

GERAD ANNUAL REPORT

2020-2021



GROUP FOR RESEARCH
IN DECISION ANALYSIS

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MESSAGE FROM THE DIRECTOR



Olivier Bahn
GERAD Director

I'm very pleased to introduce the 2020–2021 GERAD Annual Report, featuring a new, more succinct and updated presentation.

My second year as GERAD director was once again an unusual one for our research centre, due to the continuation of the health crisis in 2020–2021. But despite this, GERAD researchers continued to maintain an excellent scientific output, as seen in the various indicators presented in this report: number of students graduating and supervised, funding received, scientific publications, scientific activities organized, etc. I also want to congratulate our students and members who received honours and awards from national and international organizations, as well as the 17 GERAD members who ranked among the world's most influential in the area of research, according to a study published in 2019, carried out by Mendeley (Elsevier).

In 2020–2021, we also prepared our renewal request for the FRQNT strategic cluster grant. This involved updating our mission and redefining our scientific program and culminated in us submitting a letter of intent to the FRQNT in May 2021. GERAD continued to innovate in 2020–2021, for instance by revamping its [website](#) and launching its own [YouTube channel](#) (GERAD Recherche). It also set up, under the leadership of our director of development and transfer, a pool of research professionals to support our researchers, particularly for carrying out industrial contracts. Innovation at GERAD is also achieved by recruiting new members, so I would like to welcome our new regular members, Masoud Asgharian (McGill University), Loubna Benabbou (UQAR), Hanane Dagdougui (Polytechnique Montréal), Amina Lamghari (UQTR), Alejandro Murua (Université de Montréal), Janosch Ortmann (UQÀM), Samira A. Rahimi (McGill), Fatiha Sadat (UQÀM), as well as our new associate member, Silvio de Araujo (UNESP, Brazil).

In closing, on behalf of the GERAD community, I would like to offer these thanks: A special mention goes out to the FRQNT (which gives us a strategic cluster grant). I want to express my gratitude to HEC Montréal, Polytechnique Montréal, McGill University and UQAM, which sponsor and support GERAD. I also want to thank all our members who get involved in our varied committees and organize GERAD's scientific outreach activities. Further, I want to acknowledge our industrial partners, who place their trust in GERAD's expertise. And I salute the professionalism of our administrative and technical staff, who provide support we could not do without to the whole GERAD community.

Enjoy your reading !

Olivier Bahn

GERAD

IN BREF

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



69 members from Quebec universities



102 research professionals and postdoctoral researchers



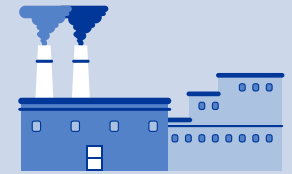
over \$30M
in grants and projects



106
members



636
students



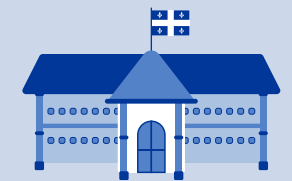
ABOUT SIXTY
industrial
partners



111
research
activities



335
scientific
publications

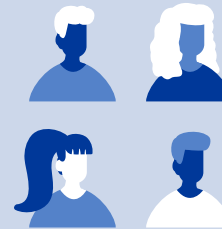


14
Quebec
universities

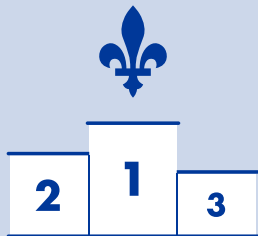
GERAD'S MISSION:



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 know-how 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:**

1 Data valuation for decision-making

2 Decision support made in complex systems

3 Decision support made under uncertainty

4 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 **broad fields of application, seven of which are outlined here.**

