaub, Jean-Philippe

14h00

### **The Tradeoff between Security and Commerce in Urban Areas**

**Roberts, Fred S.**, DIMACS, Rutgers University, [froberts@dimacs.rutgers.edu](mailto:froberts@dimacs.rutgers.edu)

There is often a perceived conflict between freedom of economic activity and the need for increased security. Are the goals of enhanced economic activity and increased security necessarily in conflict? That is the question underlying the Urban Commerce and Security Study (UCASS), which will be described in this talk. The talk will describe the project's interactions with numerous stakeholders in Lower Manhattan, the economic modeling and computer simulation modeling that is the core of UCASS, and a decision support tool that planners and decision makers can use to make choices about security initiatives by assessing relevant costs and benefits of various combinations of security measures and policies.

**MB1 Exposé magistral II / Tutorial II**

**Salle/Room:** Banque Scotia  
**Président/Chairman:** Bahn, Olivier

**15h30 Energy Systems Engineering at the Cellular Level and Implications in Disease**

**Cloutier, Mathieu**, GERAD, [mathieu.cloutier@gerad.ca](mailto:mathieu.cloutier@gerad.ca)

Living organisms must manage their energy production in order to match expenditure in a timely manner. For example, a single muscle contraction generally involves a multiple fold increase in energy demand over a very short time. Thus, energy production has to be tightly coupled with consumption and the biological organisms achieve this in ways that are surprisingly similar to human made systems. Moreover, cellular energy regulation is affected in many human diseases, including cancer and neurodegeneration. However this problematic is rarely looked upon from the systems engineering viewpoint. We will thus provide examples where a better understanding of cellular energy systems offers new approaches for treatment. More specifically, in this tutorial we will first explore how energy systems in living organisms can be represented in the form of Ordinary Differential Equations (ODE) models and then use these models to delineate the underlying energy regulation structures. Interestingly, it is possible to decompose each energy regulating mechanism into a corresponding control structure. From this representation of cellular energy systems, we will then highlight a few examples of how it can be linked to diseases such as cancer and Parkinson's. Through these examples, we will emphasize how the tools of systems engineering, mathematical modelling and optimization can and should be used to complement the empirical approaches in medicine.

**MB2 OPDE 2 - Applications en aménagement urbain et transport / Applications: Urban and Transportation Planning**

**Salle/Room:** TAL  
**Président/Chairman:** Joerin, Florent

**15h30 Sustainable Urban Mobility: An Operational Multi-Criteria Decision Analysis (OMCDA)**

**Bernardini, Annalia**, Vrije Universiteit Brussel, MOSI-Transport&Logistics, [annalia.bernardini@vub.ac.be](mailto:annalia.bernardini@vub.ac.be)  
**Macharis, Cathy**, Vrije Universiteit Brussel, MOSI-Transport&Logistics, [cathy.macharis@vub.ac.be](mailto:cathy.macharis@vub.ac.be)

**15h55 S'approprier le changement : une démarche participative pour une place publique**

**Joerin, Florent**, Haute École d'Ingénierie et de Gestion du Canton de Vaud, HES-SO, [florent.joerin@heig-vd.ch](mailto:florent.joerin@heig-vd.ch)  
**Bombenger, Pierre-Henri**, Haute École d'Ingénierie et de Gestion du Canton de Vaud, HES-SO, [pierre-henri.bombenger@heig-vd.ch](mailto:pierre-henri.bombenger@heig-vd.ch)

**16h20 Évaluation de la participation citoyenne en aménagement : Une approche longitudinale de la conflictualité**

**Pelletier, Mathieu**, INRS, [Mathieu.Pelletier@UCS.INRS.ca](mailto:Mathieu.Pelletier@UCS.INRS.ca)  
**Collin, Jean-Pierre**, INRS, [Jean-Pierre.Collin@UCS.INRS.ca](mailto:Jean-Pierre.Collin@UCS.INRS.ca)  
**Joerin, Florent**, Haute Ecole d'Ingénierie et de Gestion du Canton de Vaud, HES-SO, [florent.joerin@heig-vd.ch](mailto:florent.joerin@heig-vd.ch)

**16h45 Urban Planning and Design Strategies Generation to Reduce Urban Vulnerability Facing Technological Hazards. Tools to Make Decisions through a Participatory Planning**

**Lopez, Adriana**, Universidad del Valle, [adriana.lopez@correounivalle.edu.co](mailto:adriana.lopez@correounivalle.edu.co)  
**Lopez, Oswaldo**, Universidad del Valle, [oswaldo.lopez@correounivalle.edu.co](mailto:oswaldo.lopez@correounivalle.edu.co)

## **MB3      Tournées de véhicules II / Vehicle Routing Problem II**

**Salle/Room:** St-Hubert

**Président/Chairman:** Gouveia, Luis

### **15h30      Polynomial-Time Separation of Enhanced Reverse Multistar Inequalities**

**Gouveia, Luís**, University of Lisbon, [legouveia@fc.ul.pt](mailto:legouveia@fc.ul.pt)

**Salazar Gonzalez, Juan Jose**, Universidad de La Laguna, [jjsalaza@ull.es](mailto:jjsalaza@ull.es)

The Vehicle Routing Problem with a minimum number of customers per route concerns the Capacitated Vehicle Routing Problem with unit-demand customers and a lower bound on the number of customers visited by each vehicle. This paper answers two open questions in a previous article, namely finding a compact formulation for the problem such that the corresponding linear programming relaxation implies the Enhanced Reverse Multistar inequalities, and finding a polynomial-time separation algorithm for this class of inequalities.

### **15h55      The Dynamic Dial-a-Chauffeur Problem**

**Oppen, Johan**, Molde University College, [johan.oppen@himolde.no](mailto:johan.oppen@himolde.no)

**Agatz, Niels**, Rotterdam School of Management, [nagatz@rsm.nl](mailto:nagatz@rsm.nl)

**Srour, F Jordan**, Lebanese American University, [fjsrour@gmail.com](mailto:fjsrour@gmail.com)

We present a real-world problem, where a company offers a service to transport customers from one location to another in the customer's own car. One of many uses for this type of service is people who need to get themselves and their car home safely after drinking too much to drive. Results from initial computational experiments will be presented.

### **16h20      Tactical Time Slot Management for Home Delivery**

**Famildardashti, Vahid**, Université de Montréal, [famildav@iro.umontreal.ca](mailto:famildav@iro.umontreal.ca)

**Gendreau, Michel**, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)

**Potvin, Jean-Yves**, Université de Montréal, [potvin@iro.umontreal.ca](mailto:potvin@iro.umontreal.ca)

We consider a problem found in home delivery applications where time slots for service must be assigned to different geographical zones based on customer demand. A mathematical programming model is first presented, which allows for split deliveries. Then, an adaptive large neighborhood search framework is proposed to solve the problem.

## **MB4      Applications en génie des mines II / Applications in Mining Engineering II**

**Salle/Room:** Van Houtte

**Président/Chairman:** Lamghari, Amina

### **15h30      A Tabu Search Procedure for Open Pit Mine Scheduling**

**Senécal, Renaud**, McGill University, [renaud.senecal2@mail.mcgill.ca](mailto:renaud.senecal2@mail.mcgill.ca)

**Dimitrakopoulos, Roussos**, McGill University, [roussos.dimitrakopoulos@mcgill.ca](mailto:roussos.dimitrakopoulos@mcgill.ca)

This study presents a metaheuristic solution for the open pit mine scheduling problem with multiple destinations and geological uncertainty. The feasible domain is explored by a Tabu search procedure, which finds the best local solution and uses a diversification strategy to generate new initial solutions. A case study is presented to show the efficiency of the approach.

### **15h55      Stochastic Short-term Mine Production Scheduling Accounting for Fleet Allocation and Operational Considerations**

**Villalba Matamoros, Martha E.**, McGill University, [martha.villalbamatamoros@mail.mcgill.ca](mailto:martha.villalbamatamoros@mail.mcgill.ca)

**Dimitrakopoulos, Roussos**, McGill University, [roussos.dimitrakopoulos@mcgill.ca](mailto:roussos.dimitrakopoulos@mcgill.ca)

A stochastic short-term mine production scheduling problem is presented, where the ore body metal content, the fleet availability, and the hauling process are uncertain. We propose a stochastic integer formulation that is solved using the commercial solver CPLEX. Operational considerations, such as mining width and mining directions, are addressed and deliver practically mineable production scheduling patterns.

16h20

### Long-Term Planning at Raglan Mine (Part 1)

**Collard, Jean**, Polytechnique Montréal, [jean.collard@polymtl.ca](mailto:jean.collard@polymtl.ca)

**Martinelli, Rafael**, GERAD - Polytechnique Montréal, [rafael.martinelli@gerad.ca](mailto:rafael.martinelli@gerad.ca)

**Gamache, Michel**, GERAD - Polytechnique Montréal, [michel.gamache@polymtl.ca](mailto:michel.gamache@polymtl.ca)

We present a mixed-integer model for long-term planning in a large underground nickel mining complex. The Raglan Mine is located in Nunavik region, the extreme limit of Northern Quebec, Canada. The model incorporates operating characteristics like resource constraints, precedence between activities, nickel cutoff grade, among other. Results will be presented.

16h45

### Long-Term Planning at Raglan Mine (Part 2)

**Martinelli, Rafael**, GERAD - Polytechnique Montréal, [rafael.martinelli@gerad.ca](mailto:rafael.martinelli@gerad.ca)

**Collard, Jean**, Polytechnique Montréal, [jean.collard@polymtl.ca](mailto:jean.collard@polymtl.ca)

**Gamache, Michel**, GERAD - Polytechnique Montréal, [michel.gamache@polymtl.ca](mailto:michel.gamache@polymtl.ca)

In this talk, we show heuristic approaches to improve a MIP model resolution for a long-term planning in a large underground nickel mining complex. The heuristics work together with a commercial MIP solver. This technique can lead to high quality solutions fast. We compare our results with some existing ones.

**MB5**

## Optimisation sans dérivées II / Derivative-Free Optimization II

**Salle/Room:** CPA du Québec

**Président/Chairman:** Audet, Charles

15h30

### Approximating Normal Cones for Constrained Optimization

**Hare, Warren**, UBC, [warren.hare@ubc.ca](mailto:warren.hare@ubc.ca)

Normal cones provide powerful information about projections, tangent directions, and stopping conditions in constrained optimization. When the constraint set is defined through a collection of (well-behaved) analytic functions, normal cones are easily computed. In this talk we consider the situation where the constraint set is provided through an oracle function or collection of oracle functions. Methods for approximating normal cones under these conditions are provided and compared.

15h55

### Directional Direct-Search Optimization with Polling Directions Based on Equal Angle Distributions

**Asaki, Thomas**, Washington State University, [tasaki@wsu.edu](mailto:tasaki@wsu.edu)

**Van Dyke, Benjamin**, Washington State University, [bvandyke@math.wsu.edu](mailto:bvandyke@math.wsu.edu)

We consider new instances of MADS/GSS algorithms which emphasize uniform distributions of search directions. We utilize minimal or maximal positive bases having equal, or nearly equal, angle distributions. The goal is performance enhancement for high-dimensional constrained problems. Results and comparisons are presented for a variety of test problems.

16h20

### Pairing Derivative-Free Optimization and Sensitivity Analysis Using a Hybrid Framework

**Gray, Genetha**, Sandia National Labs, [gagray@sandia.gov](mailto:gagray@sandia.gov)

**Sirola, John**, Sandia National Labs, [jdsirola@sandia.gov](mailto:jdsirola@sandia.gov)

Because each optimization method has inherent strengths and weaknesses, picking a suitable algorithm is quite challenging and has been the subject of many studies and much debate. In order to take advantage of the benefits of more than one approach and to try to overcome their shortcomings, two or more methods may be combined, forming a hybrid. In this talk, we will discuss a hybrid software framework and give some examples of its use. We will also explain how it can be used to incorporate sensitivity studies into a derivative-free optimization process in order to describe some of the uncertainties associated the suggested solutions.

16h45

### **Reducing the Number of Function Evaluations in Mesh Adaptive Direct Search Algorithms**

**Audet, Charles**, GERAD - École Polytechnique de Montréal, [Charles.Audet@gerad.ca](mailto:Charles.Audet@gerad.ca)

**Ianni, Andrea**, Università di Roma La Sapienza, [10ianni@gmail.com](mailto:10ianni@gmail.com)

**Le Digabel, Sebastien**, GERAD - Polytechnique Montréal, [Sebastien.Le.Digabel@gerad.ca](mailto:Sebastien.Le.Digabel@gerad.ca)

**Tribes, Christophe**, Polytechnique Montréal, [christophe.tribes@polymtl.ca](mailto:christophe.tribes@polymtl.ca)

We propose strategies to improve the efficiency of MADS algorithms by reducing the maximal number of trial points at each iteration without impacting the quality of the solution. We devise various strategies, embedded in a generic algorithmic framework, that order the trial points in such a way that the promising points are evaluated first, and the unpromising points are discarded and replaced by a single point. A crucial element is that the proposed methods retain the hierarchical nonsmooth convergence analysis.

**MB6**

### **Transport / Transportation**

**Salle/Room:** Mary Husny

**Président/Chairman:** Cirillo, Cinzia

15h30

### **A Methodology to Dynamic Assign to Drivers Alternative Paths in Congested Street Networks**

**Souza, Leonard**, TRANA Construções Ltda., [leonardaugusto@gmail.com](mailto:leonardaugusto@gmail.com)

**Negreiros, Marcos José**, State University of Ceará, [negreiro@graphvs.com.br](mailto:negreiro@graphvs.com.br)

The best guidance to drivers on traffic routes within an urban network is of great importance on the structural point of view and organizational traffic in major cities. Using this resource to aid in traffic management becomes increasingly necessary, to the point that contributes to traffic flow on roads. The goal of this work is to show a system that designs the fastest path to drivers in monitored traffic networks. The research is basically divided into three sections: use of algorithms to detect similarity of strings to increase efficiency in the comparisons of the plates read by electronic surveillance equipment, methods to forecast travel time of paths between adjacent vertices of the monitored network, and finally, the calculation of the shortest route between points of the network by a using multilayered Dijkstra algorithm here developed. The results obtained in the implementation of the system is highly satisfactory, considering the increasing efficiency in obtaining the real identification of the plates of vehicles detected between two adjacent vertices of the network, also because of the recent improvements in forecasting methods of traffic conditions on time and adaptation of a shortest path algorithm to the reality. The results of this work can be used to make a better evaluation to the Origin-Destination matrix traffic of the city. This work was developed with the data and support of TRANA Construções Ltda, a company that is responsible to monitor the traffic in the city of Fortaleza/CE.

15h55

### **Enchère combinatoire double basée sur la réputation pour l'approvisionnement des services de transport**

**Ben Othmane, Intissar**, Université Laval, [intissar.ben-othmane.1@ulaval.ca](mailto:intissar.ben-othmane.1@ulaval.ca)

Une enchère combinatoire de transport routier permet aux expéditeurs et aux transporteurs d'économiser des coûts de transport. Nous proposons un modèle d'enchère combinatoire double basée sur la réputation dans lequel la détermination des transporteurs gagnants se base sur le prix et sur d'autres attributs représentant la qualité de service fournie.

16h20

### **Dynamic Discrete Choice Model for Railway Ticket Cancellation and Exchange Behavior**

**Cirillo, Cinzia**, University of Maryland, [ccirillo@umd.edu](mailto:ccirillo@umd.edu)

**Hetrakul, Pratt**, Resource System Group, [hetrakul@umd.edu](mailto:hetrakul@umd.edu)

**Bastin, Fabian**, Université de Montréal, [bastin@iro.umontreal.ca](mailto:bastin@iro.umontreal.ca)

The increasing use of internet as a major ticket distribution channel has resulted in passengers becoming more strategic to fare policy. This potentially induces passengers to book the ticket well in advance in order to obtain a lower fare ticket, and later adjust their ticket when they are sure about trip scheduling. In this presentation, we propose an inter-temporal choice model of ticket cancellation and exchange for railway passengers where customers are assumed to be forward looking agents. A dynamic discrete choice model (DDCM) is applied to predict the timing in which ticket exchange or cancellation occurs in response to fare

and trip schedule uncertainty. Passengers' decisions involve a two steps process. First, the passenger decides whether to keep or adjust the ticket. Once the decision to adjust the ticket has been made, the passenger has the choice to cancel the ticket or to change departure time. The problem is formulated as an optimal stopping problem, and a two steps look-ahead policy is adopted to approximate the dynamic programming problem.

**16h45 Transport et disparités régionales au Maroc**

Malyadi, Sanaa, [sanaarachi@gmail.com](mailto:sanaarachi@gmail.com)

Cet article tente d'examiner la relation entre les infrastructures de transport et la croissance économique, ainsi que leur éventuel rôle dans la réduction des disparités régionales. Sur un échantillon de 16 régions marocaines sur la période 2000-2008. Les résultats des estimations économétriques soutiennent que les infrastructures de transport influencent positivement la croissance économique sans permettre aux régions pauvres de rattraper les régions riches

**MB7 Énergie et environnement II / Energy and Environment II**

Salle/Room: Hélène-Desmarais

Président/Chairman: Fertel, Camille

**15h30 Climate Change Mitigation Through Reduced Meat and Dairy Product Consumption: An Analysis with the TIMES-Canada Energy Model**

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Bahn, Olivier, GERAD - HEC Montréal, [olivier.bahn@hec.ca](mailto:olivier.bahn@hec.ca)

Waaub, Jean-Philippe, GERAD - Université du Québec à Montréal, [waaub.jean-philippe@uqam.ca](mailto:waaub.jean-philippe@uqam.ca)

Vaillancourt, Kathleen, Université du Québec à Montréal, [kathleen.vaillancourt@gerad.ca](mailto:kathleen.vaillancourt@gerad.ca)

The environmental impacts tied to the consumption of meat and dairy products, in terms of energy usage and greenhouse gas emissions, are estimated and discussed using the TIMES-Canada energy model. First, the modelling of the agriculture sector is explained. Second, results for different meat and dairy consumption scenarios are discussed.

**15h55 Analyse des corridors électriques selon l'approche TIMES**

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Bahn, Olivier, GERAD - HEC Montréal, [olivier.bahn@hec.ca](mailto:olivier.bahn@hec.ca)

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Vaillancourt, Kathleen, GERAD - Université du Québec à Montréal, [kathleen.vaillancourt@gerad.ca](mailto:kathleen.vaillancourt@gerad.ca)

Fertel, Camille, GERAD, [camille.fertel@gerad.ca](mailto:camille.fertel@gerad.ca)

Cette présentation s'intéressera à la modélisation des corridors électriques selon une approche technico-économique. L'objectif sera d'analyser l'évolution des flux d'électricités échangés entre les provinces canadiennes et les États-Unis et de déterminer l'infrastructure nécessaire pour garantir l'approvisionnement en électricité. Le modèle TIMES, utilisé au cours de ce travail, est un modèle d'équilibre partiel basé sur la programmation linéaire dont l'objectif est de maximiser le surplus collectif. D'abord un bref aperçu sur les marchés de l'électricité et sur les modèles de tarification électrique sera donné. Ensuite il s'agira de documenter les principales interconnexions qui relient les réseaux provinciaux et les États-Unis. Enfin la troisième partie s'articulera autour de l'élaboration et de l'analyse des différents scénarios qui permettent de prévoir l'évolution des échanges d'électricité.

**16h20 Stochastic Inventory Control for an Assembly System under Sustainable Development**

Garcia Alvarado, Marthy Stivaliz, École de Technologie Supérieure, [marthy-stivaliz.garcia-alvarado.1@ens.etsmtl.ca](mailto:marthy-stivaliz.garcia-alvarado.1@ens.etsmtl.ca)

New regulations and laws with aim to reduce GHG emissions are increasing. Environmental performance has become a major goal for companies. In consequence, inventory models must be redesigned to balance environmental and financial objectives. Through a stochastic multi-echelon inventory model with returns, we discuss modeling challenges and how inventory policies should react in response to environmental constraints.



Salle/Room: Demers Beaulne

Président/Chairman: Lahrichi, Nadia

15h30

### Home Care Routing with Synchronization Constraints

Rönnqvist, Mikael, Université Laval, [mikael.ronnqvist@gmc.ulaval.ca](mailto:mikael.ronnqvist@gmc.ulaval.ca)

Routing of homecare workers is integrated with visit allocations. Each visit requires competences and has a time window. Some visit requires synchronization between workers. In addition there are multiple objectives including quality, efficiency, fairness and preferences. We describe solution methods and a decision support system used in the Nordic countries.

15h55

### Planning Healthcare and Social Services for an Aging Population: Simulation Model for the Continuum of Care for Elderly in Québec

Hosatte-Ducassy, Caroline, Université Laval,

Zubieta, Lourdes, Bishop's University,

Ruiz, Angel, Université Laval, [angel.ruiz@fsa.ulaval.ca](mailto:angel.ruiz@fsa.ulaval.ca)

Lemire, Stéphane, Interniste-Gériatre et Professeur de clinique, CHUQ, [stlemire@googlemail.com](mailto:stlemire@googlemail.com)

In Québec, the population aged 75 years and over will almost double to reach over 1 million individuals by 2031. Considering that gains in life expectancy are not associated with a compression of morbidity so far, the demand for health and long-term care services will continue to increase. Financial resources being limited, efficiency is of utmost importance, and decision makers need a better understanding of the relationships between demand, capacity, their mismatch, and management policies of resource allocation within the continuum care. Therefore, modelling and simulation has the potential to provide the information required to plan healthcare delivery proactively. The aim of this project is to create a model that represents the best possible the patient flows within the continuum for elderly care. The preliminary model represents the flow of elderly patients through the system. Although most live independently initially, many have or will develop disabilities at known yearly rates for the 14 autonomy profiles described using the provincial toolset. Services are sought at different institutions: community services, GPs, emergency departments, hospitals, rehabilitation facilities, and long term care facilities. Administrative data collected over the last 10 years in one of the 16 regions in Québec will be used to validate our model and understand the dynamics of this system, estimate distributions of operating measures, evaluate the gradient effects of overflows, both in quantity and time. Several scenarios and management policies impacting different service points will be tested to allow optimization. Therefore, using simulation, a proactive, dynamic and organized management approach will be possible in Québec to face the healthcare challenges linked to an aging population. We expect our modelling and simulating approach to be used in other regions of Quebec thereafter.

