GERAD ANNUAL REPORT

2023-2024



TABLE OF CONTENTS

Message from the director.	3
Presentation	
Mission	
Fundamental research and applications	6
Board of directors	
Members	8
Chair holders	9
Members of the Royal Society of Canada	11
Composition	12
Students	13
Highlights of the year	14
Funding and grants	21
Publications and scientific activities	22

MESSAGE FROM THE DIRECTOR



Olivier Bahn
GERAD Director

It is my pleasure as the GERAD Director to present our 2023–2024 Annual Report.

This year marked the beginning of my second term as the GERAD Director, which will run from June 1, 2023, to May 31, 2027. It is a great privilege to continue pursuing this mission and to work with all of you to further our centre's scientific influence and its leading role in the development of data and decision sciences.

This year, GERAD welcomed new members who enhance our community and diversify our expertise. I would like to welcome our new regular members: Julie Carreau (Polytechnique Montréal), Matthieu Gruson (ESG-UQAM), Annie Levasseur (ÉTS), Frédéric Quesnel (ESG-UQAM) and Juan C. Serpa (McGill University). We also welcome Amira Dems (IREQ) and Ryan Baker (CRNC) as associate members. Their arrival demonstrates the vitality and appeal of our strategic group.

Among the highlights of 2023–2024, I would like to highlight several collective achievements. First, funding obtained through the FRONT's Stratégia program has enabled us to launch large-scale projects involving several of our members (p. 14). Second, four new research chairs awarded to our members strengthen our position in strategic areas such as artificial intelligence, energy systems, and operations management (p. 14). Finally, the presence of many GERAD members in the international rankings compiled by Research.com (p. 14) and Mendeley (Elsevier, p. 19) attests to the global recognition of our community and illustrates the excellence of our scientific contributions.

In closing, I would like to express my sincere thanks to all those who contribute to the vitality of GERAD. I would particularly like to thank our main funders: the FRQNT, our partner universities (HEC Montréal, Polytechnique Montréal, McGill University, and UQAM) as well as the Institute for Data Valorization (IVADO) and several of our research chairs. I would also like to express my gratitude to our industrial partners, who place their trust in GERAD's expertise. Finally, I would like to acknowledge the commitment and creativity of our members, our students and our postdoctoral researchers, and the professionalism of our administrative and technical staff, whose support is essential to keep the centre operating smoothly.

Enjoy your reading!

Olivier Bahn



Created in 1979, GERAD is an inter-university research centre that brings together specialists in data and decision sciences, computer science, applied mathematics and mathematical engineering. These scientists come mainly from HEC Montréal, Polytechnique Montréal, McGill University and the Université du Québec à Montréal.

regular members from Quebec universities

research professionals and postdoctoral researchers











121

research activities



375
scientific publications



Quebec universities

GERAD'S MISSION:



To develop the mathematics of decision-making in all its forms in complex systems – be they technological, commercial or economic – and upstream of decision-making, to develop modelling based on statistics, simulation and data valuation



To train highly qualified personnel in the above fields, promoting equity, diversity and inclusion



To bring university researchers together with industry, with a view to carrying out large-scale research and development projects and to contribute to the international influence of Quebec research



To have a significant impact on society through scientific innovation, the transfer of knowhow in important sectors of the economy and the development of decision-making tools

FUNDAMENTAL

RESEARCH

GERAD's scientific program is based on **four research axes:**

Data valuation for decision-making

Decision support made in complex systems

Decision support made under uncertainty

Real-time decision support

APPLICATIONS

GERAD doesn't only tackle theoretical and methodological developments along these four research axes, in fact, one of its defining characteristics is that it deploys these methods in the following **broad fields of application.**

Economy and finance

Energy, environment and natural resources

3 Smart infrastructures

1 Engineering

5 Smart logistics

Marketing

7 Health

BOARD OF DIRECTORS

HEC Montréal



Caroline AubéDirector of the Research and Knowledge
Transfer Office



Olivier BahnGERAD Director and Chairman of the Board
HEC Montréal



Roussos Dimitrakopoulos Professor; Member Representative McGill University



Olivier Grenier
Director of the Research Office/Centre for Technological Development
Polytechnique Montréal