16h20

### Modeling of Patient Flow in the New Emergency Room of the Jewish General Hospital at Montreal

Gil, Alvaro, Polytechnique Montréal / Jewish General Hospital, [agil@jgh.mcgill.ca](mailto:agil@jgh.mcgill.ca)

The aim of this project is to identify and model all the different external and internal circulation flows associated with the new emergency room of the Jewish General Hospital of Montreal, currently under construction. The data base was built by using historical medical records, and then some data-mining techniques were applied, after which we found some general and repeated trajectories for patients. A second model was built for the medical staff. The final result was a general circulation model that can be used as a decision tool for some policies like the logistics schedule (food, pharmacy, etc.) or the elevators policies (i.e. dedicated periods of time).

16h45

### Collaboration Mechanisms in Reverse Supply Chains

Weraikat, Dua, Concordia University, [d\\_wer@encs.concordia.ca](mailto:d_wer@encs.concordia.ca)

Lehoux, Nadia, Université Laval, [nadia.lehoux@gmc.ulaval.ca](mailto:nadia.lehoux@gmc.ulaval.ca)

Kazemi, Masoumeh, Concordia University, [kazemi@encs.concordia.ca](mailto:kazemi@encs.concordia.ca)

This study, as a first research on a pharmaceutical RSC decision-making model, contributes to the literature by modeling a pharmaceutical RSC, exploring the role of collaboration approaches in facilitating the recovery process, determining the proper techniques to share RSC's savings and comparing the effect of non-collaborative and collaborative approaches.

## **MB9 Applications de la théorie des jeux en marketing / Game Theory Applications in Marketing**

**Salle/Room:** Dutilleul International  
**Président/Chairman:** Taboubi, Sihem

### **15h30 Pricing Strategies of Complementary Products in Distribution Channels: A Dynamic Approach**

**Ngendakuriyo, Fabien**, GERAD, [Fabien.Ngendakuriyo@gerad.ca](mailto:Fabien.Ngendakuriyo@gerad.ca)  
**Taboubi, Sihem**, GERAD - HEC Montréal, [sihem.taboubi@hec.ca](mailto:sihem.taboubi@hec.ca)

Most of the literature on the issue of pricing in vertical channel structures examined either the case of a unique product sold in a bilateral monopoly, or the case of substitute products sold in competitive channels. In this paper, we investigate the dynamic pricing strategies of firms in a distribution channel where a unique retailer sells two products that could be substitutes or complements. The diffusion of each product evolves according to a differential equation that captures the impact of its cumulative sales and the retail prices of both products on its adoption rate. We consider that the retailer could behave in a myopic or a farsighted manner. A myopic retailer maximizes its instantaneous profit without taking into account the diffusion of products. The literature on pricing in bilateral monopolies proved that the retailer fixes higher retail prices and loses profits when he acts in a myopic manner (Jørgensen and Zaccour, 2004). In competitive channels, there are some conditions under which the retailer's myopic behavior could be a strategic choice. In this paper, we want to examine the impact of retailer's myopia on the pricing strategies, the diffusion, and channel members' profits when the retailer handles complementary products, and compare these results to the case where these products are substitutes.

### **15h55 Cost-Reducing R&D with Free Spillovers and Price Competition in a Dynamic Duopoly**

**El Ouardighi, Fouad**, ESSEC Business School, [elouardighi@essec.fr](mailto:elouardighi@essec.fr)  
**Pasin, Federico**, HEC Montréal, [secretaire.general@hec.ca](mailto:secretaire.general@hec.ca)  
**Shniderman, Matan**, Bar-Ilan University, [Matan.Shniderman@biu.ac.il](mailto:Matan.Shniderman@biu.ac.il)

The objective of this paper is to study the R&D investment and pricing strategies of two firms competing for consumer demand in a dynamic setup. A firm's R&D is production cost-reducing and can benefit the rival firm without payment. We consider decisions that follow from symmetric noncooperative equilibria, that is, Nash equilibria. In such a dynamic game, a player's action can be based on the information on the current time  $t$  solely (open-loop strategy), or it can also include the information on the current value of the state vector if it is available (closed-loop strategy). The purpose of this paper is to compare open-loop and closed-loop strategies to determine the extent to which they affect the pricing and R&D investment decisions and the payoffs of the competitors in the presence of free spillovers.

### **16h20 ANNULÉ/CANCELLED - Why Would a Retailer Want to Use a Category Captain?**

**Timoumi, Ahmed**, Koç University, [atimoumi@ku.edu.tr](mailto:atimoumi@ku.edu.tr)  
**Essegaier, Skander**, Koç University, [skander@ku.edu](mailto:skander@ku.edu)

Many retailers rely on one national brand manufacturer, called the "category captain," for the management of the entire product category. Captains get access to privileged category data (including data about competitor brands) and recommend a category plan (e.g., shelf space allocation) that affects the store level demand for all brands in the category. Why would a retailer share privileged category data with one of the brand manufacturers and delegate critical category decisions? Why are competing brand manufacturers not protesting? This research addresses these questions. Our starting point is that store demand response to a category decision varies across brands in the category. As large retailers carry myriad of categories, they find it impossible to assess the extent of differences in brand responsiveness for all categories. Yet, understanding how a category decision differentially enhances store demand across brands is critical to optimize the pricing of these brands relative to the category decision; failure to do so results in



poor pricing and inferior profit. We develop a signaling model to show that a retailer may benefit by delegating category decisions to a brand manufacturer that has the ability to assess the differences in responsiveness across brands. Results indicate that category decisions taken by the informed category captain can reveal the captain's information about brands' differences in responsiveness. The revealed information allows the retailer to optimize its retail pricing of all brands relative to the captain's category decision; it also allows the competing manufacturer to better wholesale price its own brand. Through better pricing, both retailer and competing manufacturer are better off, even when the captain behaves opportunistically.

**16h45**

#### **ANNULÉ/CANCELLED - Recommendation Systems and Competition**

**Bahani, Sofiane**, Koç University, [sbahani@ku.edu.tr](mailto:sbahani@ku.edu.tr)  
**Essegaier, Skander**, Koç University, [skander@ku.edu](mailto:skander@ku.edu)

This paper studies the strategic implications of the use of recommendation systems by competing retailers. We develop a game theoretical model to explain how product recommendations enable competing retailers to reduce the intensity of price competition and generate higher profits. Our model captures, in a stylized way, some key features of the competitive setting in book retailing on the Internet (Amazon.com vs. Barnesandnobles.com). We consider two retailers serving their own store-loyal customers while competing over store-switchers. Both retailers carry a similar assortment of products that are imperfect substitutes (e.g., Gardening Books). All consumers, both "store-switchers" and "store-loyals," have heterogeneous preferences over these items. Store-loyals are addressable in a way that switchers are not: each retailer has the ability to send its own store-loyals a recommendation. Building on evidence from the behavioral literature that indicate that recommendations can increase preference, we show that in equilibrium, both retailers recommend the same subset of items to their respective loyals. This is because retailers who recommend the same items have the same incentive to raise prices for the recommended items, thereby taking advantage of the enhanced preference and the larger demand stemming from their store-loyals customers for these items. As a result, competition between the two stores to sell the recommended items to store-switchers would be muted. Stores competition for the non recommended items, however, would be more aggressive and price would decrease. Overall, we show that both retailers achieve higher profits.

**17h10**

#### **Pricing Optimal Contingent Products in Marketing Channels**

**Taboubi, Sihem**, GERAD - HEC Montréal, [sihem.taboubi@hec.ca](mailto:sihem.taboubi@hec.ca)  
**Kort, Peter M.**, Tilburg University, [kort@uvt.nl](mailto:kort@uvt.nl)  
**Zaccour, Georges**, GERAD - HEC Montréal, [georges.zaccour@gerad.ca](mailto:georges.zaccour@gerad.ca)

This paper studies the pricing strategies of firms belonging to a vertical channel structure where optional contingent products are sold. Optional contingent products are characterized by unilateral demand interdependencies. That is, the base product can be used independently of a contingent product. On the other hand, the contingent product's purchase is conditional on the possession of the base product. We aim to examine the optimality of loss-leader pricing in a context where the interdependent products are controlled by different firms located at two levels of the distribution channel and to investigate the impact of competition at the contingent product's market. The problem is modeled as a game played between a manufacturer and a (two) retailer(s). The manufacturer controls the transfer price while one of the retailer(s) control(s) the base product's retail price. Under both the monopoly case and the competitive case, the retailer(s) control(s) the contingent product's retail price and the manufacturer is considered as the channel leader.

**MB10**

#### **Localisation et conception de réseaux I / Location and Network Design I**

**Salle/Room:** Nancy et Michel-Gaucher  
**Président/Chairman:** Gendron, Bernard

**15h30**

#### **Lagrangian Relaxation Approaches for Multicommodity Uncapacitated Network Design**

**Gorgone, Enrico**, Università della Calabria, [egorgone@deis.unical.it](mailto:egorgone@deis.unical.it)  
**Gendron, Bernard**, Université de Montréal, [bernard.gendron@cirreil.ca](mailto:bernard.gendron@cirreil.ca)  
**Frangioni, Antonio**, Dipartimento di informatica, Università di Pisa, [frangio@di.unipi.it](mailto:frangio@di.unipi.it)

We present several algorithms for solving the multicommodity uncapacitated network design problem. We report the results obtained by using different Lagrangian relaxation approaches, a classical specialized dual-ascent method and combinations of these algorithms. We solve the Lagrangian duals by using different variants of non differentiable optimization approaches like (incremental, deflected, projected) subgradient-type methods and (disaggregated, generalized) bundle type methods.

**15h55 Primal Heuristic and Lagrangian Relaxation for an Industrial Two-Echelon Location-Distribution Problem**

**Khuong, Paul-Virak**, Université de Montréal, [khuongpv@iro.umontreal.ca](mailto:khuongpv@iro.umontreal.ca)  
**Gendron, Bernard**, Université de Montréal, [bernard.gendron@cirrelt.ca](mailto:bernard.gendron@cirrelt.ca)

We describe practical methods to solve an industrial location-distribution problem approximately, with solution quality estimates. Solving the problem as a MIP seems difficult. We instead present a multilayer neighbourhood search method and a Lagrangian decomposition method: the former quickly solutions, while the latter proves their quality.

**16h20 Benders Decomposition for a Location-Design Problem in Green Wireless Local Area Networks**

**Gendron, Bernard**, Université de Montréal, [bernard.gendron@cirrelt.ca](mailto:bernard.gendron@cirrelt.ca)  
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**Tavanti, Luca**, Dipartimento di Ingegneria dell'Informazione, Università degli Studi di Pisa, Pisa, Italy, [luca.tavanti@iet.unipi.it](mailto:luca.tavanti@iet.unipi.it)

We consider a problem arising in the design of green (or energy-saving) wireless local area networks (GWLANS). Decisions on both location and capacity dimensioning must be taken simultaneously. We model the problem as an integer program with nonlinear constraints and derive valid inequalities. We handle the nonlinearity of the formulation by developing a Benders decomposition algorithm. We propose various ways to improve the Benders master problem and the feasibility cuts.

**16h45 Routing and Wavelength Assignment Problem with Geodesics in Realistic Optical Transport Network Topologies**

**Cousineau, Martin**, McGill University, [martin.cousineau@mail.mcgill.ca](mailto:martin.cousineau@mail.mcgill.ca)  
**Perron, Sylvain**, GERAD - HEC Montréal, [sylvain.perron@hec.ca](mailto:sylvain.perron@hec.ca)  
**Caporossi, Gilles**, GERAD - HEC Montréal, [gilles.caporossi@gerad.ca](mailto:gilles.caporossi@gerad.ca)  
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**Segatto, Marcelo**, Federal University of Espirito Santo, [segatto@ele.ufes.br](mailto:segatto@ele.ufes.br)

We present a decomposition approach for solving a variant of the Routing and Wavelength Assignment (RWA) problem. The results show that our approach can find the optimal number of wavelengths for 28 of the 29 realistic optical transport networks tested in a short computing time.

**MB11 Tournées de véhicules stochastiques / Stochastic Vehicle Routing Problems**

**Salle/Room:** Gérard Parizeau  
**Président/Chairman:** Gendreau, Michel

**15h30 A Branch-Cut-and-Price Algorithm for the Vehicle Routing Problem with Stochastic Demands**

**Gauvin, Charles**, Polytechnique Montréal, [charles.gauvin@polymtl.ca](mailto:charles.gauvin@polymtl.ca)

This talk presents a state-of-the-art branch-cut-and-price (BCP) algorithm for the vehicle routing problem with stochastic demands (VRPSD). We adapt the model of Christiansen and Lysgaard (Christiansen, H. C. and Lysgaard, J. (2007). A branch-and-price algorithm for the capacitated vehicle routing problem with stochastic demands. Operations Research Letters, 37, 773–781.) and formulate the VRPSD as a set

partitioning model with additional constraints. Feasible routes are generated using a dynamic programming algorithm executed over a state-space graph. Our method combines 2-cycle elimination with ng-routes. In addition, our pricing problem is significantly accelerated by the introduction of a new aggregate dominance rule. To speed up the generation of negative reduced costs columns, we use a tabu search heuristic and a bidirectional labelling algorithm. We also add capacity constraints and subset-row inequalities dynamically in order to strengthen the linear relaxation of the master problem. To derive integer solutions, we dynamically choose between 2 types of branching methods. As extensive tests illustrate, our algorithm is very competitive with the one of Christiansen and Lysgaard. We manage to solve 20 additional instances and we considerably improve the computing times for instances already closed. Only 2 instances out of the 40 considered remain unsolved.

**15h55      A Branch-and-Price Approach for a Stochastic Vehicle Routing Problem with Correlated Demands.**

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**Crainic, Teodor Gabriel**, Université du Québec à Montréal, [TeodorGabriel.Crainic@cirrelt.ca](mailto:TeodorGabriel.Crainic@cirrelt.ca)  
**Gendreau, Michel**, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)  
**Rei, Walter**, Université du Québec à Montréal, [walter.rei@cirrelt.ca](mailto:walter.rei@cirrelt.ca)

Many applications of the Vehicle Routing Problem (VRP) with correlated stochastic demands (supplies) exist in real-life logistic systems. In this paper, we model one type of these problems which is encountered in the context of milk collection from the milk producers' farms in the Province of Quebec. In the derived model, the uncertainty in terms of producers' daily production levels is represented through a set of finite scenarios. We propose a branch-and-price solution approach to optimally solve this problem. Computational results showed that this approach is able to solve instances with up to 25 producers and 10 scenarios.

**16h20      The Vehicle Routing Problem with Hard Time Windows and Stochastic Service Times**

**Errico, Fausto**, Polytechnique Montréal, [fausto.errico@cirrelt.ca](mailto:fausto.errico@cirrelt.ca)  
**Desaulniers, Guy**, GERAD - Polytechnique Montréal, [Guy.Desaulniers@gerad.ca](mailto:Guy.Desaulniers@gerad.ca)  
**Gendreau, Michel**, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)  
**Rei, Walter**, Université du Québec à Montréal, [walter.rei@cirrelt.ca](mailto:walter.rei@cirrelt.ca)  
**Rousseau, Louis-Martin**, Polytechnique Montréal, [louis-martin.rousseau@polymtl.ca](mailto:louis-martin.rousseau@polymtl.ca)

We consider a variant of the Vehicle Routing Problem where stochastic service times and hard time windows are associated with customers. We provide a new set-partitioning formulation which includes a probabilistic constraint and solve the problem by Branch & Price & Cut. We deploy new heuristic and exact dominance rules to limit the number of states visited in the Dynamic Programming algorithm. This is done by developing a recursive method to exactly compute the arrival time probability distribution at customers. Results show that on modified Solomon's R100 and RC100 benchmark instances, our algorithm optimally solves all but two of the 50-customer instances

**16h45      Vehicle Routing with Soft Time Windows and Stochastic Travel Times: A Column Generation and Branch-and-Price Solution Approach**

**Gendreau, Michel**, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)  
**Tas, Duygu**, TU/e Eindhoven University of Technology, [D.Tas@tue.nl](mailto:D.Tas@tue.nl)  
**Dellaert, Nico P.**, TU/e Eindhoven University of Technology, [N.P.Dellaert@tue.nl](mailto:N.P.Dellaert@tue.nl)  
**Van Woensel, Tom**, Eindhoven University of Technology, [t.v.woensel@tue.nl](mailto:t.v.woensel@tue.nl)  
**de Kok, A.G. (Ton)**, Eindhoven University of Technology, [A.G.d.Kok@tue.nl](mailto:A.G.d.Kok@tue.nl)

We study a vehicle routing problem with stochastic travel times. For each customer, a soft time window allows early and late servicing. The objective is to minimize the sum of transportation costs (total distance traveled, number of vehicles used and total expected overtime of drivers) and service costs (penalties for time-window violations). We apply a column generation procedure. The master problem is a classical set partitioning problem. The pricing subproblem corresponds to an elementary shortest path problem with resource constraints. Integer solutions are obtained by branch-and-price.

**TAP Séance plénière III / Plenary Session III**

**Salle/Room:** Amphithéâtre IBM  
**Président/Chairman:** Anjos, Miguel

**09h00 Mathematical Programming with Linear Complementarity Constraints: Algorithms and Applications**

**Júdice, Joaquim João**, Instituto de Telecomunicações, [Joaquim.Judice@co.it.pt](mailto:Joaquim.Judice@co.it.pt)

A Mathematical Program with Linear Complementarity Constraints (MPLCC) is an optimization problem where a linear or nonlinear function is minimized on a set defined by linear constraints and complementarity conditions on pairs of complementary variables. This problem finds many applications in several areas of science, engineering and economics and is also an important tool for the solution of some NP-hard structured and nonconvex optimization problems. In particular, bilevel, bilinear and nonconvex quadratic programs and the linear complementarity problem can be reduced to MPLCCs and solved by exploiting these formulations. In this talk, the most important applications and formulations of the MPLCC are first reviewed. The problems of finding a feasible solution, a stationary point and a global minimum for the MPLCC are addressed next. Local methods and special purpose techniques can be used for computing a feasible solution in some special cases, in particular for those MPLCCs associated with the reformulations mentioned before. In general, an enumerative method is required for such a task. Active-set algorithms have been designed for finding stationary points of the MPLCC and can be employed in a sequential complementarity algorithm for computing a global minimum to the MPLCC. Branch-and-bound algorithms can also be useful for finding a global minimum for the MPLCC and exploit the dichotomy of the complementary variables. RLT and SDP techniques can be incorporated in these algorithms in order to speed up the search for a global minimum. Finally the MPLCC can be shown to be equivalent to a zero-one program and solved by using a special purpose integer programming technique. Some comments about the computational performance of the algorithms and a few topics for future research are presented in the last part of the talk.

**TA1 Exposé magistral III / Tutorial III**

**Salle/Room:** Banque Scotia  
**Président/Chairman:** Sansò, Brunilde

**10h30 The Practice of Network Modeling and Design in Commercial Telecommunications Networks**

**Doverspike, Robert**, AT&T Labs - Research, [rdd@research.att.com](mailto:rdd@research.att.com)

The key to designing carrier telecommunications networks is realistic modeling of network traffic, switching/transport technologies, layering, reliability, restoration methods, and design rules imposed by network operators. In addition, the models vary among various segments of the network, such as a metropolitan area network vs. a wide area (inter-city) network. This talk will provide a glimpse into this practice and the resulting optimization problems.