Patrick Jeandroz
Head of Expertise – Data Science and
High-Performance Computing; Industry
Representative
IREQ



Kristina Öhrvall
Director, Strategic Initiatives
McGill University

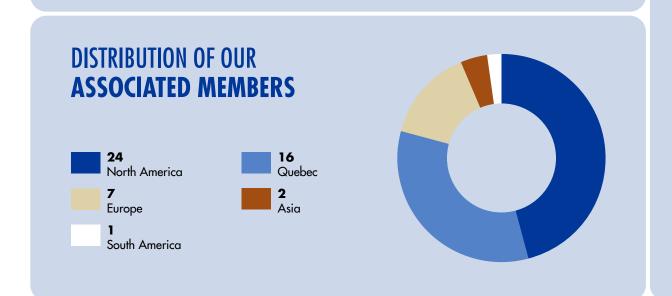


Nicolas RiendeauDirector of the Research and Creation Office
UQAM

OUR MEMBERS

EVOLUTION OF OUR MEMBERSHIP

	2020-21	2021-22	2022-23	2023-24
Regular members	69	73	73	79
Associated members	32	34	33	34
Honorary members	3	3	2	2
Visiting members	2	1	2	2



REGULAR MEMBERS BY INSTITUTION HEC Montréal 22 Polytechnique Montréal 21 McGill University 16 UQAM 7 Concordia University Université de Montréal **UQAC** ÉTS UQAR 1 Université Laval Université de Sherbrooke **UQAT** 10 15 20 25

CHAIR HOLDERS AT GERAD



Yossiri Adulyasak Canada Research Chair in Supply Chain Analytics



Loubna Benabbou Research Chair in Artificial Intelligence for Digital, Resilient, Agile and Sustainable **Supply Chains**



Leandro C. Coelho Canada Research Chair in Integrated Logistics



Maxime Cohen Scale Al Chair in Data Science for Retail



Jean-François Cordeau Chair in Logistics and **Transportation**



Erick Delage Canada Research Chair in Decision Making Under Uncertainty



Roussos **Dimitrakopoulos** Canada Research Chair in Sustainable Mineral Resource Development and Optimization Under Uncertainty



Christian Genest Canada Research Chair in Stochastic Dependence Modeling



Amir Ardestani-Jaafari Principal's Research Chair in Data-Driven Operations Management



Raf Jans Chair in Supply Chain **Operations Planning**



Annie Levasseur Canada Research Chair in Measuring the Impact of Human Activities on Climate Change



Andrea Lodi Canada Excellence Research Chair in Data Science for Real-Time **Decision-Making**

CHAIR HOLDERS AT GERAD



Carolina Osorio Scale Al Research Chair in Artificial Intelligence for Urban Mobility and Logistics



Samira A. Rahimi Canada Research Chair in Advanced Digital Primary Health Care



Xiaozhe Wang Canada Research Chair in Resilient and Stable Zero-**Emission Electric Power** Grids



Georges Zaccour Chair in Game Theory and Management

MEMBERS OF THE

ROYAL SOCIETY OF CANADA (RSC)



Michèle Breton



Peter E. Caines



Erick Delage



Jacques Desrosiers



Roussos Dimitrakopoulos



Pierre Hansen



Gilbert Laporte

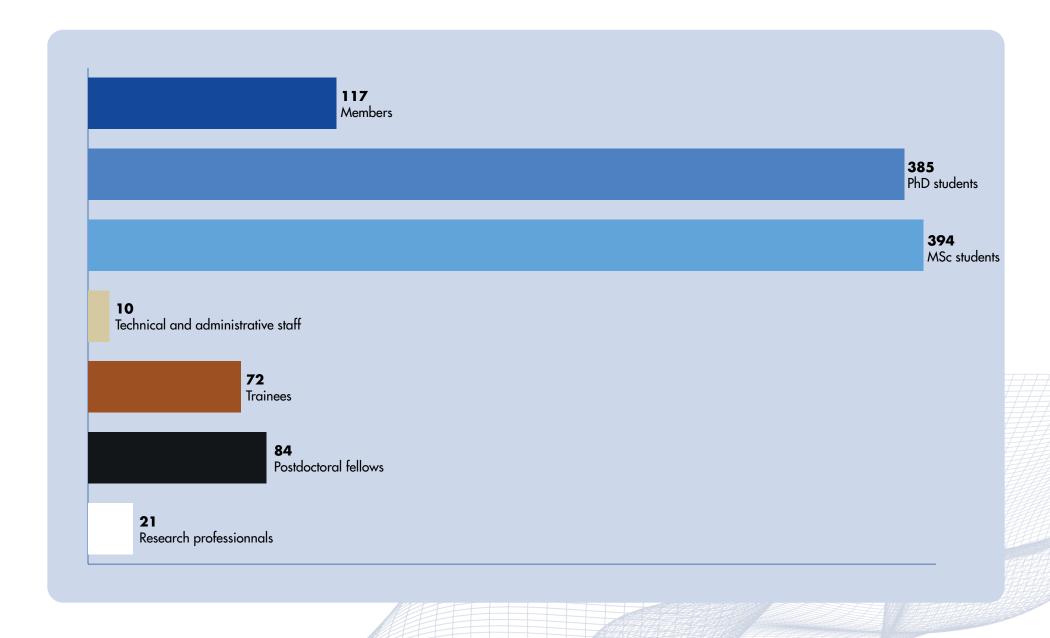


Saibal Ray

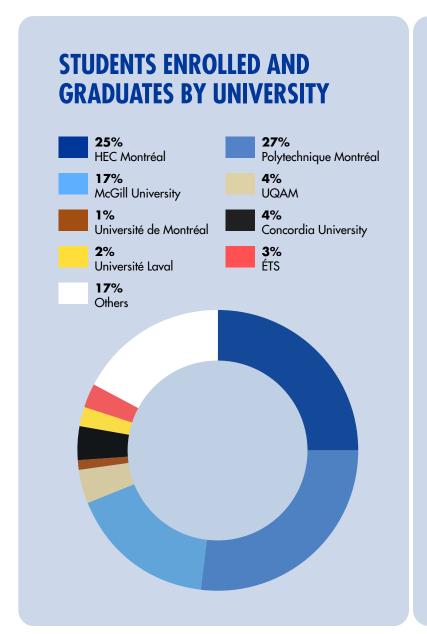


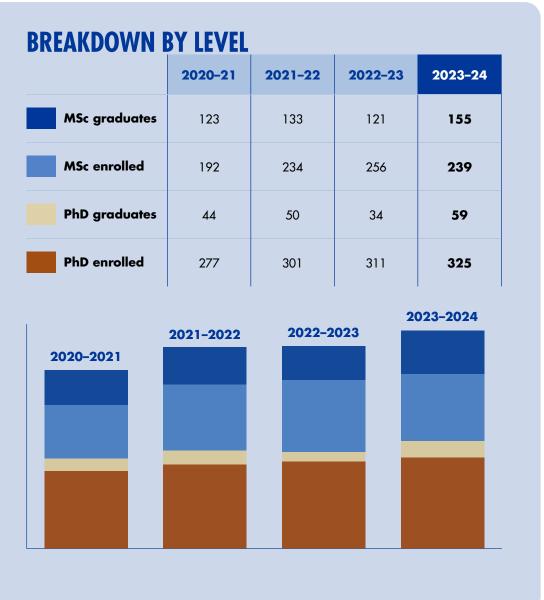
Georges Zaccour

COMPOSITION OF THE GERAD



STUDENTS





HIGHLIGHTS OF THE YEAR

Professor Olivier Bahn of HEC Montréal has been appointed director of the centre for a second term, beginning June 1, 2023, and ending May 31, 2027.

The FRQNT Stratégia program is funding two projects at GERAD. First, \$1.1 million for "Modelling of Emerging Challenges," with Octav Cornea (Director of CRM) as principal investigator. The group of researchers comes mainly from CRM, GERAD, and UNIQUE. The GERAD members participating in the project are Olivier Bahn and Annie Levasseur. And \$0.9 million for "Transforming and Enhancing the Integration of Public Transport Networks," with Antoine Legrain as principal investigator, and GERAD co-investigators Julie Carreau and François Soumis participating in the project.