**TA2 OPDE 3 - Applications en contexte multi-usages des ressources naturelles / Applications: Multipurpose Context of Natural Resources**

**Salle/Room:** TAL  
**Président/Chairman:** Waaub, Jean-Philippe

**10h30 Scénarios de priorisation des chemins multi usages en Abitibi-Témiscamingue : outils d'animation et démarche d'aide à la concertation**

**Waaub, Jean-Philippe**, GERAD - GEIGER - Université du Québec à Montréal, [waaub.jean-philippe@uqam.ca](mailto:waaub.jean-philippe@uqam.ca)  
**Dallaire, Nathalie**, CRÉ-AT, [mailto:nathalie.dallaire@conferenceregional.ca](mailto:mailto:nathalie.dallaire@conferenceregional.ca)

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| 10h55      | <b>Proposition d'une approche multicritère comme modèle d'aide à la décision pour la gestion participative des eaux souterraines en Tunisie (Cas de la nappe de Kairouan)</b><br>Trabelsi, Hedia,, <a href="mailto:trabelsi_hedia@yahoo.com">trabelsi_hedia@yahoo.com</a><br>Prévil, Carlo, Université du Québec en Abitibi-Témiscamingue, <a href="mailto:previl.carlo@gmail.com">previl.carlo@gmail.com</a><br>Matoussi, Mohamed Salah, Professeur, <a href="mailto:msm@gmail.com">msm@gmail.com</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 11h20      | <b>L'AMCD comme outil d'intégration de la biodiversité dans les aménagements fluviaux</b><br>Cissé Djibrilla, Hassane, GEIGER/UQAM, <a href="mailto:djibrilla_cisse.hassane@courrier.uqam.ca">djibrilla_cisse.hassane@courrier.uqam.ca</a><br>Waaub, Jean-Philippe, GERAD - GEIGER - Université du Québec à Montréal, <a href="mailto:waaub.jean-philippe@uqam.ca">waaub.jean-philippe@uqam.ca</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 11h45      | <b>Des conflits autour du multi-usage des ressources naturelles en zone sahélienne du Cameroun. Un pas vers la gestion consensuelle des territoires entre les acteurs</b><br>Balna, Jules, Université de Maroua, <a href="mailto:julesbalna@yahoo.fr">julesbalna@yahoo.fr</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>TA3</b> | <b>Tournées de véhicules III / Vehicle Routing Problem III</b><br>Salle/Room: St-Hubert<br>Président/Chairman: C. Coelho, Leandro                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 10h30      | <b>The Multi-Compartment Delivery Problem</b><br>Coelho, Leandro C., CIRRELT - HEC Montréal, <a href="mailto:leandro.coelho@cirrelt.ca">leandro.coelho@cirrelt.ca</a><br>Laporte, Gilbert, CIRRELT - GERAD - HEC Montréal, <a href="mailto:gilbert.laporte@cirrelt.ca">gilbert.laporte@cirrelt.ca</a><br><p>The distribution of products using vehicles with compartments involves many decisions such as vehicle routing, inventory control of several types of products, and their allocation to vehicle compartments. In this presentation we will review the main categories of Multi-Compartment Delivery problems and present two linear models and their resolution.</p>                                                                                                                                                                                                                                                                                            |
| 10h55      | <b>Multicriteria Optimization of a Long-Haul Routing and Scheduling Problem</b><br>Rancourt, Marie-Ève, Université du Québec à Montréal, <a href="mailto:rancourt.marie-eve@uqam.ca">rancourt.marie-eve@uqam.ca</a><br>Paquette, Julie, HEC Montréal, <a href="mailto:julie.2.paquette@hec.ca">julie.2.paquette@hec.ca</a><br><p>We introduce a multi-objective vehicle routing and truck driver scheduling problem under the legislative requirements on work and rest hours in the United States (USMOVRTDSP). We present a tabu search algorithm that solves this problem and provides solution sets from which tradeoffs between operating costs and driver inconvenience are evaluated.</p>                                                                                                                                                                                                                                                                           |
| 11h20      | <b>Adaptative Large Neighborhood Search for the Periodic Capacitated Arc Routing Problem with Inventory Constraints</b><br>Riquelme-Rodriguez, Juan-Pablo, École Polytechnique de Montréal, <a href="mailto:juan-pablo.riquelme@polymtl.ca">juan-pablo.riquelme@polymtl.ca</a><br>Gamache, Michel, GERAD - Polytechnique Montréal, <a href="mailto:michel.gamache@polymtl.ca">michel.gamache@polymtl.ca</a><br>Langevin, André, Polytechnique Montréal, <a href="mailto:andre.langevin@polymtl.ca">andre.langevin@polymtl.ca</a><br><p>The edges of a network behave as customers. Routing and inventory decisions are made simultaneously. An example is dust suppression in open-pit mines. We develop a mathematical model that minimizes the penalty for the lack of humidity and watering and traversing costs of each edge. Due to the complexity of the mathematical model, we also develop an adaptive large neighborhood search program to solve the problem.</p> |
| 11h45      | <b>Network Design in Order to Minimize Soil Damage While Maintaing Efficient Logistic Operations</b><br>Rönnqvist, Mikael, Université Laval, <a href="mailto:mikael.ronnqvist@gmc.ulaval.ca">mikael.ronnqvist@gmc.ulaval.ca</a><br>Flisberg, Patruk, The Forestry Research Institute of Sweden, <a href="mailto:pafli@mweb.co.za">pafli@mweb.co.za</a><br>Jönsson, Petrus, The Forestry Research Institute of Sweden, <a href="mailto:petrus.jonsson@skogforsk.se">petrus.jonsson@skogforsk.se</a><br><p>We develop a decision support tool to construct road network at harvest areas for harvesters and forwarders. We use high quality GIS information to minimize ground damage and at the same time</p>                                                                                                                                                                                                                                                               |

maintain efficient logistic operations. The solution method is based on a Lagrangian relaxation of a network design model. Each subproblem is a shortest path tree. In addition of the network design, we also find an efficient routing of forwarders. The system is tested on case studies from Swedish forest companies.

## **TA4 Applications de modèles de choix discrets en recherche opérationnelle / Applications of Discrete Choice Models in Operations Research**

**Salle/Room:** Van Houtte

**Président/Chairman:** Sharif Azadeh, Shadi

### **10h30 A Mathematical Programming Approach to Improved Bid Prices under a Parametric Choice Model of Demand**

**Hosseinalifam, Morad**, Polytechnique Montréal, [morad.hosseinalifam@polymtl.ca](mailto:morad.hosseinalifam@polymtl.ca)

**Marcotte, Patrice**, Université de Montréal, [marcotte@iro.umontreal.ca](mailto:marcotte@iro.umontreal.ca)

**Savard, Gilles**, GERAD - Polytechnique Montréal, [gilles.savard@polymtl.ca](mailto:gilles.savard@polymtl.ca)

In quantity based revenue management, one of the most powerful and simple approach to control perishable inventories, consists in assigning threshold prices ("bid prices") to each resource. We propose a new mathematical programming approach to estimate time dependent bid prices, within the framework of customer choice-based network revenue management. In contrast with most heuristics proposed in the literature, our approach is flexible and can easily accommodate technical and practical side constraints. To solve the model, we develop a modified column generation algorithm combined with an efficient heuristic procedure for addressing the NP-Hard subproblem.

### **10h55 A Non-Parametric Algorithm of Uncensoring Demand under Availability Constraints in RM Systems**

**Sharif Azadeh, Shadi**, École Polytechnique de Montréal, [shadi.sharifazadeh@polymtl.ca](mailto:shadi.sharifazadeh@polymtl.ca)

**Savard, Gilles**, GERAD - Polytechnique Montréal, [gilles.savard@polymtl.ca](mailto:gilles.savard@polymtl.ca)

We examine the challenge of demand forecasting in revenue management. Due to booking limits, registered reservations do not represent the real value of demand. Usually transportation companies continue to accept reservations in a fare class until the booking limit is reached. From this point forward, the data is censored. In revenue management systems, it is desired to uncensor the observations for representing the true demand. We propose an algorithm that takes availability constraints into account via a non-parametric mathematical representation. We solve the problem by introducing a new heuristic method.

### **11h20 A Link Based Dynamic Route Choice Model with Unrestricted Choice Set**

**Fosgerau, Mogens**, Technical University of Denmark, [mf@transport.dtu.dk](mailto:mf@transport.dtu.dk)

**Frejinger, Emma**, DIRO, Université de Montréal, [frejinge@iro.umontreal.ca](mailto:frejinge@iro.umontreal.ca)

**Karlstrom, Anders**, Royal Institute of Technology, Stockholm, [anders.karlstrom@abe.kth.se](mailto:anders.karlstrom@abe.kth.se)

Probabilistic route choice models are central in many transport applications. Such models are typically path based and require sampling of alternatives to define choice sets. We propose a link-based formulation that require no restriction on the choice set and no generation of paths. The model can be consistently estimated and efficiently used for prediction.

### **11h45 Dynamic Discrete Choice Model for Railway Ticket Cancellation and Exchange Behavior**

**Hetrakul, Pratt**, University of Maryland, [hetrakul@umd.edu](mailto:hetrakul@umd.edu)

**Cirillo, Cinzia**, University of Maryland, [ccirillo@umd.edu](mailto:ccirillo@umd.edu)

**Bastin, Fabian**, Université de Montréal, [bastin@iro.umontreal.ca](mailto:bastin@iro.umontreal.ca)

We apply dynamic discrete choice model to ticket cancellation and exchange behavior in the revenue management context. Each time period, a passenger makes the decision of whether to keep, exchange or cancel the ticket. The exchange decision allows for departure time specific choices. A 1-SL policy is adopted to approximate this dynamic programming problem.



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| <b>TA5</b>   | <b>Optimisation sans dérivées III : applications / Derivative-Free Optimization III: Applications</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|              | <p><b>Salle/Room:</b> CPA du Québec<br/> <b>Président/Chairman:</b> Cartier, Dominique</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>10h30</b> | <p><b>Challenges in Optimal and Sustainable Water Allocation for Berry Farming</b></p> <p><b>Fowler, Kathleen</b>, Clarkson University, <a href="mailto:kfowler@clarkson.edu">kfowler@clarkson.edu</a><br/> We present results and challenges in seeking to meet a sustainable water yield while maximizing profit and demand via derivative-free constrained optimization. The goal is a coupled hydrological decision-making tool using modeling, simulation, and optimization to understand trade-offs and guide practitioners that is flexible and applicable across various agricultural regions.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>10h55</b> | <p><b>Application of Black Box Optimization for Flood Control and Hydropower Production</b></p> <p><b>Côté, Pascal</b>, Rio Tinto Alcan, <a href="mailto:pascal.cote@riotinto.com">pascal.cote@riotinto.com</a><br/> <b>Paquin, Jean</b>, Rio Tinto Alcan, <a href="mailto:jean.paquin@riotinto.com">jean.paquin@riotinto.com</a><br/> <b>Desreumaux, Quentin</b>, Université de Sherbrooke, <a href="mailto:desreumauxq@gmail.com">desreumauxq@gmail.com</a></p> <p>The Kemano Hydropower System is located in British Columbia and is operated by Rio Tinto Alcan. Many challenges arise while operating with this system such as: supply the load from the Aluminium Smelter, flood control, dam protection and other environmental constraints. A Stochastic Dynamic Programming Controller is used to tackle these problems. As all the constraints cannot be satisfied, a black box optimization technique is used. It calibrates the controller so that the probabilities of constraint violations, when simulate by it on the historical scenarios, are under the decision maker criteria's.</p> |
| <b>11h20</b> | <p><b>New Approach for the Optimization of a Hydrologic Model with the MADS Algorithm</b></p> <p><b>Cartier, Dominique</b>, Polytechnique Montréal, <a href="mailto:dodo.cartier@videotron.ca">dodo.cartier@videotron.ca</a></p> <p>Hydrologic models are employed to model the water cycle through parameterized equations to estimate flows at the outlet of a watershed. Two optimization strategies oriented on physical processes are compared to the method currently used at Hydro-Québec, based on the robustness of the parameterization in the context of climate changes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>11h45</b> | <p><b>Alternatives for Optimization in Systems and Control: Convex and Non-Convex Approaches</b></p> <p><b>Simon, Émile</b>, Université Catholique de Louvain, <a href="mailto:Emile.Simon@uclouvain.be">Emile.Simon@uclouvain.be</a><br/> In this presentation, we will develop a short overview of main trends of optimization in systems and control, and from there outline some new perspectives emerging today. More specifically, we will focus on the current situation, where it is clear that convex and Linear Matrix Inequality (LMI) methods have become the most common option. However, because of its vast success, the convex approach is often the only direction considered, despite the underlying problem is non-convex and that other optimization methods specifically equipped to handle such problems should have been used instead. We will present key points on this topic, and as a side result we will propose a method to produce a virtually infinite number of papers.</p>                                                                                              |
| <b>TA6</b>   | <b>Théories des jeux I / Game Theory I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|              | <p><b>Salle/Room:</b> Mary Husny<br/> <b>Président/Chairman:</b> De Giovanni, Pietro</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>10h30</b> | <p><b>Modeling Fairness</b></p> <p><b>Hoang, Lê Nguyễn</b>, GERAD - Polytechnique Montréal, <a href="mailto:le.nguyen.hoang@gerad.ca">le.nguyen.hoang@gerad.ca</a><br/> <b>Soumis, François</b>, GERAD - Polytechnique Montréal, <a href="mailto:francois.soumis@gerad.ca">francois.soumis@gerad.ca</a><br/> <b>Zaccour, Georges</b>, GERAD - HEC Montréal, <a href="mailto:georges.zaccour@gerad.ca">georges.zaccour@gerad.ca</a></p> <p>The conceptualization of fairness is a difficult problem of mathematical modeling. Main results come from the cake-cutting literature, although they apply to a very specific sort of problem. In this talk, we generalize these ideas. In particular, we propose a quantification of fairness which can then be used for optimization.</p>                                                                                                                                                                                                                                                                                                                    |

**10h55      A Differential Game of Coordination in Supply Chain Quality Management**

**De Giovanni, Pietro**, Vrije Universiteit, [pietro.degiovanni@vu.nl](mailto:pietro.degiovanni@vu.nl)

The implementation of a conformance quality practice entails a trade-off between conformance quality (appraisal and prevention) and non-conformance quality (internal and external failures) strategies. A supply chain differential game is introduced to face this trade-off through coordination.

**TA7      Énergie et environnement III / Energy and Environment III**

**Salle/Room:** Hélène-Desmarais

**Président/Chairman:** Breton, Michèle

**10h30      Bilevel Modelling of Energy Pricing Problem**

**Afsar, Sezin**, INRIA Lille, [sezin.afsar@inria.fr](mailto:sezin.afsar@inria.fr)

**Brotcorne, Luce**, INRIA Lille, [luce.brotcorne@inria.fr](mailto:luce.brotcorne@inria.fr)

**Marcotte, Patrice**, Université de Montréal, [marcotte@iro.umontreal.ca](mailto:marcotte@iro.umontreal.ca)

**Savard, Gilles**, GERAD - Polytechnique Montréal, [gilles.savard@polymtl.ca](mailto:gilles.savard@polymtl.ca)

Pricing models for Demand Side Management methods are traditionally used to control electricity demand which became irregular recently. We propose several bilevel models to explore the relation and conflict between energy suppliers and customers who are connected to a smart grid. The models are reformulated as single level MIPs and solved.

**10h55      Cadre général pour la tarification des dérivés sur l'électricité**

**Boudhina, Ali**, HEC Montréal, [ali.boudhina@hec.ca](mailto:ali.boudhina@hec.ca)

**Breton, Michèle**, GERAD - HEC Montréal, [michele.breton@hec.ca](mailto:michele.breton@hec.ca)

Dans cet essai on présente un cadre général pour la tarification des produits dérivés sur le prix spot de l'électricité lorsque celui-ci est représenté par un modèle à deux facteurs avec sauts. On s'intéresse dans un premier volet à présenter une procédure d'estimation du modèle retenu. On présente ensuite une technique de tarification générale basée sur la programmation dynamique et l'approximation par les splines cubiques. La technique est testée pour la tarification des options de vente européennes, américaines et des options swing.

**11h20      Energy Subsidies Reform in Iran: An Example for the World?**

**Mirzapour, Hossein**, HEC Montréal, [hossein.mirzapour@hec.ca](mailto:hossein.mirzapour@hec.ca)

**Pineau, Pierre-Olivier**, HEC Montréal, [pierre-olivier.pineau@hec.ca](mailto:pierre-olivier.pineau@hec.ca)

**Breton, Michèle**, GERAD - HEC Montréal, [michele.breton@hec.ca](mailto:michele.breton@hec.ca)

In 2009, G-20 and APEC countries committed to "phase out inefficient fossil-fuel subsidies that encourage wasteful consumption". Based on Iran's reform practice as the most subsidized country, this paper reveals some related knowledge gaps by comparing empirical evidence vs. relevant theoretical constructs in the literature.

**11h45      A Decision Support System to Follow the Dynamic Evolution of an Urban Utility Network**

**Moraes, Ismália**, Cia Energética do Ceará (COELCE), [ismalia@coelce.com.br](mailto:ismalia@coelce.com.br)

**Calixto, Anderson**, Universidade Estadual do Ceará - UECE/MPCOMP, [andersonbr@gmail.com](mailto:andersonbr@gmail.com)

**Negreiros, Marcos José**, State University of Ceará, [negreiro@graphvs.com.br](mailto:negreiro@graphvs.com.br)

We consider the design of a DSS that contain a set of tools: Datawarehouse linked with the enterprise's planning and maintenance system, which is integrated to a dynamic graph web editor and evaluator (DynaGRAPH) that perform the edition/views of the changes in space-time of the utility network used by COELCE. We show how the DSS can be used to follow and/or project the changes in time of the high and low voltage network. We consider the possible results of using the system and the impact of it to the company.



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| <b>TA8</b> | <b>Optimisation en santé - études de cas et nouvelles approches / Healthcare Optimization - Case Studies and Novel Approaches</b> |
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Salle/Room: Demers Beaulne  
Président/Chairman: Cloutier, Mathieu

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| <b>10h30</b> | <b>Towards Reducing Hospital Readmission: Mining Patients Admission Records</b> |
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Izadi, Masoumeh, McGill University, [mtabae@cs.mcgill.ca](mailto:mtabae@cs.mcgill.ca)  
Hosseinzadeh, Arian, McGill University,  
Buckeridge, David, McGill University, [david.buckeridge@mcgill.ca](mailto:david.buckeridge@mcgill.ca)

One in every five patients is readmitted to the hospital within 30 days of their discharge. In order to reduce high rates of readmission after hospitalization further information is needed about characteristics of patients, and possibly care providers, which increase the chance of readmission. This research describes the design, implementation, and preliminary evaluation of learning models to predict readmission based on administrative data. Our analysis on hospital systems in Quebec illustrates promising results in the direction of identifying patients with highest risk of readmission at the time of discharge.

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| <b>10h55</b> | <b>Chemotherapy and Cytokine Responses in a Mathematical Model of the Human Hematopoietic System</b> |
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Belair, Jacques, Université de Montréal, [belair@CRM.UMontreal.CA](mailto:belair@CRM.UMontreal.CA)

We will present recent efforts to produce a mathematical model of the human hematopoietic system (regulation and control of the production of human blood cells) and use of that model to explore its response to the effects of chemotherapy: in particular, we assess the interactions between the "normal" feedback control mechanisms of regulating cytokines and the perturbations introduced by chemotherapy, trying to understand the effects of varying doses and frequency of administration. The model takes the form of a system of nonlinear delayed-differential equations. The ultimate, long-range goal is to (minimally) understand whether or not current clinical observations can be given a theoretical understanding and hopefully to make suggestions about better ways to administer these compounds in order to minimize the damage to the hematopoietic system.

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| <b>11h20</b> | <b>New Approaches to Cancer Treatment - The Role of Optimization</b> |
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Cloutier, Mathieu, GERAD, [mathieu.cloutier@gerad.ca](mailto:mathieu.cloutier@gerad.ca)

With the advent of molecular biology and high-throughput biological data, cancer treatment underwent major changes and breakthrough. However, the data-centric approach still shows major limitations. In this talk we will discuss the role that modelling and optimization should have in future research efforts, especially in terms of data analysis, prediction and hypotheses generation.

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| <b>11h45</b> | <b>Continuous Parameterization for Evolutionary Optimal Control in Epidemiology</b> |
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Rogalsky, Tim, Canadian Mennonite University, [trogalsky@cmu.ca](mailto:trogalsky@cmu.ca)

Evolutionary strategies can be effective global optimizers for optimal control of epidemics. The discrete parameterization methods currently used, however, limit the accuracy and usefulness of the resulting public health strategies. A new, continuous parameterization method is shown to provide quick and accurate solutions for a broad range of epidemiological models.

|            |                                                 |
|------------|-------------------------------------------------|
| <b>TA9</b> | <b>Graphes et réseaux / Graphs and Networks</b> |
|------------|-------------------------------------------------|

Salle/Room: Dutailier International  
Président/Chairman: Contardo, Claudio

|              |                                                                                   |
|--------------|-----------------------------------------------------------------------------------|
| <b>10h30</b> | <b>Efficient Exact Methods for the Capacitated Vehicle Routing Problem (CVRP)</b> |
|--------------|-----------------------------------------------------------------------------------|

Poggi, Marcus, Pontifícia Universidade Católica do Rio de Janeiro, [poggi@inf.puc-rio.br](mailto:poggi@inf.puc-rio.br)  
Uchoa, Eduardo B., Universidade Federal Fluminense, [uchoa@producao.uff.br](mailto:uchoa@producao.uff.br)

We present a discussion over the current most efficient exact methods for solving the CVRP. In common is the set partitioning formulation. The main issues are: the choice of routes to price (q-routes, ng-routes or elementary routes); to add or not non-robust cuts and to branch or to enumerate routes.

#### 10h55 **Improved Primal Simplex (IPS) Strongly Polynomial for Certain Types of Network Problems**

**Gauthier, Jean-Bertrand**, GERAD - HEC Montréal, [jean-bertrand.gauthier@gerad.ca](mailto:jean-bertrand.gauthier@gerad.ca)

**Desrosiers, Jacques**, GERAD - HEC Montréal, [jacques.desrosiers@hec.ca](mailto:jacques.desrosiers@hec.ca)

**Lübbecke, Marco E.**, RWTH Aachen University, [marco.luebbecke@rwth-aachen.de](mailto:marco.luebbecke@rwth-aachen.de)

Inspired by recent advances in coping with degeneracy in the primal simplex method, we apply the *Improved Primal Simplex* (IPS) method to specific network instances, namely the assignment and max flow problems. We show it echoes the mechanics of the minimum mean cycle-canceling algorithm of Goldberg and Tarjan (1989). The strongly polynomial algorithm operates as follows. Each iteration works on the *residual network* to retrieve a negative mean cost cycle indicating a strictly improving direction. We take the time to analyze the behavior of the algorithm through key concepts of the complexity analysis.