A GERAD team is a finalist for the EURO Excellence in Practice Award 2024. The team, made up of Issmail El Hallaoui, François Soumis, El Mehdi Er Raqabi, and Ahmed Beljadid, is one of three finalists for their project "OCP Optimizes its Supply Chain for Africa and The World." It is a collaboration between Polytechnique Montréal, the OCP Group, and UM6P University.



Amir Ardestani-Jaafari was awarded the Principal's Research Chair in Data-Driven Operations Management (Tier 2) at UBC Okanagan.

Mehmet Gumus was awarded the Desautels Chair in Supply Chain Management and Business Analytics at McGill University.

Samira A. Rahimi was awarded the Canada Research Chair in Advanced Digital Primary Health Care (Tier 2), CIHR.

Xiaozhe Wang was awarded the Canada Research Chair in Resilient and Stable Zero-Emission Electric Power Grids (Tier 2), NSERC.

GERAD is proud to have contributed to the awards presented this year at the <u>Deep Learning Indaba 2023</u> conference, which took place from September 3 to 9, 2023, in Accra, Ghana.

Daniel Aloise, Jérôme Le Ny, Aditya Mahajan, and Carolina Osorio were promoted to full professor; Jean-François Bégin was promoted to associate professor; and Mehiddin Al-Baali was promoted to professor emeritus. Research.com has published the 2023 edition of its ranking of the top 1,000 scientists in several fields. Here are the 15 GERAD members listed.

In the field of mathematics:

Charles Audet, Jean-François Cordeau, Guy Desaulniers, Jacques Desrosiers, Roussos Dimitrakopoulos, Pierre Hansen, Alain Hertz, Brigitte Jaumard, Gilbert Laporte, Pierre L'Ecuyer, Andrea Lodi, Gilles Savard, François Soumis

In the field of computer science:

Pierre Hansen, Alain Hertz, Andrea Lodi, Gilles Savard

In the field of economics and finance:

Georges Zaccour

In the field of electronics and electrical engineering:

Peter Caines

In the field of engineering and technology:

Charles Audet, Jean-François Cordeau, Guy Desaulniers, Jacques Desrosiers, Roussos Dimitrakopoulos, François Soumis

OUR MEMBERS

IN THE MEDIA

"Math Games Have Real Consequences and Rewards at UBC Okanagan," Amir Ardestani-Jaafari, University of British Columbia (interview published in *UBC Okanagan News*, May 2024).

"Vie privée: la reconnaissance faciale comme outil policier en préoccupe plusieurs," Samira A. Rahimi, McGill University (interview published on ICI Radio-Canada, May 2024).

"Qu'en est-il de la technologie du moteur-roue?," Annie Levasseur, ÉTS (interview aired during the program *Moteur de recherche*, on Radio-Canada OHdio, May 2024).

"Comment fonctionne la mise à l'arrêt automatique du moteur des voitures," Annie Levasseur, ÉTS (interview aired during the program *Moteur de recherche*, on OHdio Radio-Canada, April 2024).

"Construction de nouvelles autoroutes d'électricité au Québec," François Bouffard, McGill University (interview aired during the program *Ça nous regarde*, on Radio-Canada OHdio, April 2024).

"De nouvelles « autoroutes » d'électricité à travers le Québec, jusqu'en Gaspésie," François Bouffard, McGill University (interview published on ICI Radio-Canada, April 2024).

"Pannes d'électricité de plus en plus nombreuses : comment y faire face?," François Bouffard, McGill University (interview aired during the program *Même le week-end*, on 98.5 fm, April 2024).

"<u>Il faut construire plus, mais il faut aussi construire mieux</u>," Annie Levasseur, ÉTS (open letter published in *Le Devoir*, March 2024).

"Économie circulaire et génie : un partenariat indissociable," Annie Levasseur, ÉTS (interview published in the *Revue PLAN* of the OIQ (Ordre des ingénieurs du Québec), March 2024).

"<u>Plastique, verre ou aluminium?</u>," Annie Levasseur, ÉTS (interview published in *La Presse*, February 2024).

"Comment adapter nos villes aux épisodes de pluies extrêmes?," Annie Levasseur, ÉTS (interview aired during the program *Moteur de recherche*, on Radio-Canada OHdio, February 2024).

"Comment les huiles à moteur usées sont-elles gérées?," Annie Levasseur, ÉTS (interview aired during the program *Moteur de recherche*, on Radio-Canada OHdio, January 2024).

"N'ayons pas peur du potentiel de l'IA!," Maxime Cohen, McGill University (interview published in *Le Devoir*, January 2024). "<u>La technologie au cœur de l'innovation</u>," Loubna Benabbou, UQTR (interview published in *Le Devoir*, January 2024).

"<u>La transition énergétique</u>," Annie Levasseur, ÉTS (interview aired on Savoir Média, January 2024).

"<u>Bâtissons autrement et innovons collectivement !</u>," Annie Levasseur, ÉTS (open letter published in *La Presse*, January 2024).

"Hydro-Québec veut moins de pannes, mais néglige le remplacement préventif de ses poteaux," François Bouffard, McGill University (interview published in *Le journal de Montréal*, December 2023).

"<u>Le réseau cellulaire mise à mal en Estrie</u>," Brunilde Sansò, Polytechnique Montréal (interview published on ICI Radio-Canada, December 2023).

"Hydro-Québec : la durée des pannes a plus que doublé en un an," François Bouffard, McGill University (interview published in *Le journal de Montréal*, November 2023).

"L'UQAR: l'IA au service du trafic maritime," Loubna Benabbou, UQTR (interview published in *Le Soleil*, November 2023).

OUR MEMBERS

IN THE MEDIA

"Des résidents de la Péninsule acadienne n'en peuvent plus du réseau cellulaire défaillant," Brunilde Sansò, Polytechnique Montréal (interview published on ICI Radio-Canada, October 2023).

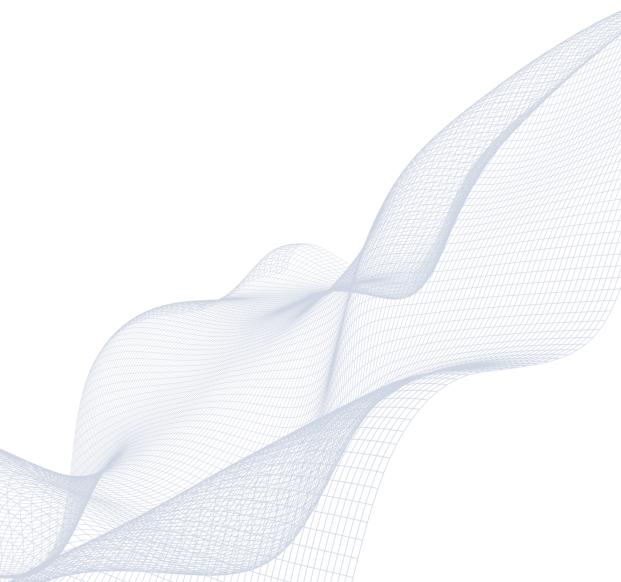
"Forte baisse des stocks d'énergie dans les barrages d'Hydro-Québec," François Bouffard, McGill University (interview published on ICI Radio-Canada, October 2023).

"Intelligence artificielle: « donner des superpouvoirs à nos gens qui servent les clients »," Maxime Cohen, McGill University (interview published on TVA Nouvelles, September 2023).

"Can Doctor AI Predict Cancer, Save Lives?," Samira A. Rahimi, McGill University (interview published on *Al Jazeera*, August 2023).

"Les puits de pétrole abandonnés au Canada, bombe à retardement écologique," Mary Kang, McGill University (interview published on France 24, July 2023).

"Risques et opportunités environnementaux des puits de pétrole et de gaz orphelins," Mary Kang, McGill University (interview published on the McGill website, June 2023).