#### 11h20 **A Contraction-Expansion Algorithm for the Capacitated Minimum Cost Flow Problem**

**Gauthier, Jean-Bertrand**, GERAD - HEC Montréal, [jean-bertrand.gauthier@gerad.ca](mailto:jean-bertrand.gauthier@gerad.ca)

**Desrosiers, Jacques**, GERAD - HEC Montréal, [jacques.desrosiers@hec.ca](mailto:jacques.desrosiers@hec.ca)

**Lübbecke, Marco E.**, RWTH Aachen University, [marco.luebbecke@rwth-aachen.de](mailto:marco.luebbecke@rwth-aachen.de)

We show that a slight modification of the *Improved Primal Simplex* (IPS) used for solving degenerate linear programs (Raymond et al. 2010, Elhallaoui et al. 2011) results in a strongly polynomial algorithm for solving arbitrary capacitated minimum cost network flow problems. The key additive is that the traditional residual network is contracted with respect to non-degenerate variables. Acceleration strategies used in the implementation are also discussed and involve the concepts established in IPS such as compatibility and independent cycles. Moreover, we bias the algorithm around the residual capacities and the reduced cost of previous iterations to speed up the search.

#### 11h45 **Efficient Elementary and Restricted Non-Elementary Shortest Path Problems with Resource Constraints**

**Martinelli, Rafael**, GERAD - Polytechnique Montréal, [rafael.martinelli@gerad.ca](mailto:rafael.martinelli@gerad.ca)

**Pecin, Diego**, Pontifícia Universidade Católica do Rio de Janeiro, [dpecin@inf.puc-rio.br](mailto:dpecin@inf.puc-rio.br)

**Poggi, Marcus**, Pontifícia Universidade Católica do Rio de Janeiro, [poggi@inf.puc-rio.br](mailto:poggi@inf.puc-rio.br)

Our work aims at efficiently solving the Shortest Path Problem with Resource Constraints (SPPRC) with restricted non-elementary routes and also the Elementary SPPRC. We adapt the Decremental State-Space Relaxation to the SPPRC using completion bounds. We show how to extend this approach by dynamically rebuilding the ng-sets to obtain only elementary routes.

### TA10 **Algorithmes I / Algorithms I**

**Salle/Room:** Nancy et Michel-Gaucher

**Président/Chairman:** Wen, Jinming

#### 10h30 **Quadratic Programming Algorithm**

**Chikhaoui, Ahmed**, Ibn khaldoun University Tiaret, [ah\\_chikhaoui@yahoo.fr](mailto:ah_chikhaoui@yahoo.fr)

The aim of this study is to calculate the maximum of a convex quadratic function under linear constraints when the optimal solution is a summit (convex quadratic programming for example). Here, we propose an algorithm very similar to simplex method in linear case. One important result of this paper is that when moving from one summit to neighbouring one, cumulating of the objective function does not depend on the values of its double products. Another result is the new expression of the objective function at each iteration; allowing to obtain a quadratic system equivalent to the original system. Note that this algorithm is also valid for the linear programming problems. Like simplex method, the complexity of this algorithm needs no depending explicitly on the size of the numbers of the problem instances.

10h55

### Effects of the LLL Reduction on Integer Least Squares Estimation

**Wen, Jinming**, Department of Mathematics and Statistics, McGill University, [jinming.wen@mail.mcgill.ca](mailto:jinming.wen@mail.mcgill.ca)  
**Chang, Xiao-Wen**, McGill University, [chang@cs.mcgill.ca](mailto:chang@cs.mcgill.ca)  
**Xie, Xiaohu**, McGill University, [xiaohu.xie@mail.mcgill.ca](mailto:xiaohu.xie@mail.mcgill.ca)

To estimate an integer parameter vector in a linear model, a typical method is to solve an integer least squares (ILS) problem. The most widely used approach to solving an ILS problem is the so called sphere decoding methods. It has been observed that using the well-known LLL reduction as preprocessing can make a sphere decoder faster and can improve the success probability of the Babai point, a suboptimal solution. In this talk we rigorously show that both observations are true in theory.

11h20

### Nearest Facet of a Higher Dimensional Convex Hull to an Inner Point

**Gao, Zhan**, University of New Brunswick, [gao.erick@gmail.com](mailto:gao.erick@gmail.com)

In a convex polytope of H-representation, finding the nearest facet can be solved using linear programming. However for a convex hull or convex polytope of V-representation, such objective would be time consuming. By applying a simplex with suitable radius, we can prune facets and vertices which are natively far away from that point. And the remaining polytope which is generated by the left vertices and the intersection points of original polytope and the simplex will be hoped to be less complex than the original one.

11h45

### Alleviate the Total Dependency of the EM Algorithm on the Initial Value Choice Using EMVNS Algorithm

**Bessadok, Adel**, Institut supérieur de gestion de Gabès, [a\\_bessadok@yahoo.com](mailto:a_bessadok@yahoo.com)  
**Hansen, Pierre**, GERAD - HEC Montréal, [pierre.hansen@gerad.ca](mailto:pierre.hansen@gerad.ca)

Over many years the outstanding challenge for Clustering is widely used in almost every discipline in order to discover natural groups in a large data base. Probabilistic model-based clustering techniques and in particular Finite Gaussian Mixture Models (FGMM) have shown attracted results in a corpus of applications. Finding maximum likelihood parameter values for FGMM is often done with the Expectation Maximization (EM) algorithm. However the choice of initial values can severely affect the time and the accuracy to attain convergence of the algorithm in finding global maxima. However, in practice, the data dimension is very large modelled by FGMM and without guarantees to have a large basin attraction of the global max. In spite of this, the need of applying a robust method for complex problems is necessary. Contrarily to other methods based in local search, VNS provide a powerful and simple tool to implement for getting a best results comparing to competitive methods. Moreover, the use of the appropriate structures in VNS leads not only to improve the Maximization of the likelihood function but with best time realization

TA11

### Logistique / Logistics

**Salle/Room:** Gérard Parizeau  
**Président/Chairman:** Marcotte, Suzanne

10h30

### Failure Modes and Effect Analysis for ITS Implementation in City Logistics

**Badakhshian, Mostafa**, MIE Concordia University, [m\\_badak@encs.concordia.ca](mailto:m_badak@encs.concordia.ca)  
**Awasthi, Anjali**, Concordia University, [awasthi@ciise.concordia.ca](mailto:awasthi@ciise.concordia.ca)

ITS is applied in improvement the efficiency of freight transportation in city logistics. There are Barriers to implement ITS successfully. The Failure mode and effect analysis is preventive technique to decrease failure rates, identifies the causes and potential defects. The risks are specified based on severity, occurrence and detection values.

10h55

### A New Model for a Fair Relief Distribution Network

**Anaya Arenas, Ana Maria**, Université Laval, [anamaria.anayaarenas@cirre.lt.ca](mailto:anamaria.anayaarenas@cirre.lt.ca)  
**Renaud, Jacques**, Université Laval, [jacques.renaud@fsa.ulaval.ca](mailto:jacques.renaud@fsa.ulaval.ca)  
**Ruiz, Angel**, Université Laval, [angel.ruiz@fsa.ulaval.ca](mailto:angel.ruiz@fsa.ulaval.ca)

The emergency logistics field is a new and particular challenge for logistics' managers. In these networks, the satisfaction of the affected people's demand is much more important than the cost minimization. And more than that, emergency logistics' managers are looking for a network that ensures an equitable distribution of resources over affected people. We propose a new mathematical formulation that reflects this interest, and its effectiveness is supported by some preliminary numerical results.

**11h20**

#### **Location Problems in Humanitarian Logistics**

**Rahimi Vahed, Alireza**, HEC Montréal, [payam.rahimivahed@gmail.com](mailto:payam.rahimivahed@gmail.com)  
**Laporte, Gilbert**, CIRRELT - GERAD - HEC Montréal, [gilbert.laporte@cirrelt.ca](mailto:gilbert.laporte@cirrelt.ca)  
**Jabali, Ola**, HEC Montréal, [Ola.Jabali@hec.ca](mailto:Ola.Jabali@hec.ca)

In this talk, we present the fundamental differences between location problems in commercial and the broad field of humanitarian logistics. We also focus on areas in which additional research is required to ensure that analytical formulations provide a realistic depiction of the system being modeled. This talk is concluded by presenting key findings and an outline of future research directions.

**11h45**

#### **Integrating Shared Storage Space Deployment in the Holographic Design of Refurbishing and Recycling Facilities**

**Marcotte, Suzanne**, Université du Québec à Montréal, [suzanne.marcotte@cirrelt.ca](mailto:suzanne.marcotte@cirrelt.ca)  
**Montreuil, Benoît**, Université Laval, [Benoit.Montreuil@cirrelt.ulaval.ca](mailto:Benoit.Montreuil@cirrelt.ulaval.ca)

Our research aims to develop a refurbishing and recycling facilities design methodology integrating buffer storage grouping and location decisions. It also investigates the space and flow efficiency issues at stakes. We adapt and extend the HoloDesign methodology for such purposes. We then provide preliminary empirical results and insights.

**TBP**

#### **Séance plénière IV/ Plenary Session IV**

**Salle/Room:** Amphithéâtre IBM  
**Président/Chairman:** Orban, Dominique

**14h00**

#### **Convergence Properties of the Primal and Dual Forms of Variational Data Assimilation**

**Gauthier, Pierre**, Université du Québec à Montréal, [gauthier.pierre@uqam.ca](mailto:gauthier.pierre@uqam.ca)

Our understanding of the fundamental processes governing the atmosphere and their interactions is achieved through observations and modeling based on first principles. Numerical modeling is the laboratory in which our knowledge is encompassed within a mathematical and numerical framework, the results of which are then confronted to observations through data assimilation, in which observations and model predictions are combined based on their relative accuracy to produce analyses representing our best estimate of the current state of the system. This paper discusses the variational data assimilation problem which can be solved in either its primal (3D/4DVar) or dual (3D/4D-PSAS) form. The methods are equivalent at convergence but the dual method exhibits a spurious behaviour at the beginning of the minimization which leads to less probable states than the background state. This is a serious concern when using the dual method in operational implementations when only a finite number of iterations can be afforded. Two classes of minimization algorithms are examined in this article: the conjugate gradient (CG) and the minimum residual (MINRES) methods. While the CG algorithms ensure a monotonic reduction of the cost function, those based on the MINRES enforce instead a monotonic decrease of the norm of the gradient. In this article, it is shown that when applied to the minimization of the dual problem, the MINRES algorithms also lead to iterates for which their 'image' in physical space leads to a monotonic decrease of the primal cost function. A relationship is established showing that the primal objective function is related to the value of the dual cost function and the norm of its gradient. This holds for the incremental forms of both the three- and four-dimensional cases. A new convergence criterion is introduced based on the error norm in model space to make sure that, for the dual problem, the same accuracy is obtained in the analysis when only a finite number of iterations is completed.

|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>TB1</b>   | <b>Exposé magistral IV / Tutorial IV</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|              | <p><b>Salle/Room:</b> Banque Scotia</p> <p><b>Président/Chairman:</b> Orban, Dominique</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>15h30</b> | <p><b>An Introduction to the COIN-OR Optimization Suite: Open Source Tools for Building and Solving Optimization Models</b></p> <p><b>Ralphs, Ted</b>, Lehigh University, <a href="mailto:ted@lehigh.edu">ted@lehigh.edu</a></p> <p>The COIN-OR (Computational Infrastructure for Operations Research) software repository (<a href="http://www.coin-or.org">www.coin-or.org</a>) is an open source repository operated by the non-profit COIN-OR Foundation. The organization's goal is to support the development and distribution of open source software for operations research applications. The tutorial will begin with an overview of what software is available in the repository, emphasizing the problem classes and use cases supported. The remainder of the tutorial will focus on the COIN-OR Optimization Suite, a powerful suite of flexible and interoperable open source tools that can be used in a wide range of optimization applications and in a wide range of use cases. We will first describe the use of the tools out-of-the-box through various front ends, including the command line and a number of different modeling languages. Finally, we'll describe how to build the suite from source in Windows, Linux, and OSX, and how to use it to implement custom applications. The tutorial will focus particularly on use within Python through Python-based modeling languages and wrappers.</p> |
| <b>TB2</b>   | <b>OPDE 4 - Applications dans le domaine de la santé / Applications: Health Sector</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|              | <p><b>Salle/Room:</b> TAL</p> <p><b>Président/Chairman:</b> de Paula Reis, Alline</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>15h30</b> | <p><b>A Feasibility Study to Improve Communication in the Health Care System</b></p> <p><b>Norese, Maria Franca</b>, DIGEP Politecnico di Torino, <a href="mailto:mariafranca.norese@polito.it">mariafranca.norese@polito.it</a></p> <p><b>Antonelli, Dario</b>, DIGEP Politecnico di Torino, <a href="mailto:dario.antonelli@polito.it">dario.antonelli@polito.it</a></p> <p><b>Novello, Chiara</b>, <a href="mailto:chiaranovello.polito@gmail.com">chiaranovello.polito@gmail.com</a>, DIGEP Politecnico di Torino</p> <p><b>Gilli, Giulio</b>, SIC SaS Turin, <a href="mailto:gilli.giulio@gmail.com">gilli.giulio@gmail.com</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>15h55</b> | <p><b>Multi-Criteria Decision Analysis as an Innovative Approach to Managing Zoonoses: Results from a Pilot Study on Lyme Disease in Canada</b></p> <p><b>Aenishaenslin, Cécile</b>, GREZOSP - Université de Montréal, <a href="mailto:cecile.aenishaenslin@umontreal.ca">cecile.aenishaenslin@umontreal.ca</a></p> <p><b>Hongoh, Valérie</b>, GREZOSP - Université de Montréal, <a href="mailto:valerie.hongoh@umontreal.ca">valerie.hongoh@umontreal.ca</a></p> <p><b>Waaub, Jean-Philippe</b>, GERAD - GEIGER - Université du Québec à Montréal, <a href="mailto:waaub.jean-philippe@uqam.ca">waaub.jean-philippe@uqam.ca</a></p> <p><b>Bélanger, Denise</b>, GREZOSP - Université de Montréal, <a href="mailto:denise.belanger@umontreal.ca">denise.belanger@umontreal.ca</a></p> <p><b>Michel, Pascal</b>, GREZOSP - Université de Montréal and Laboratory for Foodborne Zoonoses, Public Health Agency of Canada, <a href="mailto:pascal.michel@phac-aspc.gc.ca">pascal.michel@phac-aspc.gc.ca</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>16h20</b> | <p><b>Démarche de l'utilisation de l'Aide multicritère à la décision (AMCD) pour l'élaboration du plan stratégique de lutte contre les maladies diarrhéiques dans le bassin de Yitenga au Burkina Faso</b></p> <p><b>Yonkeu, Samuel</b>, ISIG International, <a href="mailto:syonkeu@yahoo.fr">syonkeu@yahoo.fr</a></p> <p><b>Samoura, Karim</b>, GEIGER, <a href="mailto:samourakarim@yahoo.fr">samourakarim@yahoo.fr</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>16h45</b> | <p><b>Biotechnologies in the Horse Industry through the Lenses of Design</b></p> <p><b>de Paula Reis, Alline</b>, SESG - INA-PG Agroparistech, <a href="mailto:alline.depaulareis@agroparistech.fr">alline.depaulareis@agroparistech.fr</a></p> <p><b>Nakhla, Michel</b>, CSG - Mines - Paristech, <a href="mailto:michel.nakhla@mines-paristech.fr">michel.nakhla@mines-paristech.fr</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

**TB3      Tournées de véhicules IV / Vehicle Routing Problem IV**

Salle/Room: St-Hubert  
Président/Chairman: Perron, Sylvain

**15h30      A Constraint Programming-Based Large Neighborhood Search for the Vehicle Routing Problem with Synchronization Constraints**

Hojabri, Hossein, Université de Montréal, [hojabrih@iro.umontreal.ca](mailto:hojabrih@iro.umontreal.ca)  
Gendreau, Michel, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)  
Potvin, Jean-Yves, Université de Montréal, [potvin@iro.umontreal.ca](mailto:potvin@iro.umontreal.ca)  
Rousseau, Louis-Martin, Polytechnique Montréal, [louis-martin.rousseau@polymtl.ca](mailto:louis-martin.rousseau@polymtl.ca)

A synchronized VRP happens when vehicles of different types are required at some customer location to perform a service. A constraint programming-based adaptive large neighborhood search is proposed to solve this type of problem, where the latter explores large neighborhoods while the former evaluates every single move.

**15h55      Column Generation Heuristic for the Time-Dependent Vehicle Routing Problem with Time Windows**

Huart, Vincent, ISIMA, [vincent.huart@gerad.ca](mailto:vincent.huart@gerad.ca)  
Perron, Sylvain, GERAD - HEC Montréal, [sylvain.perron@hec.ca](mailto:sylvain.perron@hec.ca)  
Duhamel, Christophe, ISIMA, [christophe.duhamel@isima.fr](mailto:christophe.duhamel@isima.fr)

We present a heuristic solution method for the Time-Dependent Vehicle Routing Problem with Time Windows (TDVRPTW). The method is based on column generation and on Variable Neighborhood Descend (VND). We validate our algorithm on Solomon instances adapted to the case of time-dependency.

**16h20      The Multi-zone Multi-trip Pickup and Delivery Problem with Time Windows and Synchronization**

Nguyen Khanh, Phuong, Université de Montréal, [phuong@crt.umontreal.ca](mailto:phuong@crt.umontreal.ca)  
Crainic, Teodor Gabriel, Université du Québec à Montréal, [TeodorGabriel.Crainic@cirrelt.ca](mailto:TeodorGabriel.Crainic@cirrelt.ca)  
Toulouse, Michel, Oklahoma State University, [michel.toulouse@okstate.edu](mailto:michel.toulouse@okstate.edu)

Multi-zone Multi-trip Pickup and Delivery Problem with Time Windows and Synchronization (MZT-PDTWS) is an extension of the Multi-zone Multi-trip Vehicle Routing Problem with Time Windows by addressing the integration of outbound traffic into a single city logistic system. We propose a meta-heuristic to solve the problem.

**TB4      Optimisation pour les problèmes d'alimentation électrique / Optimization for Electric Power Problems**

Salle/Room: Van Houtte  
Président/Chairman: Anjos, Miguel

**15h30      Strategic Bidding under Wind Uncertainty: A Robust Equilibrium Method**

Kiani, Arman, University of Calgary, [kiani@ucalgary.ca](mailto:kiani@ucalgary.ca)  
Zareipour, Hamid, University of Calgary, [h.zareipour@ucalgary.ca](mailto:h.zareipour@ucalgary.ca)  
Rosehart, William, University of Calgary, [rosehartg@ucalgary.ca](mailto:rosehartg@ucalgary.ca)  
Anjos, Miguel, GERAD - Polytechnique Montréal, [miguel-f.anjos@polymtl.ca](mailto:miguel-f.anjos@polymtl.ca)

In this work, we present a practical method for strategic GenCos to properly hedge against wind uncertainty and guarantee the revenue security using a robust optimization. First the strategic offering problem is formulated as a bilevel programming, which the upper-level problem represents the profit maximization for the strategic GenCos subject to the unit constraints and to the Independent System Operator (ISO) problem as the lower-level optimization problem. The lower optimization problem represents the market clearing mechanism by minimizing the overall operation cost based on power systems security and reliability in the presence of wind power. The upper-level and lower-level problems



are tightly coupled since the upper-level problem provides the optimal bidding parameter for the lower-level problem and the lower-level problem determines the Locational Marginal Prices (LMPs) and the production quantities. The LMPs and production quantities that follow from the lower-level problem have a direct effect on the strategic bidding parameter as a result of the upper-level problem.

**15h55 Electric Vehicle Aggregator/System Operator Coordination for Optimal Charging Scheduling and Services Procurement**

**Bouffard, François**, McGill University, [francois.bouffard@mcgill.ca](mailto:francois.bouffard@mcgill.ca)  
**Ortega-Vazquez, Miguel**, University of Washington, [maov@uw.edu](mailto:maov@uw.edu)  
**Silva, Vera**, EDF R&D, [vera.silva@edf.fr](mailto:vera.silva@edf.fr)

We present the necessary adaptations in market clearing algorithms to integrate aggregated fleets of electric vehicles in typical North American electricity markets. We show how aggregation and market coordination are indeed necessary to avoid potential generation capacity shortages and to obtain the best use of generation resources for fleet charging.

**16h20 Optimization of Wind, Diesel and Battery Systems for Remote Areas**

**Barbier, Thibault**, Polytechnique Montréal, [thibault.barbier@polymtl.ca](mailto:thibault.barbier@polymtl.ca)  
**Savard, Gilles**, GERAD - Polytechnique Montréal, [gilles.savard@polymtl.ca](mailto:gilles.savard@polymtl.ca)  
**Anjos, Miguel**, GERAD - Polytechnique Montréal, [miguel-f.anjos@polymtl.ca](mailto:miguel-f.anjos@polymtl.ca)

Hybrid energy systems are often designed by simulation. In that case, rules of dispatching must be settled by deciders and influence results. We present a linear-integer programming model to find the optimal design and dispatching scenario without rules. The best implantable rules are then extracted from these results.

**16h45 Improving the Mixed Integer Linear Programming (MILP) Formulation for Unit Commitment Problems**

**Ostrowski, James**, University of Tennessee Knoxville, [jostrows@utk.edu](mailto:jostrows@utk.edu)  
**Anjos, Miguel**, GERAD - Polytechnique Montréal, [miguel-f.anjos@polymtl.ca](mailto:miguel-f.anjos@polymtl.ca)  
**Vannelli, Anthony**, University of Guelph, [vannelli@uoguelph.ca](mailto:vannelli@uoguelph.ca)

We present two ways to improve the MILP formulation for the unit commitment problem. The first is a new class of inequalities that give a tighter description of the feasible generator schedules. The second is a modified orbital branching technique that exploits the symmetry created by identical generators.

**TB5 Optimisation combinatoire / Combinatorial Optimization**

**Salle/Room:** CPA du Québec  
**Président/Chairman:** Brimberg, Jack

**15h30 The Minimum Flow Cost Hamiltonian Tour Problem**

**Contreras, Ivan**, Concordia University, [icontrer@encs.concordia.ca](mailto:icontrer@encs.concordia.ca)  
**Laporte, Gilbert**, CIRRELT - GERAD - HEC Montréal, [gilbert.laporte@cirreлт.ca](mailto:gilbert.laporte@cirreлт.ca)  
**Ortiz, Camilo**, Concordia University, [camiloortiza@gmail.com](mailto:camiloortiza@gmail.com)

This talk introduces the Minimum Flow Cost Hamiltonian Tour Problem (HTP), which consist of finding a Hamiltonian Circuit that minimizes the total flow cost for sending commodities between pair of nodes. The HTP is closely related to the Traveling Salesman Problem. We present several formulations and compare them theoretically and computationally.

**15h55 A Dual Local Search Algorithm for the Traveling Salesman Problem**

**Ouenniche, Jamal**, University of Edinburgh, [jamal.ouenniche@ed.ac.uk](mailto:jamal.ouenniche@ed.ac.uk)  
**Ramaswamy, Prasanna Kumar**, University of Edinburgh, [p.ramaswamy@sms.ed.ac.uk](mailto:p.ramaswamy@sms.ed.ac.uk)

In this research, we design a dual local search algorithm to solve the travelling salesman problem (TSP). The proposed design aims to replicate the designs of optimal solution methodologies such as Branch-and-

Bound. To be more specific, we solve a combinatorial relaxation of a TSP formulation and design neighbourhood structures to repair such an infeasible starting solution. Computational results suggest that this dual design is competitive.

#### 16h20 **Skewed Variable Neighborhood Search for Maximum Diversity Grouping Problem**

**Brimberg, Jack**, GERAD - The Royal Military College of Canada, [Jack.Brimberg@rmc.ca](mailto:Jack.Brimberg@rmc.ca)  
**Mladenovic, Nenad**, GERAD - Brunel University, [nenad.mladenovic@brunel.ac.uk](mailto:nenad.mladenovic@brunel.ac.uk)  
**Urosevic, Dragan**, Mathematical Institute SANU, [draganu@mi.sanu.ac.rs](mailto:draganu@mi.sanu.ac.rs)

Given a set of entities and distances (dissimilarities) between any two of them. Maximum Diversity Grouping problem consists of dividing a given entities into groups (clusters) such that the sum of distances between all pairs of entities that belong to the same group is maximal. We propose Skewed Variable Neighborhood Search for solving it. Computational experience is reported.

#### 16h45 **Mathématiques tropicales et optimisation**

**Wagneur, Edouard**, GERAD - Polytechnique Montréal, [edouard.wagneur@gerad.ca](mailto:edouard.wagneur@gerad.ca)

Les mathématiques tropicales sont nées des applications : informatique (théorie des langages) automatique (commande), télécommunications (optimisation de réseaux) ordonnancements,... Développées de manière relativement indépendantes, mais restant relativement proches des applications. Nous présenterons une sélection de problèmes où elles apportent une vision renouvelée des problèmes et suggère des méthodes originales de solution.

### TB6 **Théories des jeux II / Game Theory II**

**Salle/Room:** Mary Husny  
**Président/Chairman:** Marin-Solano, Jesus

#### 15h30 **Auto Manufacturer's Green Strategy Choice in Presence of Rivals**

**Keivanpour, Samira**, Université Laval, [samira.keivanpour.1@ulaval.ca](mailto:samira.keivanpour.1@ulaval.ca)  
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**Masclé, Christian**, École Polytechnique de Montréal, [christian.masclé@polymtl.ca](mailto:christian.masclé@polymtl.ca)

An extended form of evolutionary game theory for modeling the game between automakers in complying with End-of-life (EOL) vehicles legislations is proposed. The introduced model analyzes the strategic choice of auto manufacturers in response to EOL vehicles directives as the result of interaction of competitors in the market.

#### 15h55 **Optimization Models for Cost Allocation and Coalition Structure**

**Guajardo, Mario**, NHH Norwegian School of Economics and Business Administration, [mario.guajardo@nhh.no](mailto:mario.guajardo@nhh.no)  
**Rönnqvist, Mikael**, Université Laval, [mikael.ronnqvist@gmc.ulaval.ca](mailto:mikael.ronnqvist@gmc.ulaval.ca)

Given a set of players and the cost of each coalition, we formulate mixed integer programming models to determine coalition structure and cost allocations. We consider core stability conditions and others such as maximum size constraints and strong stability. We illustrate our approach in problems in forest and petroleum industries.

#### 16h20 **On the Sustainability of Cooperation in a Differential Game with Asymmetric Players and Time Inconsistent Preferences**

**Marin-Solano, Jesus**, Universitat de Barcelona, [jmarin@ub.edu](mailto:jmarin@ub.edu)

The problem of finding time-consistent equilibria in a differential game with asymmetric players is studied. Players in the model discount the future at different (nonconstant) discount rates of time preference. The issue of the dynamic consistency of the grand coalition (sustainability of cooperation) is addressed. Results are illustrated with a simple example.



**TB7** **Énergie et environnement IV / Energy and Environment IV**

**Salle/Room:** Hélène-Desmarais  
**Président/Chairman:** Cada, Roman

**15h30** **A Model System for Household Vehicle Holding, Type and Usage: A Continuous Probit Approach**

**Cirillo, Cinzia**, University of Maryland, [ccirillo@umd.edu](mailto:ccirillo@umd.edu)  
**Liu, Yangwen**, University of Maryland, [aliceliu@umd.edu](mailto:aliceliu@umd.edu)  
**Tremblay, Jean-Michel**, University of Maryland, [jeanmi.tremblay@gmail.com](mailto:jeanmi.tremblay@gmail.com)

This paper proposes a joint discrete-continuous model to estimate household choices on vehicle holding, type and usage. The model is estimated using the 2009 US National Household Travel Survey and a secondary dataset on vehicle characteristics. The discrete components are respectively, multinomial probit for vehicle holding and multinomial logit for the vehicle type/vintage sub-models. A flexible estimation approach with unrestricted correlation between the discrete and the continuous parts is proposed to estimate the joint discrete continuous models. The estimated model contains a number of policy variable that can be applied to predict changes in the household decisions on vehicle holding and miles driven, in response to the evolution of social societies, living environment and transportation policies.

**15h55** **The Integration of Power as a Criteria in Decision-Making Processes to Improve Integrated Water Resources Management Implementation Over Shared Watershed**

**Khennache, Lylia**, McGill University, [lylia\\_k@hotmail.com](mailto:lylia_k@hotmail.com)

This research suggests how the assessment of power variables involved the informal interactions between the riparian countries over a watershed could improve the applicability of integrated water resources management framework and further on, features preferred policies that would improve the legitimacy of the watershed institution and the collaborative effort of countries sharing the watershed.

**16h20** **Parallelization of Multi-Cycle Loading Design for Nuclear Reactors**

**Cada, Roman**, University of West Bohemia, [cadar@kma.zcu.cz](mailto:cadar@kma.zcu.cz)

Optimization of loadings in reactors is a task of nonlinear combinatorial optimization. It is possible to parallelize optimization of every cycle, but also to use a parallel "preprocessor" phase for estimating parameters of next cycle to speed-up optimization. We present a mathematical background and also several results of a new code tau-Athena.

**TB8** **Ingénierie financière / Financial Engineering**

**Salle/Room:** Demers Beaulne  
**Président/Chairman:** Denault, Michel

**15h30** **A Simulation and Regression Dynamic Programming Approach to Portfolio Optimization**

**Denault, Michel**, GERAD - HEC Montréal, [michel.denault@hec.ca](mailto:michel.denault@hec.ca)  
**Simonato, Jean-Guy**, HEC Montréal,  
**Delage, Erick**, GERAD - HEC Montréal, [erick.delage@hec.ca](mailto:erick.delage@hec.ca)

We consider portfolio optimization with a dynamic programming approach that relies on simulation and regression. Simulations are used to model the stocks returns uncertainty. Regressions are used to approximate the value function. Wealth, an endogenous state variable, requires special care. We provide some preliminary numerical results.

**15h55** **Performance Evaluation of Bankruptcy Prediction Models: A Multidimensional Framework**

**Mousavi, Seyed Mohammad M.**, University of Edinburgh, [S.M.M.Mousavi@ed.ac.uk](mailto:S.M.M.Mousavi@ed.ac.uk)  
**Ouenniche, Jamal**, University of Edinburgh, [jamal.ouenniche@ed.ac.uk](mailto:jamal.ouenniche@ed.ac.uk)

Although most studies on the modelling and analysis of corporate bankruptcy data use several performance criteria and measures to assess the performance of competing prediction models, the assessment

methodology used so far remains unidimensional in nature, which leads to reporting conflicting results. In this research, we overcome this methodological issue by proposing a multidimensional assessment framework and report on numerical results on UK data.

**16h20      Developing an Hybrid Approach for Market Deployment Roadmapping**

**Kimiagari, Salman**, Université Laval, [salman.kimiagari.1@ulaval.ca](mailto:salman.kimiagari.1@ulaval.ca)  
**Montreuil, Benoît**, Université Laval, [Benoit.Montreuil@cirrelt.ulaval.ca](mailto:Benoit.Montreuil@cirrelt.ulaval.ca)

The paper focuses on the development of market deployment roadmaps. It proposes an hybrid approach. Geo-markets are clustered using self-organizing maps, exploiting their multi-criteria, spatial and visualization capabilities model. Within the generated clusters, an optimization model is used for deciding on the selection and timing of geo-markets deployment. The paper demonstrates the application of the approach to a business design case.

**TB9      Optimisation des trajectoires d'avions / Aircraft Trajectory Optimization**

**Salle/Room:** Dutailier International  
**Président/Chairman:** Omer, Jérémy

**15h30      Conception et analyse d'un système d'optimisation des trajectoires aériennes pour les avions**

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**Soumis, François**, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)  
**Dufour, Steven**, Polytechnique Montréal, [steven.dufour@polymtl.ca](mailto:steven.dufour@polymtl.ca)  
**Pestieau, Charles**, Polytechnique Montréal, [charles.pestieau@polymtl.ca](mailto:charles.pestieau@polymtl.ca)

Nous présentons une méthode d'optimisation des trajectoires aériennes qui minimise tous les coûts associés au vol d'un avion. Nous minimisons le coût total du vol (coût du carburant, coût du temps, coût de survol des territoires) en tenant compte du type d'avion, des conditions météorologiques et des coûts de retard.

**15h55      Interactions between Operations and Planning Decisions in ATC**

**Lehouillier, Thibault**, GERAD, [thibault.lehouillier@gerad.ca](mailto:thibault.lehouillier@gerad.ca)  
**Soumis, François**, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)  
**Allignol, Cyril**, Université de Toulouse, [allignol@cena.fr](mailto:allignol@cena.fr)

In a context of growing trafic, it is necessary to determine which decisions can save money for companies. We present a study of the cost evolution of operations decisions when changing planning policies. Results will enlighten subjects for optimization and therefore indicate priorities for our future research.

**16h20      EOSID Optimization with Genetic Algorithm**

**Talgorn, Bastien**, GERAD - Université de Montréal, [bastientalgorn@yahoo.fr](mailto:bastientalgorn@yahoo.fr)

Aircraft takeoff weight is calculated on the SID trajectory considering the case of an engine failure. In case of mountainous landscape, an alternative trajectory can be designed to reduce obstacle constraints. This trajectory, called EOSID (Engine Out SID), is optimized with a genetic algorithm to maximize the takeoff weight.

**16h45      Stochastic Programming with Recourse for Aircraft Separation under Uncertainty**

**Omer, Jeremy**, ONERA, [jeremy.omer@gmail.com](mailto:jeremy.omer@gmail.com)

The optimization of air traffic control aims at increasing the airspace capacity and flexibility of use. Meteorological forecast and trajectory predictions being inexact, uncertainty is an important issue. A stochastic program with recourse is thus developed to explicitly include errors on wind predictions and speed measures when separating conflicting aircraft.

12h10

## Framework for the Aircraft Conflict Resolution Problem

Allignol, Cyril, Université de Toulouse, [allignol@cena.fr](mailto:allignol@cena.fr)

We propose a new framework for the conflict resolution problem, separating the model from the solver, to be able to: enhance the model with as many refinements as necessary, and compare different resolution methods on the same data. We compare an Evolutionary Algorithm and Constraint Programming on this optimization problem.

TB10

## Algorithmes II / Algorithms II

Salle/Room: Nancy et Michel-Gaucher

Président/Chairman: Takouda, Matthias

15h30

## Validation de la Méthode de Vogel Modifiée pour la Résolution du Problème d'Affectation linéaire

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Le problème d'affectation linéaire consiste à déterminer un couplage optimal entre deux ensembles de même dimension. Un exemple patent est celui d'affectation optimale de  $n$  tâches à  $n$  travailleurs. Dans cette présentation, nous introduisons ce problème qui possède une pléthore d'applications en recherche opérationnelle. Nous en fournissons certaines pour mieux illustrer son importance dans ce domaine. Ce problème d'affectation est usuellement résolu par la méthode hongroise. Une nouvelle approche de résolution du problème d'affectation est proposée dans cette recherche. Elle est une modification de la méthode d'approximation de Vogel appliquée à la matrice réduite. Pour cette raison, elle s'apparente beaucoup à la méthode hongroise et semble procurer un outil efficace de détermination de zéros indépendants. L'utilisation de la matrice réduite permet d'introduire de nouvelles règles pour lever les embarras de choix. Contrairement à la méthode d'approximation de Vogel, cette approche est convergente pour les problèmes d'affectation. Dans cette présentation, nous proposons une programmation de la méthode de Vogel modifiée en utilisant Java ce qui nous permet de la valider par des tests numériques.

15h55

## Méthode de Vogel modifiée pour la résolution des problèmes de transport simple

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L'algorithme de Dantzig (1963) du problème de transport simple, comme toute application de la méthode du simplexe à la résolution de problèmes linéaires, nécessite une solution initiale de base. Sa détermination à partir de la forme standard n'est pas appropriée compte tenu de la structure de ses problèmes de transport. D'autres techniques plus simples et adaptées leurs sont appliquées. La méthode de Vogel (MV), un exemple très utilisé de détermination de solution initiale, est également une méthode d'approximation qui réduit assez considérablement le nombre d'itérations de l'algorithme de transport. Dans cette présentation, une nouvelle méthode d'approximation est introduite. Elle est une modification de la méthode de Vogel permettant d'obtenir une meilleure solution initiale. Nous observons que la méthode modifiée (MVM) fournit directement la solution optimale dans un nombre assez impressionnant de problèmes. De plus, elle permet également dans certains cas de détecter directement l'optimalité sans devoir faire appel à l'évaluation des coûts réduits. Cette démarche ouvre la voie à une nouvelle méthode de résolution des problèmes de transport qui éviterait la sollicitation de l'algorithme de transport.

16h20

## Regression Trees and Forests for Non-homogeneous Poisson Process

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Fredette, Marc, GERAD - HEC Montréal, [marc.fredette@hec.ca](mailto:marc.fredette@hec.ca)

Non-homogeneous Poisson processes (NHPP), for which the rate function varies over time, constitute a class of a very versatile model for modeling recurrent events. The existing tree-based methods for count and Poisson data were developed under the assumption of a constant rate function. We propose tree and random forest methods for NHPP. The proposed tree splitting criterion is based on the observed log-likelihood of a model with piecewise constant rate function over pre-specified intervals. The first approach builds a random forest using an aggregation of many trees built with the same intervals. The second approach builds the forest by varying the number, length, and position of the intervals from one tree to another. This produces a smooth estimate of the rate compared to the piecewise constant estimation of the first approach. The results from a simulation study, showing that the proposed models work very well, and an application with real data will be presented.

**16h45 Optimal Stopping Rule for the Full-Information Duration Problem with a Random Number of Objects**

**Tamaki, Mitsushi**, Aichi University, Business Administration, [tamaki@vega.aichi-u.ac.jp](mailto:tamaki@vega.aichi-u.ac.jp)

A full information duration problem with random horizon is considered. A random number of iid random variables are observed with the objective of maximizing the expected duration of holding a relatively largest observation. A necessary and sufficient condition for the optimal stopping rule to be monotone is given.

**17h10 Planification de chemin : l'état de l'art 2013**

**Souissi, Omar**, Université de Valenciennes, [souiomar@hotmail.com](mailto:souiomar@hotmail.com)

Les dernières décennies ont connu un développement conséquent de la robotique et des systèmes de haute autonomie. L'objectif de ma présentation est de revenir sur l'état de l'art concernant la recherche du chemin le plus court. En effet, il s'agit de l'un des outils clé pour la conception de systèmes autonomes.

**TB11 Horaires de personnel / Shift Scheduling**

**Salle/Room:** Gérard Parizeau

**Président/Chairman:** Desaulniers, Guy

**15h30 A Two-Stage Approach to Solve Multi-Department Shift Scheduling Problems**

**Dahmen, Sana**, Université Laval, [sana.dahmen.1@ulaval.ca](mailto:sana.dahmen.1@ulaval.ca)

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**Rekik, Monia**, Université Laval, [monia.rekik@fsa.ulaval.ca](mailto:monia.rekik@fsa.ulaval.ca)

**Soumis, François**, GERAD - Polytechnique Montréal, [francois.soumis@gerad.ca](mailto:francois.soumis@gerad.ca)

We present a two-stage approach to solve multi-department shift scheduling problems. The first stage solves the problem in an aggregate way to identify a good transfer scheme between departments. The second stage uses this scheme to construct daily schedules for employees.

**15h55 Shift Scheduling and Activity Assignment with Employee Preference Satisfaction**

**Elahipanah, Mahsa**, GERAD - Polytechnique Montréal, [mahsa.elahipanah@gerad.ca](mailto:mahsa.elahipanah@gerad.ca)

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**Hoang, Lê Nguyễn**, GERAD - Polytechnique Montréal, [le.nguyen.hoang@gerad.ca](mailto:le.nguyen.hoang@gerad.ca)

A two-phase column generation heuristic is proposed for multi-objective shift scheduling and activity assignment to work shifts. Controlled by a parameter, the minimized costs in the first phase can be slightly increased in favor of higher and more balanced employees satisfactions with respect to individual preferences for different criteria in the second phase. M-MACBETH software is used to quantify preferences over the alternatives for each criterion and over the criteria themselves.