AWARDS AND HONOURS

Samira Abbasgholizadeh-Rahimi

President, Canadian Operations Research Society, 2023–2024

Finalist in the Women in AI Awards North America, 2023

Daniel Aloise

CAPTRS Special Award for Serious Games, HurricaneLog, Serious Games Society, 2023

Amir Ardestani-Jaafari

2024 Golden Apple Award in the category "Openly Discussing Wellbeing-related Topics," University of British Columbia, 2024

Okan Arslan

Award for Teaching Excellence, HEC Montréal, 2023

Olivier Bahn

2023 Award of Excellence in the category of scientific collaboration for the <u>creation of modelling tools to combat climate change</u>, Institut d'administration publique du Québec 2023

Jean-François Bégin

Maple Leaf Research Award, Actuarial Foundation of Canada, 2023

Early Career Faculty Research Award 2023, Faculty of Science, Simon Fraser University, 2023

Maxime Cohen

Appointed Head of Artificial Intelligence, Intégral, 2023

Finalist for the Best Paper Award on Diversity, Equity, Inclusion, and Justice (DEIJ), INFORMS, 2023 (for the article "The Impact of the Opportunity Zone Program on Residential Real Estate")

Finalist in the 2023 INFORMS Behavioural Operations Management Best Working Paper Competition, INFORMS, 2023 (for the article "Customers' Multihoming Behaviour in Ride-hailing: Empirical Evidence Using a Structural Model")

Named one of RETHINK Retail's Top Retail Influencers, 2024

Guy Desaulniers

INFORMS 2023 *Transportation Science* Meritorious Service Award for serving as an associate editor, 2023



Roussos Dimitrakopoulos

Elected Fellow of the Industry Academy, International Artificial Intelligence Industry Alliance (AIIA), 2024

Yichuan Daniel Ding

Winner, 18th International Conference on Service System and Service Management, 2023

3rd prize, POMS International Conference in China, 2023

Issmail El Hallaoui, El Mehdi Er Raqabi, François Soumis

Finalist for the IFORS Prize for OR in Development, International Federation of Operational Research Societies (IFORS), 2023 (for the project "OCP optimizes its supply chain for Africa")

AWARDS AND HONOURS

James Richard Forbes

Winner of the Samuel and Ida Fromson Outstanding Teaching Award in Engineering, McGill University, 2024

Michel Gamache

Teaching Merit Award, Best Professor in Mining Engineering, Polytechnique Montréal, 2024

Alain Hertz

Finalist for Best Graduate Teacher in Mathematics, Polytechnique Montréal, 2024

Minyi Huang

Fellow, Institute of Electrical and Electronics Engineers Association (IEEE), 2024

Mary Kang

2022 ES&T Best Paper Award (4th Runner-Up), Policy Analysis, 2024 (for the article "Documented Orphaned Oil and Gas Wells Across the United States")

Michael Kokkolaras

2023 Design Automation Award in recognition of his longstanding and meritorious contributions to the design automation community, American Society of Mechanical Engineers, 2023

Gilbert Laporte

SEIO-BBVA Foundation prize for the best article in applied operations research, 2023 (for the article "A Cost-Sharing Mechanism for Multi-Country Partnerships in Disaster Preparedness")

Appointed Knight of the Ordre national du Québec, 2023

Doctorate *honoris causa* from Molde University College, 2023

Editor's Award for Excellence in Reviewing, *European Journal of Operational Research*, 2024

Andrea Lodi

Fellow, INFORMS, 2023

Saibal Ray

Appointed Vice-Dean of the Desautels Faculty of Management and Academic Affairs at McGill University, 2023

Named one of RETHINK Retail's Top Retail Influencers, 2024

Sara Séguin

Outstanding reviewer, IEEE Transactions on Sustainable Energy, 2024

Xiaozhe Wang

Humboldt Research Fellowship for Experienced Researchers, 2024

International Excellence Scholarship, Karlsruhe Institute of Technology, 2024

Rubin & So Foundation Faculty Scholar Award, McGill's Trottier Institute for Sustainability in Engineering and Design (TISED), 2023 These 20 GERAD members are among the most influential scientists in the world in various fields of research, according to a study by Mendeley (Elsevier) published in October 2023.