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|------------|----------------------------------------------|
| <b>WAP</b> | <b>Séance plénière V / Plenary Session V</b> |
|------------|----------------------------------------------|

**Salle/Room:** Amphithéâtre IBM  
**Président/Chairman:** Orban, Dominique

**09h00      Fast Fourier Optimization: High-Contrast Imaging and the Search for Exoplanets**

**Vanderbei, Robert J.**, Princeton University, [rvdb@princeton.edu](mailto:rvdb@princeton.edu)

Many interesting and fundamentally practical optimization problems, ranging from optics, to signal processing, to radar and acoustics, involve constraints on the Fourier transform of a function. It is well-known that the fast Fourier transform (fft) is a recursive algorithm that can dramatically improve the efficiency for computing the discrete Fourier transform. However, because it is recursive, it is difficult to embed into a linear optimization problem. In this paper, we explain the main idea behind the fast Fourier transform and show how to adapt it in such a manner as to make it encodable as constraints in an optimization problem. We demonstrate a real-world problem from the field of high-contrast imaging. On this problem, dramatic improvements are translated to an ability to solve problems with a much finer grid of discretized points. As we shall show, in general, the “fast Fourier” version of the optimization constraints produces a larger but sparser constraint matrix and therefore one can think of the fast Fourier transform as a method of sparsifying the constraints in an optimization problem, which is often a good thing.

|            |                                                                                                                                   |
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| <b>WA2</b> | <b>OPDE 5 - Décider ensemble en contexte corporatif et institutionnel / Group Decision in Corporate and Institutional Context</b> |
|------------|-----------------------------------------------------------------------------------------------------------------------------------|

**Salle/Room:** TAL  
**Président/Chairman:** Damart, Sébastien

**10h30      Policy Analytics: An Agenda for Research and Practice**

**Tsoukiàs, Alexis**, LAMSADE-CNRS, [alexis.tsoukias@dauphine.fr](mailto:alexis.tsoukias@dauphine.fr)  
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**Lucertini, Giulia**, LAMSADE-CNRS, [giulialucertini@hotmail.com](mailto:giulialucertini@hotmail.com)  
**Belton, Valerie**, University of Strathclyde, [val.belton@strath.ac.uk](mailto:val.belton@strath.ac.uk)

**10h55      Interactive Decision Support within Corporate Environmental Management Information Systems**

**Renatus, Fabian**, Universität Göttingen, [fabian.renatus@wiwi.uni-goettingen.de](mailto:fabian.renatus@wiwi.uni-goettingen.de)  
**Geldermann, Jutta**, Universität Göttingen, [geldermann@wiwi.uni-goettingen.de](mailto:geldermann@wiwi.uni-goettingen.de)

**11h20      Formes prises par le « décider ensemble » dans les établissements sanitaires et médico-sociaux en France**

**Damart, Sébastien**, Université de Rouen, [sebastien.damart@univ-rouen.fr](mailto:sebastien.damart@univ-rouen.fr)  
**Kletz, Frédéric**, CGS / Mines ParisTech, [frederic.kletz@ensmp.fr](mailto:frederic.kletz@ensmp.fr)

**11h45      Réseaux sociaux : ambivalences et opportunités pour la mobilisation citoyenne**

**Huang, Ping**, Centre de recherche sur les innovations sociales (CRISES), Université du Québec à Montréal, [ping.huang.ph@gmail.com](mailto:ping.huang.ph@gmail.com)

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| <b>WA3</b> | <b>Tournées de véhicules V / Vehicle Routing Problem V</b> |
|------------|------------------------------------------------------------|

**Salle/Room:** St-Hubert  
**Président/Chairman:** Cherkesly, Marilène

**10h30      Clustering Methods for Vehicle Routing Problems**

**Hamid, Mona**, University of Edinburgh, [s1265920@sms.ed.ac.uk](mailto:s1265920@sms.ed.ac.uk)  
**Ouenniche, Jamal**, University of Edinburgh, [jamal.ouenniche@ed.ac.uk](mailto:jamal.ouenniche@ed.ac.uk)

VRP is a core routing problem in logistics. Both optimal and heuristic solution methodologies have been proposed to address it. Somehow the success of generic solution frameworks such as metaheuristics has led to less research on the design of problem specific heuristics – whether construction heuristics or decomposition heuristics. For some problems, however, metaheuristics could be very time consuming. In this research, we show that Cluster First-Route Second Decomposition Procedures could deliver high quality solutions much faster than metaheuristics – if designed properly

**10h55 Un algorithme de type séparation locale pour le problème de tournées de véhicules avec demandes stochastiques**

**Khtatfa, Sahbi**, UQAM, [Khtatfa.sahbi@hotmail.com](mailto:Khtatfa.sahbi@hotmail.com)

Nous proposons une métaheuristique pour résoudre le problème de tournées de véhicules avec demandes stochastiques. Cet algorithme applique des stratégies de diversification et d'intensification, fondées sur les principes de la séparation locale, de façon à résoudre le problème considéré. Les sous-problèmes traités par l'algorithme sont résolus de façon exacte en utilisant la méthode L-Shaped.

**11h20 Branch-Cut-and-Price for the Pickup and Delivery Problem with Time Windows and LIFO Loading**

**Cherkesly, Marilène**, GERAD - Polytechnique Montréal, [marilene.cherkesly@gerad.ca](mailto:marilene.cherkesly@gerad.ca)  
**Desaulniers, Guy**, GERAD - Polytechnique Montréal, [Guy.Desaulniers@gerad.ca](mailto:Guy.Desaulniers@gerad.ca)  
**Laporte, Gilbert**, CIRRELT - GERAD - HEC Montréal, [gilbert.laporte@cirrelt.ca](mailto:gilbert.laporte@cirrelt.ca)

In this presentation, we focus on the pickup and delivery problem with time windows and last-in-first-out (LIFO) loading (PDPTWL). LIFO loading ensures that no handling is required while unloading objects from the vehicle: a linear stack loading structure is assured and an object can only be delivered if it is the one closest to the door. To solve this problem, we propose three exact branch-cut-and-price algorithms. The first algorithm incorporates the LIFO constraints in the master problem. The second algorithm handles the LIFO constraints directly in the shortest path subproblem. To solve it, a dynamic programming algorithm relying on an ad hoc dominance criterion is developed. The third algorithm is a hybrid between the first two methods. We adapt known valid inequalities to the PDPTWL and study the impact of different path relaxations on the total computation time. Computational results will be presented.

**WA4 Théorie et applications de l'optimisation conique / Theory and Applications of Conic Optimization**

**Salle/Room:** Van Houtte  
**Président/Chairman:** Anjos, Miguel

**10h30 On the Sensitivity of Semidefinite Programs**

**Cheung, Yuen-Lam**, University of Waterloo, [y2cheun@uwaterloo.ca](mailto:y2cheun@uwaterloo.ca)  
**Wolkowicz, Henry**, University of Waterloo, [hwolkowi@uwaterloo.ca](mailto:hwolkowi@uwaterloo.ca)

Given a feasible conic program with finite optimal value that does not satisfy strong duality, a small perturbation of the problem data may lead to a relatively big change in the optimal value. We quantify the notion of big change in the case of semidefinite programs, by showing that a sufficiently small  $\epsilon > 0$  perturbation of the problem data can change the optimal value by at least a constant multiple of  $\epsilon^{1/2}$ .

**10h55 Polytope Cuts for the Basic Semidefinite Relaxation of the Max-Cut Problem**

**Adams, Elspeth**, Polytechnique Montréal, [elspeth.adams@polymtl.ca](mailto:elspeth.adams@polymtl.ca)  
**Anjos, Miguel**, GERAD - Polytechnique Montréal, [miguel-f.anjos@polymtl.ca](mailto:miguel-f.anjos@polymtl.ca)  
**Rendl, Franz**, Klagenfurt, [rendl@uni-klu.ac.at](mailto:rendl@uni-klu.ac.at)  
**Wiegeler, Angelika**, Klagenfurt, [angelika.wiegeler@aau.at](mailto:angelika.wiegeler@aau.at)

We introduce a cutting plane method for the basic semidefinite relaxation of the max-cut problem, specifically by defining a new class of linear cuts that are based on the cut polytope and describing methods for identifying violated cuts. We present theoretical and computational results.

11h20

### Generalized Trust Region Subproblem

Pong, Ting Kei, postdoctoral fellow, [ptingkei@uwaterloo.ca](mailto:ptingkei@uwaterloo.ca)

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We consider a generalized version of Trust Region Subproblem, where the constraint is replaced by a general quadratic constraint with both upper and lower bounds. We characterize optimality under a mild constraint qualification and extend the Rendl-Wolkowicz algorithm to this setting.

WA5

### Optimisation sans dérivées IV : applications / Derivative-Free Optimization IV: Applications

Salle/Room: CPA du Québec

Président/Chairman: Gheribi, Aimen

10h30

### Identifying Optimal Conditions for Ironmaking Process Using Thermodynamic and Properties Databases, the Simusage Process Simulation Package and the Mesh Adaptive Direct Searches Algorithm

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In this work operational parameters such as temperature, pressure, and feedstock composition of chemical and metallurgical processes of high industrial importance, such as coal-fired boilers and blast furnaces, have been optimized using simultaneously the SimuSage thermodynamic simulation package along with the NOMAD black-box optimization algorithm.

10h55

### Évaluation de méthodes d'optimisation pour le calage efficace de modèles hydrologiques coûteux en temps de calculs

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Trois algorithmes, SCE-UA, DDS et NOMAD sont comparés pour le calage automatique d'HYDROTEL, un modèle hydrologique distribué et à bases physiques. Les tests portent sur deux versions d'HYDROTEL (10 et 19 paramètres) et deux bassins versants aux caractéristiques physiques différentes. Algorithmes et modèles seront discutés et quelques résultats préliminaires présentés.

11h20

### Optimisation de la forme du fond de canette 2D à base de métamodèle

Benki, Aalae, INRIA, [aalae.benki@inria.fr](mailto:aalae.benki@inria.fr)

Les problèmes d'optimisation de forme de structures nécessitent de nombreuses évaluations de critères à optimiser, ce qui peut être très coûteux en temps de calcul. Pour remédier à cela, on a développé un algorithme efficace qui consiste à coupler une méthode de capture de front de Pareto pour ce genre des problèmes d'optimisation avec un métamodèle.

WA6

### Optimisation globale / Global Optimization

Salle/Room: Mary Husny

Président/Chairman: Ninin, Jordan

10h30

### Global Optimization using Contractor Programming

Ninin, Jordan, GERAD, [jordan.ninin@gmail.com](mailto:jordan.ninin@gmail.com)

Nowadays, the optimization problems are complex. But, despite the increasing number of solvers, the resolution is always a hard task to merge different kinds of constraints (linear, non-convex or black-box,...) and different kinds of variables (continuous, integer, optimal control,...). The Contractor Programming is a united framework which combines heterogeneous solvers. The principle is based on a Branch-and-Bound using Interval Analysis. Each algorithm is brought to an elementary operation which consists to contract or to prune a box.



10h55

### Heuristic Global Optimization via Quick Exploration of the Variable Space

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Shafique, Mubashsharul, Carleton University, [shafique.cit.2@gmail.com](mailto:shafique.cit.2@gmail.com)

Many heuristics for global optimization require numerous launches of an expensive local solver. We avoid this by using quick and computationally inexpensive methods (constraint consensus, clustering, simple search) to explore the variable space before choosing a small number of launch points for the local solver. Encouraging empirical results are given.

11h20

### Packing Unit Spheres into Three Dimensional Sphere Using VNS

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The NP hard optimization problem of packing unit radii spheres into the three dimensional sphere is approximately solved using a variable neighborhood search (VNS) which identifies (near-) global optima by searching the neighborhoods of local minima. VNS obtains neighboring solutions by shaking one or more spheres. It alters the size of a neighborhood every time it fails to find an improving solution. Keywords: variable neighborhood search, packing spheres in a cube, non-linear programming, three dimensional packing

WA7

### Optimisation multiobjectif / Multiobjective Optimization

Salle/Room: Hélène-Desmarais

Président/Chairman: Saboonchi, Behnaz

10h30

### A Bi-Objective Tactical Planning model for the Reverse Supply Chain of Durable Products

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Khajavi, Amir, Concordia University, [a\\_khaj@encs.concordia.ca](mailto:a_khaj@encs.concordia.ca)

We proposes an integrated acquisition, grading, and disposition planning model in the reverse supply chain of durable product returns with two quality levels. Two objective functions based on the economic and environmental criteria are considered. The model is solved for the electronics waste case by the epsilon constraint method.

10h55

### Bi-Objective Reverse Supply Chain Design for Durable Products

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Kazemi Zanjani, Masoumeh, Concordia University, [kazemi@encs.concordia.ca](mailto:kazemi@encs.concordia.ca)

This paper proposes a network design model for the reverse supply chain of durable products with two quality states, while coordinating the forward and backward flows. Two objectives are considered in the model based on economic and environmental criteria. The model is solved for the washing machines case by themethod.

11h20

### Approche multicritère pour la prise de décision des modèles d'affaire en maintenance

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Les coûts associés à la maintenance des biens en entreprise est une réelle préoccupation en maintenance. Notre contribution utilise une approche multicritère, basée sur l'évaluation de la performance d'une activité de maintenance vis-à-vis des aspects techniques, stratégiques, économiques et environnementaux...etc. permettant de développer un modèle d'affaire approprié en maintenance.

|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11h45      | <b>A Comparison of Conventional and Fuzzy Methods in Decision Making Involving Performance Appraisal Process</b><br><b>Osinuga, Idowu Ademola</b> , Federal University of Agriculture, <a href="mailto:osinuga08@gmail.com">osinuga08@gmail.com</a><br><b>Adekoya, Oluseyi</b> , Olabisi Onabanjo University, Ago-Iwoye, <a href="mailto:princeoluseyi2005@yahoo.com">princeoluseyi2005@yahoo.com</a><br><p>The purpose of this paper is to address the performance appraisal process via conventional and Fuzzy methods. This research work shows that the Fuzzy method is an easy to understand and realistic method as it gives better understanding of the relative strengths and weaknesses of employees which improve competitive advantage.</p>                                                                                              |
| 12h10      | <b>Bi-Objective Variable Neighborhood Search for the p-Diversity-Proximity Problem</b><br><b>Saboonchi, Behnaz</b> , GERAD - HEC Montréal, <a href="mailto:behnaz.saboonchi@gerad.ca">behnaz.saboonchi@gerad.ca</a><br><b>Hansen, Pierre</b> , GERAD - HEC Montréal, <a href="mailto:pierre.hansen@gerad.ca">pierre.hansen@gerad.ca</a><br><b>Perron, Sylvain</b> , GERAD - HEC Montréal, <a href="mailto:sylvain.perron@hec.ca">sylvain.perron@hec.ca</a><br><p>Dispersion models address the cannibalization phenomenon within franchised chains by the maximization of dispersion among the units without considering their proximity to the clients. We propose a bi-objective location model that is aimed at maximizing the dispersion among the newly located units while minimizing their gravity-based distance to the customer zones.</p> |
| <b>WA8</b> | <b>Problèmes de localisation de centres / Hub Location Problems</b><br><b>Salle/Room:</b> Demers Beaulne<br><b>Président/Chairman:</b> Contreras, Ivan                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 10h30      | <b>Cycle Hub Location Problem</b><br><b>Tanash, Moayad</b> , Concordia University, <a href="mailto:tanash25@yahoo.com">tanash25@yahoo.com</a><br><b>Contreras, Ivan</b> , Concordia University, <a href="mailto:icontrer@encs.concordia.ca">icontrer@encs.concordia.ca</a><br><b>Vidyarathi, Navneet</b> , John Molson School of Business, Concordia University, <a href="mailto:navneetv@jmsb.concordia.ca">navneetv@jmsb.concordia.ca</a><br><p>In this talk we present the Cycle Hub Location Problem, in which the set of hubs have to be connected by means of a cycle. We propose a branch-and-cut method combined with a GRASP metaheuristic to optimally solve the problem. Computational results on instances with up to 100 nodes are reported and analyzed.</p>                                                                          |
| 10h55      | <b>Hub Location with Benefits</b><br><b>Alibeyg, Armaghan</b> , <a href="mailto:a.alibeig@gmail.com">a.alibeig@gmail.com</a><br><b>Contreras, Ivan</b> , Concordia University, <a href="mailto:icontrer@encs.concordia.ca">icontrer@encs.concordia.ca</a><br><b>Fernandez, Elena</b> , Universitat Politècnica de Catalunya, <a href="mailto:e.fernandez@upc.edu">e.fernandez@upc.edu</a><br><p>In this talk we present the Hub Location Problem with Profits, where it is not necessary to provide service to all demand nodes. A profit is associated with each flow between pair of nodes. The overall goal is the simultaneous optimization of the collected profit, the set-up cost, and the transportation cost. Different classes of applications and modeling approaches are identified and compared.</p>                                   |
| 11h20      | <b>The Modular Hub location Problem</b><br><b>Hosseini, Seyed</b> , <a href="mailto:s_babak_hosseini@yahoo.com">s_babak_hosseini@yahoo.com</a><br><b>Contreras, Ivan</b> , Concordia University, <a href="mailto:icontrer@encs.concordia.ca">icontrer@encs.concordia.ca</a><br><b>Chauhan, Satyaveer</b> , Concordia University, <a href="mailto:sschauha@alcor.concordia.ca">sschauha@alcor.concordia.ca</a><br><p>It has been shown that the common assumption of flow-independent reduced transportation costs in most hub location problems can be an oversimplification. In this talk we present the Modular Hub Location Problem, which explicitly models the flow dependency of costs and considers the design of the hub-and-spoke network as part of the decision process.</p>                                                             |

**11h45 An Improved Benders Decomposition Algorithm for the Tree of Hubs Location Problem**

**Martins de Sa, Elisangela**, Federal University of Minas Gerais, [elisangela.martinss@cirrelt.ca](mailto:elisangela.martinss@cirrelt.ca)  
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**de Miranda, Gilberto**, Federal University of Minas Gerais, [miranda@dep.ufmg.br](mailto:miranda@dep.ufmg.br)

The tree of hubs location problem is a variant of hub location problems in which the hubs are connected by means of a tree. In order to solve the problem, a Benders decomposition approach with a new cut selection scheme is presented. Computational results show that the proposed algorithm outperforms two other modern variants of the method.

**WA9 Ordonnancement / Scheduling**

**Salle/Room:** Dutailier International  
**Président/Chairman:** Ialongo, David

**10h30 Railway Timetabling Adapted to Variable Demand in One Line Corridor**

**Barrena Algara, Eva**, CIRRELT - HEC Montréal, [ebarrena@us.es](mailto:ebarrena@us.es)  
**Canca Ortiz, David**, Universidad de Sevilla, [dco@us.es](mailto:dco@us.es)  
**Coelho, Leandro C.**, CIRRELT - HEC Montréal, [leandro.coelho@cirrelt.ca](mailto:leandro.coelho@cirrelt.ca)  
**Laporte, Gilbert**, CIRRELT - GERAD - HEC Montréal, [gilbert.laporte@cirrelt.ca](mailto:gilbert.laporte@cirrelt.ca)

Determination of railway timetables is a problem that affects the network performance as well as the level of satisfaction amongst the users. In this work, we tackle the problem of designing non periodic railway timetabling with variable demand in one line corridor having both aspects jointly into consideration.

**10h55 The Departure Time and Speed Optimization Problem**

**Franceschetti, Anna**, Eindhoven University of Technology, [a.franceschetti@tue.nl](mailto:a.franceschetti@tue.nl)  
**Honhon, Dorothée**, Eindhoven University of Technology, [D.B.L.P.Honhon@tue.nl](mailto:D.B.L.P.Honhon@tue.nl)  
**Van Woensel, Tom**, Eindhoven University of Technology, [t.v.woensel@tue.nl](mailto:t.v.woensel@tue.nl)  
**Bektas, Tolga**, University of Southampton, [T.Bektas@soton.ac.uk](mailto:T.Bektas@soton.ac.uk)  
**Laporte, Gilbert**, CIRRELT - GERAD - HEC Montréal, [gilbert.laporte@cirrelt.ca](mailto:gilbert.laporte@cirrelt.ca)

Given a fixed sequence of nodes, the Departure Time and Speed Optimization problem (DSOP) consists of optimizing departure times and travel speeds as to minimize the total fuel and driver costs. We present an exact algorithm to solve the DSOP in presence of traffic congestion.

**11h20 A Dynamic Moldable Job Scheduling Based Parallel SAT Solver**

**Asghar, Sajjad**, University of New Brunswick, [sajjad.asghar@unb.ca](mailto:sajjad.asghar@unb.ca)  
**Aubanel, Eric**, University of New Brunswick, [aubanel@unb.ca](mailto:aubanel@unb.ca)  
**Bremner, David**, University of New Brunswick, [bremner@unb.ca](mailto:bremner@unb.ca)

Boolean Satisfiability (SAT) is amongst the most important problems in theoretical computer science. We present a parallel SAT solver called DMSAT. DMSAT can solve hard SAT problems that were not solvable by miniSat and other parallel SAT solvers in the past SAT race competitions.

**11h45 Modèle d'affectation des types d'avion avec scénarios de demande et réaffectation**

**Ialongo, David**, GERAD - Polytechnique Montréal, [david.lasalle.ialongo@gerad.ca](mailto:david.lasalle.ialongo@gerad.ca)  
**Desaulniers, Guy**, GERAD - Polytechnique Montréal, [Guy.Desaulniers@gerad.ca](mailto:Guy.Desaulniers@gerad.ca)

Nous intégrons des scénarios de demande au problème d'affectation des types d'avion aux vols (FAP) afin d'obtenir une solution permettant d'optimiser les décisions de réaffectation de flotte durant la période de réservation. Le problème est résolu par décomposition de Benders où chaque sous-problème correspond à un scénario.

Salle/Room: Nancy et Michel-Gaucher

Président/Chairman: Woodward, Lyne

10h30

### Ergodicity and Class-Ergodicity of Balanced Asymmetric Stochastic Chains

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Unconditional consensus is the property of a consensus algorithm for multiple agents, to produce consensus irrespective of the particular time or state at which the agent states are initialized. Under a weak condition, so-called balanced asymmetry, on the sequence  $(A_n)$  of stochastic matrices in the agents states update algorithm, it is shown that (i) the set of accumulation points of states as  $n$  grows large is finite, (ii) the asymptotic unconditional occurrence of single consensus or multiple consensus is directly related to the property of absolute infinite flow of this sequence, as introduced by Touri and Nedic. The latter condition must be satisfied on each of the islands of the so-called unbounded interactions graph induced by  $(A_n)$ , defined by Hendrickx et al. The property of balanced asymmetry is satisfied by many of the well known discrete time consensus models studied in the literature.

10h55

### Multi-Unit Optimization for Systems with Multiple Inputs - Application to Photovoltaic Arrays

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Multi-unit optimization is an extremum seeking control method in which the gradient is calculated based on differences between the outputs of each unit. Although this method is useful when the system consists of multiple units, convergence to the optimal point is proved provided units are identical, whereas a photovoltaic (PV) array consists of more than two non-identical PV cells. Therefore, an optimization procedure based on the multi-unit method is developed for three non-identical units with two inputs. The proposed algorithm consists of sequential and adaptive correction to compensate for the differences between static curves of the objective functions related to each unit. The algorithm is tested on a PV array model and is compared to other common methods of maximum power point tracking (MPPT) such as perturb and observe, and incremental conductance algorithms.