- Charles Audet
- François Bouffard
- Peter E. Caines
- Leandro C. Coelho
- Jean-François Cordeau
- Hanane Dagdougui
- Guy Desaulniers
- Roussos Dimitrakopoulos
- Pierre Hansen
- Alain Haurie
- Alain Hertz
- Minyi Huang
- Brigitte Jaumard
- Gilbert Laporte
- Pierre L'Ecuyer
- Sébastien Le Digabel
- Jérôme Le Ny
- Andrea Lodi
- Carolina Osorio
- Georges Zaccour

GERAD AWARDED \$157,161 IN SCHOLARSHIPS AND PRIZES

STUDENTS WHO OBTAINED SCHOLARSHIPS

GERAD

Six scholarships for undergraduate foreign trainees awarded

Nine conference expenses scholarships awarded

Nathan Allaire (Polytechnique Montréal) Research Scholarship for Co-supervised Doctoral Student

Lucas Alves Da Silva Santos (Polytechnique Montréal) CIRRELT-GERAD Co-supervised Research Scholarship

Rinel Foguen Tchuendom (HEC Montréal) Postdoctoral fellowship

Yu Gu (McGill University / Université de Montréal) Research Scholarship for Co-supervised Doctoral Student

Hanchao Liu (HEC Montréal)

Research Scholarship for Co-supervised Doctoral Student

Paula Metzker Soares (HEC Montréal)

Postdoctoral fellowship

Alexis Montoison (Polytechnique Montréal) Excellence scholarship for the best doctoral thesis, 2023 Maedeh Sharbaf (HEC Montréal) CIRRELT-GERAD Co-supervised Research Scholarship

Xiaohui Tu (HEC Montréal)

Research Scholarship for Co-supervised Doctoral Student

Others

Thomas Boyer (HEC Montréal)

McCall MacBain Sustainable Finance Fellowship, Canadian Sustainable Finance Network, 2023

Janos Chaim Raban Füting (HEC Montréal) Doctoral Excellence Scholarship, Fin-ML-CREATE program, NSERC, 2023

Mohand Ryad Chelbani (Polytechnique Montréal) 2023 Ken Wang Scholar, AGIFORS, 2023

Arturo Del Castillo (McGill University) McGill Engineering Doctoral Award (MEDA), McGill University, 2023

Mohan Du (McGill University) Doctoral research scholarship, FRQNT, 2024 **Mahsa Ebadat Parast** (McGill University) Doctoral research scholarship, FRQNT, 2024

Reem Mahmoud (McGill University) McCall MacBain Scholar, McGill University, 2023

Samin Nili-Ahmadabadi (McGill University) McGill Engineering Doctoral Award (MEDA), McGill University, 2023

Hair Parra (HEC Montréal) Canada Graduate Scholarship – Master's Level, NSERC, 2024

Tao Zhang (McGill University) McGill Engineering Doctoral Award (MEDA), McGill University, 2023

Yanting Zhou (McGill University) McGill Engineering Doctoral Award (MEDA), McGill University, 2023

Student awards

Rafael Ajudarte de Campos (Université Laval) Award for Best M.Sc. Thesis, Brazilian Operational Research Society 2023 Conference, "Aircraft Routing under Uncertainty Via Robust Optimization," 2023

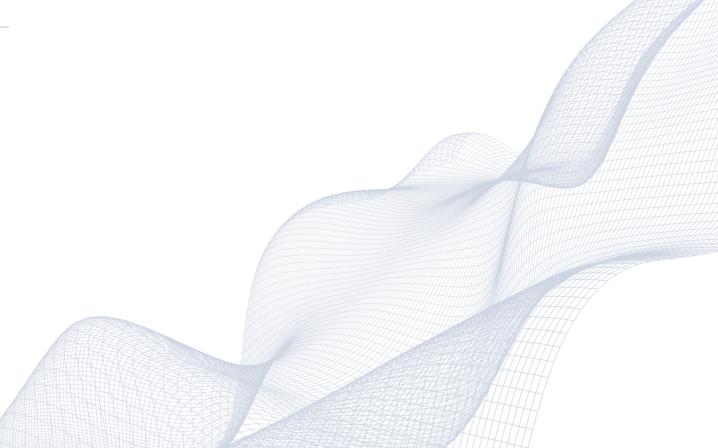
Elahe Amiri (Polytechnique Montréal) Best Poster Award, BMW Summer School, St-Raphaël, France, 2023