11h20

### MFG Systems with Recursive Estimation of Common Partially Observed Disturbances: Application to Large Scale Power Markets

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**Caines, Peter**, GERAD - McGill University, [peterc@cim.mcgill.ca](mailto:peterc@cim.mcgill.ca)

Following (KMC CDC 2012), power markets are modelled as dynamic large population games where suppliers and consumers submit their bids in real-time. The agents are coupled in their dynamics and cost functions through the price process. Extending the model in (KMC CDC 2012), a common unpredictable Partially Observed Neutral Major Agent is added to the system which is game theoretically neutral and which represents common unpredictable disturbance factors (e.g. wind) and exogenous market factors (e.g. competing energy resource prices), etc. In (KMC CDC 2012), the Mean Field Game (MFG) methodology is used to study the limit (i.e. infinite population) behaviour of large population market systems without a Major Agent; this results in a decentralized algorithm where agents submit their bids solely following the price signal and using statistical information on the dynamics of the entire population. When a Major Agent is absent, the system exhibits the standard counter intuitive property of MFG solutions that agents need not observe the behaviour (i.e. inputs and state trajectories, market price evolution, etc) of any other agent (individually or collectively) in order that simple decentralized control actions achieve a mass e-Nash equilibrium (with  $\epsilon$  vanishing as the population goes to infinity) and individual L2 stability. The contribution of this paper is the extension of the MFG theory to cover the addition of a Neutral Major Agent to the power market problem. In general, the addition of a Major Agent in the MFG framework (see MYH, MYS, MPEC) makes the mean field stochastic and this gives rise to different Nash equilibria (see [MYH, MYHS, MNPEC]). In the general situation of sporadic noisy observations of the mean field and the state of the Major Agent, the extended MFG theory (with estimation of the mean field and the Major Agent state)

yields simple decentralized control laws which achieve a mass e-Nash equilibrium (with  $\epsilon$  vanishing as the population goes to infinity) and individual L2 stability. In this paper, this is carried out for the MFG formulation of the power market problem in order to fit the situation where sporadic noisy observations of the state of the Major Agent and of the market price are available for recursive mean field state estimation.

#### 11h45 **Distributed Estimation and Control for Large Population Stochastic Multi-Agent Systems with Coupling in the Measurements**

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In this paper, we investigate a class of large population stochastic multi-agent systems where the agents have linear stochastic dynamics and are coupled via their measurement equations. Using the state aggregation technique, we propose a distributed estimation and control algorithm that combines the Kalman filtering for state estimation and the linear-quadratic-Gaussian (LQG) feedback controller. Moreover, the stability analysis in terms of exponential boundedness in the mean square is given for the proposed algorithm.

#### 12h10 **Conic-Sector-Based Control to Circumvent Passivity Violations**

**Bridgeman, Leila Jasmine**, McGill University, [leilabridge@gmail.com](mailto:leilabridge@gmail.com)  
**Forbes, James Richard**, McGill University, [james.richard.forbes@mcgill.ca](mailto:james.richard.forbes@mcgill.ca)

Strictly positive real controller design is widely used to ensure input-output stability via the Passivity Theorem, a special case of the Conic Sector Theorem. This presentation discusses use of the Conic Sector Theorem itself in stability analysis and optimal controller design for passivity-violated systems. Given an existing controller and a plant that has experienced a (partially unknown) passivity violation, a novel sector bound selection procedure is presented to assess input-output stability via the Conic Sector Theorem. Should input-output stability not be ensured, two original controller synthesis methods are designed to mimic the original controller. Both methods guarantee input-output stability by selecting controllers within appropriate conic sectors, and involve only the evaluation of readily solvable convex optimization problems constrained by linear matrix inequalities. A numerical simulation involving a flexible manipulator is provided as a proof of concept.

### WA11 **Modèles stochastiques et optimisation en énergie / Stochastic Models and Optimization in Energy**

**Salle/Room:** Gérard Parizeau  
**Président/Chairman:** Moazeni, Somayeh

#### 10h30 **SMART-ISO: Modeling Uncertainty in Renewable Sources of Energy**

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**Powell, Warren**, Princeton University, [powell@princeton.edu](mailto:powell@princeton.edu)  
**Simao, Hugo**, Princeton University, [hpsimao@princeton.edu](mailto:hpsimao@princeton.edu)

We present a stochastic modeling framework that allows for the analysis of the integration of high levels of renewable sources of energy (e.g. wind and solar) into a large transmission system. It is comprised of a multi-scale optimization and simulation system, including a day-ahead and an hour-ahead unit commitment models and a real-time simulation model. We will illustrate the application of the system through some preliminary results of an off-shore wind integration study.

#### 10h55 **Risk Management in Energy Storage Planning**

**Moazeni, Somayeh**, Princeton University, [somayeh@princeton.edu](mailto:somayeh@princeton.edu)  
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An optimal policy for a finite planning horizon, among some energy source, energy carrier electricity, and a battery storage is sought to satisfy the electricity load and minimize the expected cost (and risk) of the

system. We present a stochastic optimization framework for the problem, and develop a novel tractable parallel computational stochastic dynamic programming technique based on the direct policy search method and a parallel multi-start pattern search derivative free optimization. Impacts of the underlying non-stationary stochastic processes of the electricity price and load on the minimum expected cost energy flow structure, its associated expected cost and Value-at-Risk are then extensively discussed.

**11h20**      **Decision-Support in the Hydro Energy Market: A Stochastic Approach with Risk Aversion Measures**

**Gendreau, Michel**, Polytechnique Montréal, [Michel.Gendreau@cirrelt.ca](mailto:Michel.Gendreau@cirrelt.ca)  
**Gonçalves, Raphael E.C.**, Polytechnique Montréal, [raphael.ecg@gmail.com](mailto:raphael.ecg@gmail.com)

We present a stochastic approach for decision-support in the hydro energy market. For that, we consider risk aversion metrics based on the Conditional Value-at-Risk (CVaR), which can provide more coherent decisions and allow the decision-maker to add its risk perception into the model formulation. We present a case study based on an academic example of the Hydro-Québec (HQ) trading market environment.

**WB1**      **Exposé magistral V / Tutorial V**

**Salle/Room:** Banque de développement du Canada  
**Président/Chairman:** Waaub, Jean-Philippe

**13h30**      **Outils d'éllicitation des préférences pour l'aide multicritère: application et mise en pratique en utilisant la plateforme Decision Deck**

**Mousseau, Vincent**, École Centrale Paris, [vincent.mousseau@ecp.fr](mailto:vincent.mousseau@ecp.fr)

La mise en oeuvre de méthodes multicritère d'aide à la décision requiert d'intégrer le jugement du décideur au modèle utilisé pour représenter ses préférences. Ceci implique de disposer d'outils d'éllicitation des préférences qui permettent une interaction entre le décideur et l'analyste, où le décideur exprime des jugements/préférences dans son langage. L'exposé sera illustré par les outils logiciels du projet open source "Decision Deck".

**WB2**      **Localisation et conception de réseaux II / Location and Network Design II**

**Salle/Room:** Nancy et Michel-Gaucher  
**Président/Chairman:** Cordeau, Jean-François

**13h30**      **Hub Line Location in the Design of Public Transportation Network**

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**Contreras, Ivan**, Concordia University, [icontrer@encs.concordia.ca](mailto:icontrer@encs.concordia.ca)  
**Cordeau, Jean-François**, GERAD - HEC Montréal, [jean-francois.cordeau@hec.ca](mailto:jean-francois.cordeau@hec.ca)

The hub line location problem in public transportation consists of designing a rapid transit line that minimizes the total weighted travel time taking into account the presence of alternative modes of transportation and transferring times. Some algorithms based on the Benders decomposition method are proposed to solve the problem. Computational results show that these algorithms outperform the CPLEX on all instances.

**13h55**      **Competitive Hub Location-Pricing Problem**

**Nikbakhsh, Ehsan**, Tarbiat Modares University, [ehsan.nikbakhsh@cirrelt.ca](mailto:ehsan.nikbakhsh@cirrelt.ca)  
**Zegordi, Seyed Hessameddin**, Tarbiat Modares University, [zegordi@modares.ac.ir](mailto:zegordi@modares.ac.ir)

In this talk, we investigate configuring a hub network and determining its service price for an operator entering a market with an existing operator. Assuming static competition, a mixed integer nonlinear programming model and a hybrid genetic algorithm with the Fibonacci search method are proposed to tackle the problem.



14h20

### **Dynamic Facility Location with Generalized Modular Capacities**

Jena, Sanjay Dominik, Université de Montréal, [sanjay.jena@cirrelt.ca](mailto:sanjay.jena@cirrelt.ca)  
Cordeau, Jean-François, GERAD - HEC Montréal, [jean-francois.cordeau@hec.ca](mailto:jean-francois.cordeau@hec.ca)  
Gendron, Bernard, Université de Montréal, [bernard.gendron@cirrelt.ca](mailto:bernard.gendron@cirrelt.ca)

We introduce a facility location problem with multiple time periods, multiple commodities and multiple capacity levels, where the costs for capacity changes are based on a cost matrix. A strong mixed integer programming model is presented that unifies several existing problems found in the literature.

14h45

### **Simulation of a Physical Internet Based Transportation Network**

Furtado, Pedro, Polytechnique Montréal, [pedro.furtado@polymtl.ca](mailto:pedro.furtado@polymtl.ca)

This presentation is based on the Netlogo's simulation of the distribution of road transportation services based on the physical internet. Based on this idea, instead of hauling trailers from origin to destination using a single tractor, freight is hauled from hub-to-hub, using different tractors allocated to one specific hub.

**WB3**

## **Session industrielle / Industrial Session**

**Salle/Room:** Gérard Parizeau  
**Président/Chairman:** Le Digabel, Sebastien

13h30

### **Modèle climatique de prévision de la demande d'électricité au Québec**

Milon, Olivier, TransEnergie, [milon.olivier@hydro.qc.ca](mailto:milon.olivier@hydro.qc.ca)

Prévoir la demande provinciale d'électricité est essentiel pour Hydro-Québec, pour des raisons techniques et économiques. Nous montrerons que cette demande est largement tributaire des conditions climatiques, ce qui justifie le choix d'un modèle non-linéaire climatique, pour en faire la prévision à court terme de façon précise et efficace.

13h50

### **Outils d'aide à la décision pour planification de la production hydroélectrique chez Rio Tinto Alcan au Saguenay Lac St-Jean**

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Le groupe de ressource hydrique (GRH) de la division Énergie Électrique de Rio Tinto Alcan est en charge de la planification de la production hydroélectrique des systèmes du Saguenay Lac St-Jean et de Kemano en Colombie-Britannique. Ce processus de décision requière l'utilisation de nombreux outils d'optimisation : technique d'optimisation boîte noire pour la calibration des modèles hydrologiques, optimisation déterministe non linéaire pour la planification court terme de la génération des groupes turbo-alternateur et l'optimisation stochastique pour fin d'étude d'impact et de rentabilité de projets majeurs de même que la planification moyen terme de la trajectoire des réservoirs. Durant cette présentation, nous discuterons de l'ensemble de notre processus de prise de décision ainsi que nos principaux axes de R&D dans le domaine de la recherche opérationnelle.

14h10

### **Positionnement de stations GMON avec inversion du modèle HUT**

Alarie, Stéphane, Institut de recherche d'Hydro-Québec, [alarie.stephane@ireq.ca](mailto:alarie.stephane@ireq.ca)  
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Bien qu'on puisse établir l'équivalent en eau de la neige à partir d'images-satellite et de modèles physiques, l'information demeure partielle et des mesures au sol sont nécessaires. Des stations GMON sont ici positionnées dans le but d'améliorer la qualité des grilles de neige produites par l'inversion du modèle HUT.

14h30

### **De nouveaux outils de simulation et d'optimisation pour la gestion du centre d'appels d'Hydro-Québec**

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L'Institut de recherche d'Hydro-Québec est impliqué depuis 2009 dans le développement de nouveaux outils pour une meilleure gestion du centre d'appels de l'entreprise. Nous présentons les diverses problématiques rencontrées, passons en revue les outils en cours de développement, et terminons par la présentation d'un logiciel de simulation, développé par l'équipe de recherche de Pierre L'Ecuyer de l'Université de Montréal (DIRO), que nous avons adapté pour la gestion en temps réel du centre d'appels d'Hydro-Québec.

**14h50**

**Répartition automatisé de la production hydraulique du réseau d'Hydro-Québec**

**Fournier, Julien**, Hydro-Québec, [fournier.julien@hydro.qc.ca](mailto:fournier.julien@hydro.qc.ca)

**Delorme, Louis**, Institut de recherche d'Hydro-Québec, [delorme.louis@ireq.ca](mailto:delorme.louis@ireq.ca)

Le contrôleur de la fiabilité au Québec doit, chaque jour, élaborer un programme de production pour la journée du lendemain. Il doit planifier heure par heure la répartition de la production sur son parc de centrales afin d'alimenter la demande. Pour ce faire, les contraintes du réseau de transport et la gestion d'eau sur les rivières doivent être prises en compte.

**WC1**

**OPDE 6 - Applications régionales en énergie et transport / Applications: Energy and Transportation at Regional Level**

**Salle/Room:** Banque de développement du Canada

**Président/Chairman:** De Smet, Yves

**15h30**

**Application de la méthode DEMIT (Développement énergétique par modélisation et intelligence territoriale) au Brésil - Projet bilatéral du MRI-Québec -**

**Vazquez, Maria**, étudiante, [vazquez\\_rascon.maria\\_de\\_lourdes@courrier.uqam.ca](mailto:vazquez_rascon.maria_de_lourdes@courrier.uqam.ca)

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**Ilinca, Adrian**, LREE-UQAR, [adrian\\_ilinca@uqar.qc.ca](mailto:adrian_ilinca@uqar.qc.ca)

**15h55**

**Planification énergétique en Guinée maritime : une approche d'aide multicritère à la décision pour opérer des choix tenant compte des préoccupations environnementales**

**Kourouma, Dan Lansana**, CERE/Université de Conakry, [dan\\_lansana@yahoo.fr](mailto:dan_lansana@yahoo.fr)

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**16h20**

**Crystal City, un outil pour la stratégie énergétique des villes intelligentes (projet européen CitInEs)**

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**16h45**

**Using Multi-Objective Optimization to Assess the Sustainable Road Safety Performances of Road Projects at the Design Stage**

**De Smet, Yves**, Université Libre de Bruxelles, [yves.de.smet@ulb.ac.be](mailto:yves.de.smet@ulb.ac.be)

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**Debauche, Wanda**, Belgian Road Research Centre, [w.debauche@brrc.be](mailto:w.debauche@brrc.be)

**WC2**

**Chaîne d'approvisionnement / Supply Chain**

**Salle/Room:** Nancy et Michel-Gaucher

**Président/Chairman:** Rönnqvist, Mikael

**15h30**

**Gestion de la demande dans l'industrie du bois d'œuvre**

**Ben Ali, Maha**, Consortium de recherche FORAC, Université Laval, [maha.ben-ali.1@ulaval.ca](mailto:maha.ben-ali.1@ulaval.ca)

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Pour saisir les opportunités offertes par le marché du bois d'œuvre, on propose de formuler le problème de vente comme un système de décision intégrant tactiquement la planification des ventes et des opérations, permettant de considérer la saisonnalité, et opérationnellement une promesse de livraison basée sur la gestion de revenu.

15h55

### **Integrated Tactical Planning in the Lumber Supply Chains**

**Sanei Bajgiran, Omid**, Concordia University, [o\\_sane@encs.concordia.ca](mailto:o_sane@encs.concordia.ca)  
**Kazemi Zanjani, Masoumeh**, Concordia University, [kazemi@encs.concordia.ca](mailto:kazemi@encs.concordia.ca)  
**Nourelfath, Mustapha**, Université Laval, [Mustapha.Nourelfath@gmc.ulaval.ca](mailto:Mustapha.Nourelfath@gmc.ulaval.ca)

As the first contribution in the literature, we investigate integrated tactical planning in a lumber supply chain. The proposed model coordinates harvesting, wood procurement, production, distribution, and sale activities, so as to minimize the cost of the supply chain. The integrated model is also compared with the decoupled entity models.

16h20

### **Proposition d'un modèle pour sélectionner les fournisseurs par les variables environnementales et sociales sans perdre l'efficacité**

**Carmo, Breno**, Universidade Federal Rural do Semi Árido, [brenobarros@ufersa.edu.br](mailto:brenobarros@ufersa.edu.br)

Les variables sociales, environnementales et financières devront être transposées pour tous les fournisseurs d'une supply chain par le processus de production considéré durable. Pour joindre ensemble ces variables, cet article propose un modèle avec deux méthodologies (optimisation et MCDA) pour faire cette transposition.

16h45

### **Using Robust Optimization and Stochastic Programming to Solve a Value Chain Problem under Uncertainty**

**Rönnqvist, Mikael**, Université Laval, [mikael.ronnqvist@gmc.ulaval.ca](mailto:mikael.ronnqvist@gmc.ulaval.ca)  
**Flisberg, Patruk**, The Forestry Research Institute of Sweden, [pafli@mweb.co.za](mailto:pafli@mweb.co.za)

We study a value chain problem with uncertainty in the product demand over many time periods. We describe a solution approach where we first make a forecast of the demand based on historical data. Second, we use both robust optimization and stochastic programming to develop efficient solution methods. We test the approach on a set of well known instances.

WC3

## **Méthodes d'optimisation en ingénierie d'aérostructures / Optimization methods in aerostructural engineering**

**Salle/Room:** Gérard Parizeau  
**Président/Chairman:** Arreckx, Sylvain

15h30

### **Static Aeroelastic Design Optimization of Lightweight Structures: Computational Challenges and Opportunities**

**Kennedy, Graeme**, University of Toronto, [graeme.j.kennedy@gmail.com](mailto:graeme.j.kennedy@gmail.com)

Static aeroelastic design optimization of flexible, lightweight aircraft involves the simultaneous design of both aerodynamics and structures. Static aeroelastic analysis itself is a computationally expensive problem that often requires the use of high-performance computing techniques. Simulation-based design optimization of static aeroelastic systems presents many computational challenges and opportunities for the application of novel optimization techniques that have the potential to reduce computational times.

15h55

### **Quasi-Newton Jacobian Estimates for Matrix-Free Structural Optimization**

**Lambe, Andrew**, University of Toronto, [lambe@utias.utoronto.ca](mailto:lambe@utias.utoronto.ca)  
**Martins, Joaquim**, University of Michigan, [jrram@umich.edu](mailto:jrram@umich.edu)

In structural optimization problems with failure constraints, the computational cost is dominated by computing the gradients of all the constraints. Using a "matrix-free" optimizer can reduce this cost

significantly by requiring only appropriate matrix-vector products with the full constraint Jacobian. To keep the total number of matrix-vector products small, we will advocate estimating the constraint Jacobian within the matrix-free optimizer using a quasi-Newton method. Results from structural test problems demonstrate that the computational cost scales well compared to traditional SQP algorithms.

**16h20**

### **Implementation of a Matrix-Free Augmented Lagrangian Algorithm**

**Arreckx, Sylvain**, Polytechnique Montréal, [sylvain.arreckx@polymtl.ca](mailto:sylvain.arreckx@polymtl.ca)

In many applications, problems are so large that we cannot compute/store explicit Jacobians and don't have access to Hessian information. We will outline a matrix-free algorithm for solving nonlinear problems with both equalities and inequalities. Our algorithm is based on an augmented Lagrangian approach and relies on matrix-vector products only. We also show some numerical results on the CUTer and COPS collections.

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Ramaswamy, Prasanna Kumar, TB5  
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Rei, Walter, MB11  
Rekik, Monia, TB11  
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Renaud, Jacques, TA11  
Rendl, Franz, WA4  
Riquelme-Rodriguez, Juan-Pablo, TA3  
Rix, Greg, MA11  
Roberts, Fred S., MBP  
Rogalsky, Tim, TA8  
Rönnqvist, Mikael, MB8, TA3, TB6, WC2  
Rosat, Samuel, MA6  
Rosehart, William, TB4  
Rousseau, Louis-Martin, MA11, MA8, MB11, TB3  
Ruiz, Angel, MB8, TA11

Saboonchi, Behnaz, WA7  
Saddoune, Mohammed, MA6  
Sadre-Bazaz, Samin, WA10  
Salazar Gonzalez, Juan Jose, MB3  
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Sanei Bajgiran, Omid, WC2  
Saraiva de Camargo, Ricardo, WA8  
Sarrazin, Renaud, WC1  
Saucier, Antoine, TB9  
Savard, Gilles, TA4, TA7, TB4  
Scutellà, Maria Grazia, MB10  
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Senécal, Renaud, MB4  
Shafique, Mubashsharul, WA6  
Sharif Azadeh, Shadi, TA4  
Shniderman, Matan, MB9  
Siirola, John, MB5  
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Silva, Vera, TB4  
Simao, Hugo, WA11  
Simon, Émile, TA5  
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Soumis, François, MA6, TA6, TB9, TB11  
Souza, Leonard, MB6  
Srour, F Jordan, MB3

Taboubi, Sihem, MB9  
Takouda, Matthias, TB10  
Talgorn, Bastien, MA5, TB9  
Tamaki, Mitsushi, TB10  
Tanash, Moayad, WA8  
Tarel, Guillaume, WC1  
Tas, Duygu, MB11  
Tavanti, Luca, MB10  
Timoumi, Ahmed, MB9  
Titley-Peloquin, David, MA10  
Toint, Philippe L., MA10  
Touhami, Lalla Samira, WA7  
Toulouse, Michel, TB3  
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Tremblay, Jean-Michel, TB7  
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Uchoa, Eduardo B., TA9  
Urosevic, Dragan, TB5

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Van Dyke, Benjamin, MB5  
Van Woensel, Tom, MB11, WA9  
Vanderbei, Robert J., WAP  
Vannelli, Anthony, TB4  
Vazquez, Maria, WC1  
Vidal, Thibaut, MA3  
Vidyarthi, Navneet, WA8  
Villalba Matamoros, Martha E., MB4

Waaub, Jean-Philippe, MB7, TA2, TB2, WC1  
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Weraikat, Dua, MB8  
Wiegele, Angelika, WA4  
Wild, Stefan, MA5  
Wolkowicz, Henry, WA4  
Woodward, Lyne, WA10

Xie, Xiaohu, TA10

Yonkeu, Samuel, TB2

Zaccour, Georges, MB9, TA6  
Zaghrouti, Abdelouahab, MA6  
Zaras, Kazimierz, MA2  
Zareipour, Hamid, TB4  
Zegal, Walid, WB3  
Zegordi, Seyed Hessameddin, WB2  
Zéphyr, Luckny, MA7  
Zubieta, Lourdes, MB8

# **JOURNÉES DE L'OPTIMISATION 2014**

## **Montréal**

### **5-7 mai 2014**

Les Journées de l'Optimisation sont un événement annuel organisé en alternance par le Centre interuniversitaire de recherche sur les réseaux d'entreprise, la logistique et le transport (CIRRELT) et le Groupe d'Études et de Recherche en Analyse des Décisions (GERAD). Les thèmes de ces Journées portent principalement sur les théories, les méthodes numériques et les applications de l'optimisation. Un des objectifs de ces réunions est de permettre aux chercheurs intéressés par ces domaines de se rencontrer et ainsi de favoriser les échanges et la collaboration entre individus ou institutions de divers pays. Nous sollicitons des communications sur les sujets suivants ou des sujets connexes :

la programmation mathématique; les heuristiques; la programmation par contraintes; la théorie de la commande optimale; les méthodes numériques d'optimisation; les méthodes statistiques; les applications aux problèmes du génie, de l'administration, de la gestion des systèmes de services de santé, du transport, de l'économie, de l'urbanisme, de l'environnement, de la gestion des ressources, de l'aménagement, de la biologie, des réseaux de télécommunications, de la robotique, des systèmes experts, de la modélisation énergétique, etc.