Thiago Correia Pereira (Polytechnique Montréal) CAPTRS Special Award for Serious Games, HurricaneLog, Serious Games Society, 2023

Théophile Demazure (HEC Montréal) 2023 Best Thesis in Human and Social Sciences Award, HEC Montréal, 2024 **Alexis Montoison** (Polytechnique Montréal) Best PhD Thesis nomination, Polytechnique Montréal, 2023

Mehran Poursoltani (HEC Montréal) 2023 Best Thesis Award in Natural Sciences, HEC Montréal, 2024

Xin Wang (HEC Montréal) 2023 Esdras-Minville Award, HEC Montréal, 2024



FUNDING AND GRANTS

GERAD RECEIVED THE FOLLOWING IN **INFRASTRUCTURE GRANTS**:

\$560,000

from the FRQNT Strategic Clusters program

\$200,000

from IVADO

\$205,000

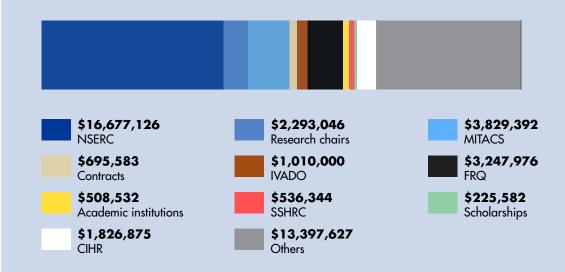
from academic institutions

\$55,000

from research chairs and professors

\$44 MILLION IN RESEARCH GRANTS

*Amount of the grants received by GERAD members. Annual amounts are the total grant divided by the duration of the grant (number of years). By weighting the number of researchers on a project who are GERAD members, the amount that is directly tied to members is approximately \$21.9 million annually.



- \$3.2 million in Discovery Grants this year
- Over \$3.4 million in NSERC research and development projects
- \$3.8 million in MITACS projects
- \$8.8 million for 40 NSERC Alliance grants

- \$707K in three NSERC CREATE grants
- \$675K for two projects under the Innovation for Defence Excellence and Security (IDEeS) program, Department of National Defence
- \$350K for the COSMO Stochastic Mine **Planning Laboratory**

PUBLICATIONS

276

published articles

97

papers in refereed conference proceedings

2

books and chapters

91

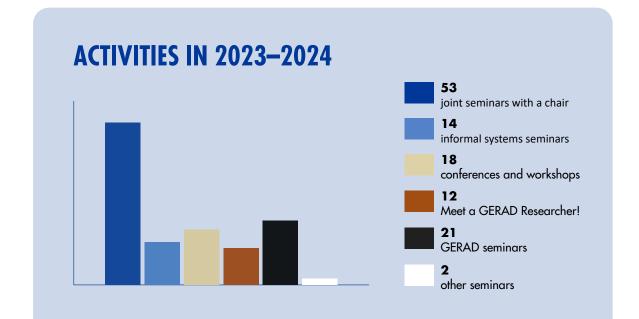
Cahiers du GERAD and revisions

WORKSHOPS

- 13th ISDG Workshop
- 13th Montreal Industrial Problem Solving Workshop
- 2 welcome sessions for new students and members of GERAD
- · TikZ: An introduction
- 2nd Workshop on Dynamic Games and Applications
- "Writing a scientific paper" Q&A session with Gilbert Laporte

SCIENTIFIC ACTIVITIES

ORGANIZED BY GERAD



- Risk-Aware/Safe RL Workshop
- Communicating OR/MS: The Scientific Writing Activity
- · LaTeX for scientific writing
- Enhancing Academic Research with a Superior PKM System – Obsidian+Zotero Integration Workshop
- Games and Optimization Workshop in honour of Michèle Breton
- 14th Montreal Industrial Problem Solving Workshop

CONFERENCES

- Optimization Days 2024
- Symposium "Anonymisation des données"
- IVADO PRF3 Workshop 2024: Towards Resilient and Sustainable Supply Chains Through Machine Learning and Optimization
- L'intelligence numérique au service de l'économie circulaire
- 2023 INFORMS Manufacturing and Service Operations Management Conference





Visit our website for more information.

WWW.GERAD.CA