Les personnes intéressées aux méthodes d'optimisation ou à leurs applications sont cordialement invitées à ces Journées. Nous désirons toutefois solliciter tout spécialement les exposés portant sur les nouvelles méthodes d'optimisation et leurs applications. Les langues des Journées seront le français et l'anglais.

En 2014, les Journées de l'Optimisation se dérouleront à HEC Montréal, 3000 Côte-Sainte-Catherine, Montréal, près du campus de l'Université de Montréal. Voici la liste des conférenciers pléniers:

- ❑ **Bernard Gendron**, Université de Montréal, Canada
- ❑ **Andrés Medaglia**, Universidad de los Andes, Colombie
- ❑ **Christian Prins**, Université de Technologie de Troyes, France
- ❑ **Mikael Rönnqvist**, Université Laval, Canada

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# **OPTIMIZATION DAYS 2014**

## **Montreal**

### **May 5-7, 2014**

Optimization Days is an annual conference organized alternately by the Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (CIRRELT) and the Groupe d'Études et de Recherche en Analyse des Décisions (GERAD). The aim of the meeting is to survey current research trends in optimization methods and their applications, and to provide an opportunity for interaction between various research groups from around the world. Topics of interest include, but are not restricted to:

Mathematical programming; heuristics; constraint programming; optimal control theory; numerical methods of optimization; statistical methods; applications to engineering, management science, healthcare systems, transportation, economics, urban and environmental problems, resource management, biology, telecommunications networks, robotics, expert systems, energy modeling, etc

All those interested in optimization methods and their present or potential applications are invited to participate. We are especially interested in talks on new methods of optimization and their applications. The languages of the conference will be English and French.

In 2014, Optimization Days will be held at HEC Montréal, 3000 Côte-Sainte-Catherine, Montreal, near the Campus of the Université de Montréal. Here is a list of the plenary speakers:

- ❑ **Bernard Gendron**, Université de Montréal, Canada
- ❑ **Andrés Medaglia**, Universidad de los Andes, Colombia
- ❑ **Christian Prins**, Troyes University of Technology, France
- ❑ **Mikael Rönnqvist**, Université Laval, Canada

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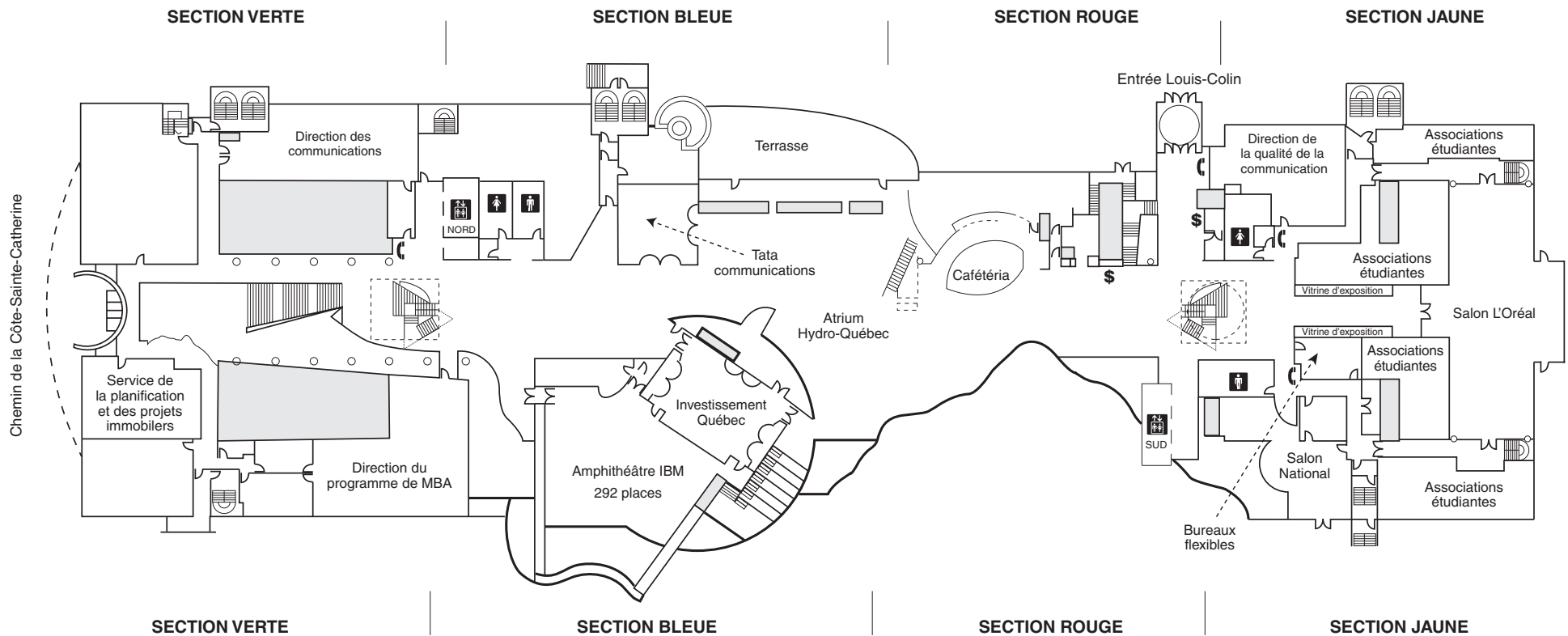
# HEC Montréal

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3000, chemin de la Côte-Sainte-Catherine  
Montréal (Québec) H3T 2A7

# RJ

Faculté de l'aménagement de l'Université de Montréal



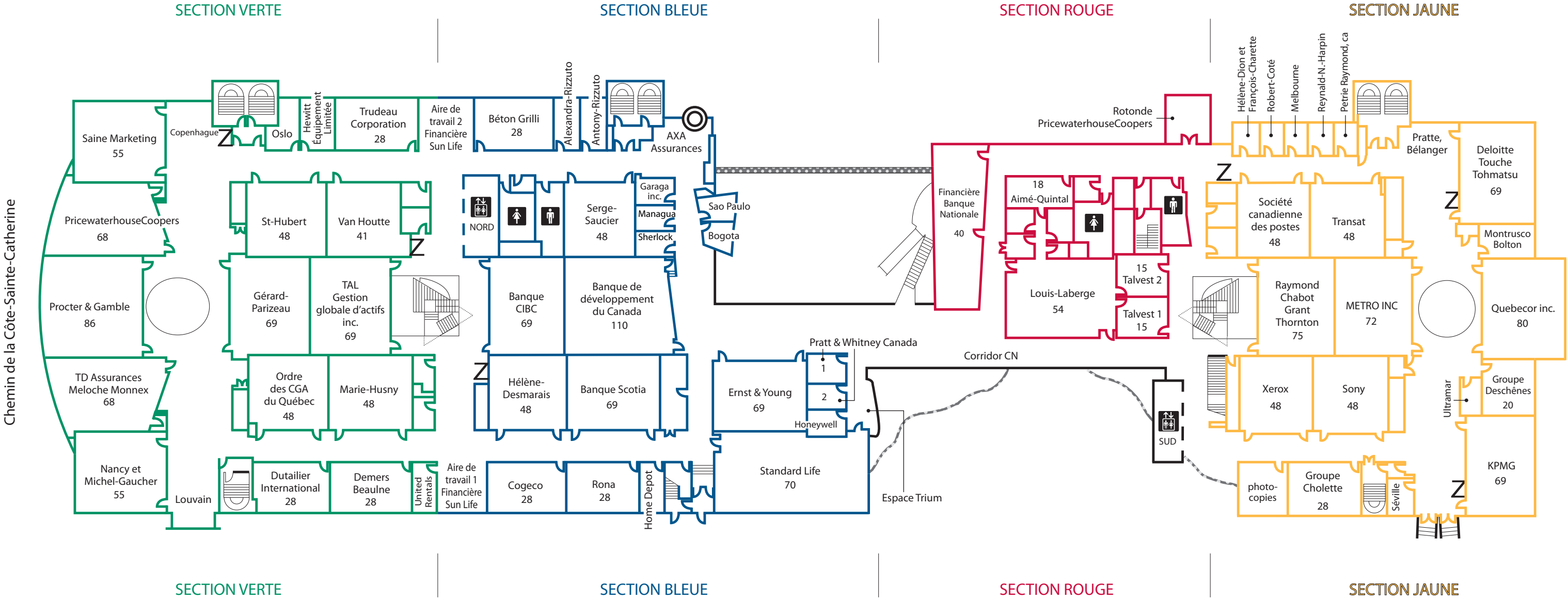
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3000, chemin de la Côte-Sainte-Catherine  
Montréal (Québec) H3T 2A7

PLAN DES SALLES DE COURS ET CUBICULES – 1<sup>er</sup> ÉTAGE

Faculté de l'aménagement de l'Université de Montréal



Collège Jean-de-Brébeuf

Le chiffre inscrit en dessous du nom de la salle indique le nombre de places disponibles.



| Salle / Room                   | Amphithéâtre IBM                                                                                                                                   | Banque Scotia                                                              | TAL Gestion globale d'actifs inc.                                                                                                                                | St-Hubert                                                                        | Van Houtte                                                                                                                                                          | CPA du Québec                                                                                  | Mary Husny                                                                                             | Hélène-Desmarais                                                                        | Demers Beaulne                                                                                                                                           | Dutailier International                                                                                                | Nancy & Michel-Gaucher                                                                                 | Gérard Parizeau                                                                                                                |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Lundi/Monday 08:45–09:00       | Amphithéâtre IBM<br>Séance d'ouverture / Opening Session                                                                                           |                                                                            |                                                                                                                                                                  |                                                                                  |                                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Lundi/Monday 09:00–10:00       | <b>MAP</b> (p.5)<br><b>A. R. Conn</b>                                                                                                              |                                                                            |                                                                                                                                                                  |                                                                                  |                                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Lundi/Monday 10:30–12:10       |                                                                                                                                                    | <b>MA1</b> (p. 5)<br>Exposé magistral<br>Tutorial<br><b>M. Breton</b>      | <b>MA2</b> (p. 5)<br>OPDE 1 - Outils de la recherche opérationnelle pour décider ensemble<br><i>Operational Research Tools for Group Decision</i>                | <b>MA3</b> (p. 6)<br>Tournées de véhicules I<br><i>Vehicle Routing Problem I</i> | <b>MA4</b> (p. 6)<br>Applications en génie des mines I<br><i>Applications in Mining Engineering I</i>                                                               | <b>MA5</b> (p. 7)<br>Optimisation sans dérivée I<br><i>Derivative-Free Optimization I</i>      | <b>MA6</b> (p. 8)<br>Problèmes d'horaires de grandes tailles<br><i>Large-Scale Scheduling Problems</i> | <b>MA7</b> (p. 9)<br>Énergie et environnement I<br><i>Energy and Environment I</i>      | <b>MA8</b> (p. 10)<br>Santé: planification d'horaires de patients et de ressources<br><i>Healthcare: Patient and Resource Scheduling</i>                 | <b>MA9</b> (p. 11)<br>Applications de l'optimisation robuste<br><i>Applications of Robust Optimization</i>             | <b>MA10</b> (p. 11)<br>Algèbre linéaire en optimisation<br><i>The Linear Algebra of Optimization</i>   | <b>MA11</b> (p. 12)<br>Applications en foresterie<br><i>Applications in Forestry</i>                                           |
| Lundi/Monday 14:00–15:00       | <b>MBP</b> (p. 13)<br><b>F. S. Roberts</b>                                                                                                         |                                                                            |                                                                                                                                                                  |                                                                                  |                                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Lundi/Monday 15:30–17:10       |                                                                                                                                                    | <b>MB1</b> (p. 14)<br>Exposé magistral<br>Tutorial<br><b>M. Cloutier</b>   | <b>MB2</b> (p. 14)<br>OPDE 2 - Applications en aménagement urbain et transport<br><i>Applications: Urban and Transportation Planning</i>                         | <b>MB3</b> (p. 15)<br>Tournées de véhicules II<br><i>Vehicle Routing II</i>      | <b>MB4</b> (p. 15)<br>Applications en génie des mines II<br><i>Applications in Mining Engineering II</i>                                                            | <b>MB5</b> (p. 16)<br>Optimisation sans dérivée II<br><i>Derivative-Free Optimization II</i>   | <b>MB6</b> (p. 17)<br>Transport<br><i>Transportation</i>                                               | <b>MB7</b> (p. 18)<br>Énergie et environnement II<br><i>Energy and Environment II</i>   | <b>MB8</b> (p. 19)<br>Santé: optimisation des flux de patients et de ressources<br><i>Healthcare: Patient and Resource Flow Optimization</i>             | <b>MB9</b> (p. 20)<br>Applications de la théorie des jeux en marketing<br><i>Game Theory Applications in Marketing</i> | <b>MB10</b> (p. 21)<br>Localisation et conception de réseaux I<br><i>Location and Network Design I</i> | <b>MB11</b> (p. 22)<br>Tournées de véhicules stochastiques<br><i>Stochastic Vehicle Routing Problems</i>                       |
| Lundi/Monday 17:30–20:00       | Salon L'Oréal<br>Vins et fromages / Wine and Cheese Party                                                                                          |                                                                            |                                                                                                                                                                  |                                                                                  |                                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Mardi/Tuesday 09:00–10:00      | <b>TAP</b> (p. 24)<br><b>J. J. Jüdice</b>                                                                                                          |                                                                            |                                                                                                                                                                  |                                                                                  |                                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Mardi/Tuesday 10:30–12:10      |                                                                                                                                                    | <b>TA1</b> (p. 24)<br>Exposé magistral<br>Tutorial<br><b>R. Doverspike</b> | <b>TA2</b> (p. 24)<br>OPDE 3 - Applications en contexte multi-usages des ressources naturelles<br><i>Applications: Multipurpose Context of Natural Resources</i> | <b>TA3</b> (p. 25)<br>Tournées de véhicules III<br><i>Vehicle Routing III</i>    | <b>TA4</b> (p. 26)<br>Applications de modèles de choix discrets en recherche opérationnelle<br><i>Applications of Discrete Choice Models in Operations Research</i> | <b>TA5</b> (p. 27)<br>Optimisation sans dérivée III<br><i>Derivative-Free Optimization III</i> | <b>TA6</b> (p. 27)<br>Théorie des jeux I<br><i>Game Theory I</i>                                       | <b>TA7</b> (p. 28)<br>Énergie et environnement III<br><i>Energy and Environment III</i> | <b>TA8</b> (p. 29)<br>Optimisation en santé - études de cas et nouvelles approches<br><i>Healthcare Optimization - Case Studies and Novel Approaches</i> | <b>TA9</b> (p. 29)<br>Graphes et réseaux<br><i>Graphs and Networks</i>                                                 | <b>TA10</b> (p. 30)<br>Algorithmes I<br><i>Algorithms I</i>                                            | <b>TA11</b> (p. 31)<br>Logistique<br><i>Logistics</i>                                                                          |
| Mardi/Tuesday 14:00–15:00      | <b>TBP</b> (p. 32)<br><b>P. Gauthier</b>                                                                                                           |                                                                            |                                                                                                                                                                  |                                                                                  |                                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Mardi/Tuesday 15:20–17:10      |                                                                                                                                                    | <b>TB1</b> (p. 33)<br>Exposé magistral<br>Tutorial<br><b>T. Ralphs</b>     | <b>TB2</b> (p. 33)<br>OPDE 4 - Applications dans le domaine de la santé<br><i>Applications: Health Sector</i>                                                    | <b>TB3</b> (p. 34)<br>Tournées de véhicules IV<br><i>Vehicle Routing IV</i>      | <b>TB4</b> (p. 34)<br>Optimisation pour les problèmes d'alimentation électrique<br><i>Optimization for Electric Power Problems</i>                                  | <b>TB5</b> (p. 35)<br>Optimisation combinatoire<br><i>Combinatorial Optimization</i>           | <b>TB6</b> (p. 36)<br>Théorie des jeux II<br><i>Game Theory II</i>                                     | <b>TB7</b> (p. 37)<br>Énergie et environnement IV<br><i>Energy and Environment IV</i>   | <b>TB8</b> (p. 37)<br>Ingénierie financière<br><i>Financial Engineering</i>                                                                              | <b>TB9</b> (p. 38)<br>Optimisation des trajectoires d'avions<br><i>Aircraft Trajectory Optimization</i>                | <b>TB10</b> (p. 39)<br>Algorithmes II<br><i>Algorithms II</i>                                          | <b>TB11</b> (p. 40)<br>Horaires de personnel<br><i>Shift Scheduling</i>                                                        |
| Mercredi/Wednesday 09:00–10:00 | <b>WAP</b> (p. 41)<br><b>R. J. Vanderbei</b>                                                                                                       |                                                                            |                                                                                                                                                                  |                                                                                  |                                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Mercredi/Wednesday 10:30–12:10 |                                                                                                                                                    |                                                                            | <b>WA2</b> (p. 41)<br>OPDE 5 - Décider ensemble en contexte corporatif et institutionnel<br><i>Group Decision in Corporate and Institutional Context</i>         | <b>WA3</b> (p. 41)<br>Tournées de véhicules V<br><i>Vehicle Routing V</i>        | <b>WA4</b> (p. 42)<br>Théorie et applications de l'optimisation conique<br><i>Theory and Applications of Conic Optimization</i>                                     | <b>WA5</b> (p. 43)<br>Optimisation sans dérivée IV<br><i>Derivative-Free Optimization IV</i>   | <b>WA6</b> (p. 43)<br>Optimisation globale<br><i>Global Optimization</i>                               | <b>WA7</b> (p. 44)<br>Optimisation multiobjectif<br><i>Multiobjective Optimization</i>  | <b>WA8</b> (p. 45)<br>Problèmes de localisation de centres<br><i>Hub Location Problems</i>                                                               | <b>WA9</b> (p. 46)<br>Ordonnancement<br><i>Scheduling</i>                                                              | <b>WA10</b> (p. 47)<br>Systèmes et contrôle<br><i>Systems and Control</i>                              | <b>WA11</b> (p. 48)<br>Modèles stochastiques et optimisation en énergie<br><i>Stochastic Models and Optimization in Energy</i> |
| Salle / Room                   | Banque de développement du Canada                                                                                                                  |                                                                            | Nancy & Michel-Gaucher                                                                                                                                           |                                                                                  | Gérard Parizeau                                                                                                                                                     |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Mercredi/Wednesday 13:30–15:10 | <b>WB1</b> (p. 49)<br>Exposé magistral<br>Tutorial<br><b>V. Mousseau</b>                                                                           |                                                                            | <b>WB2</b> (p. 49)<br>Localisation et conception de réseaux II / Location and Network Design II                                                                  |                                                                                  |                                                                                                                                                                     | <b>WB3</b> (p. 50)<br>Session industrielle<br>Industrial Session                               |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |
| Mercredi/Wednesday 15:30–17:10 | <b>WC1</b> (p. 51)<br>OPDE 6 - Applications régionales en énergie et transport<br><i>Applications: Energy and Transportation at Regional Level</i> |                                                                            | <b>WC2</b> (p. 51)<br>Chaîne d'approvisionnement<br><i>Supply Chain</i>                                                                                          |                                                                                  | <b>WC3</b> (p. 52)<br>Méthodes d'optimisation en ingénierie d'aérostructures<br><i>Optimization methods in aerostructural engineering</i>                           |                                                                                                |                                                                                                        |                                                                                         |                                                                                                                                                          |                                                                                                                        |                                                                                                        |                                                                                                                                |