1 Economy and finance

2 Energy, environment and natural resources

3 Smart infrastructures

4 Engineering

5 Smart logistics

6 Marketing

7 Health

BOARD OF DIRECTORS



Caroline Aubé

Director of the Research and Knowledge Transfer Office

HEC Montréal



Olivier Bahn

GERAD 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



Jean-Pierre Richer

Director of the Research and Creation Office

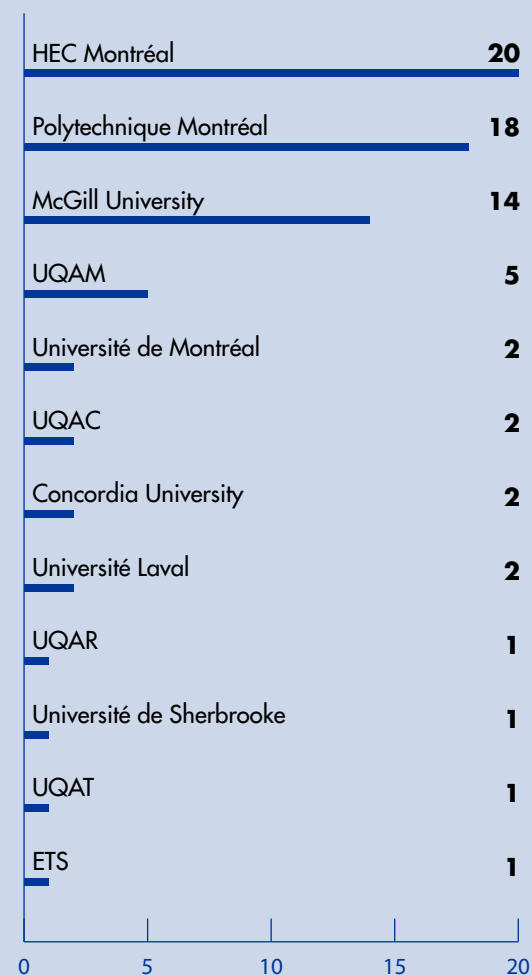
UQAM

OUR MEMBERS

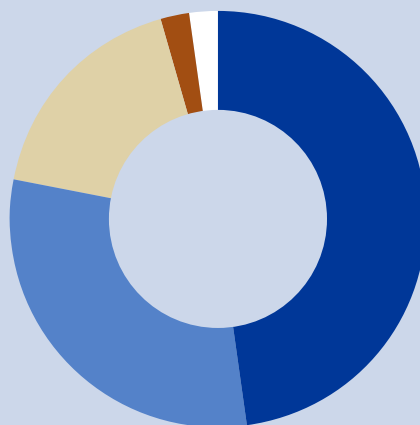
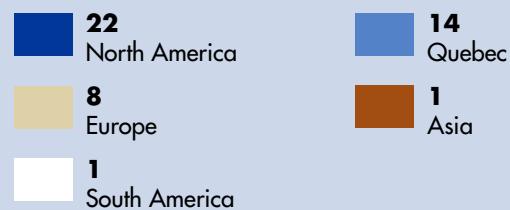
MEMBERSHIP EVOLUTION AT GERAD

	2017-18	2018-19	2019-20	2020-21
Regular members	62	61	62	69
Associated members	29	30	32	32
Honorary members	4	4	4	3
Visiting members	4	5	4	2

REGULAR MEMBERS BY INSTITUTION



DISTRIBUTION OF OUR ASSOCIATED MEMBERS



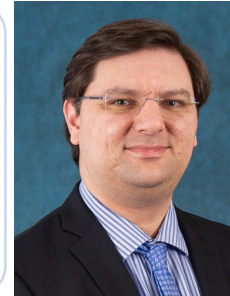
CHAIR HOLDERS AT GERAD



Yossiri Adulyasak
Canada Research Chair in
Supply Chain Analytics



Miguel F. Anjos
Inria International Chair on
Power Peak Minimization
for the Smart Grid



Leandro C. Coelho
Canada Research Chair in
Integrated Logistics



**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 Optimiza-
tion Under Uncertainty



Christian Genest
Canada Research Chair
in Stochastic Dependence
Modeling



Raf Jans
Chair in Supply Chain
Operations Planning



Gilbert Laporte
Canada Research Chair in
Distribution Management



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



Georges Zaccour
Chair in Game Theory
and Management

MEMBERS OF THE ROYAL SOCIETY OF CANADA (RSC)



Michèle Breton



Peter E. Caines



**Jean-François
Cordeau**



Erick Delage



Jacques Desrosiers



Christian Genest



Pierre Hansen



Gilbert Laporte



Saibal Ray



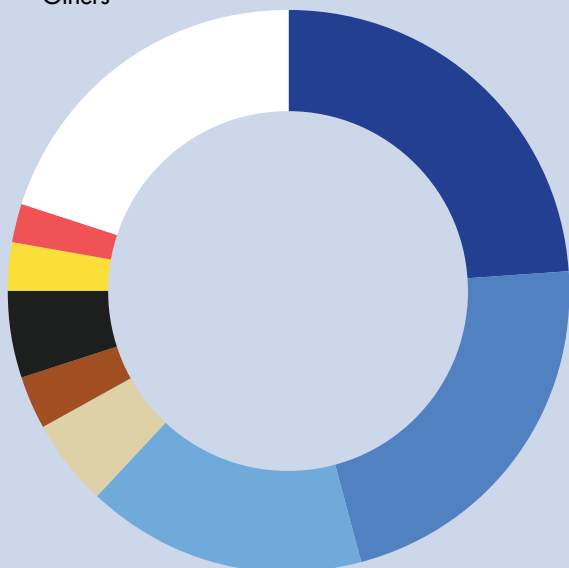
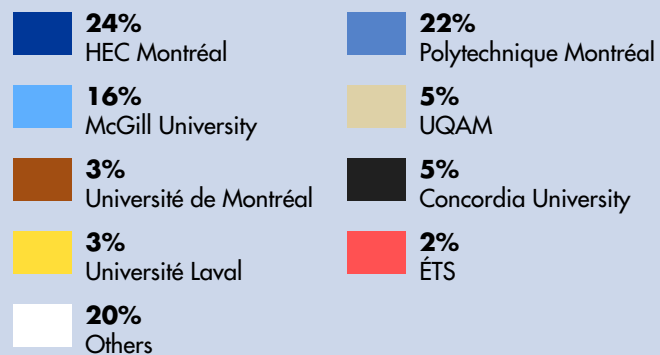
Georges Zaccour

COMPOSITION OF THE GERAD



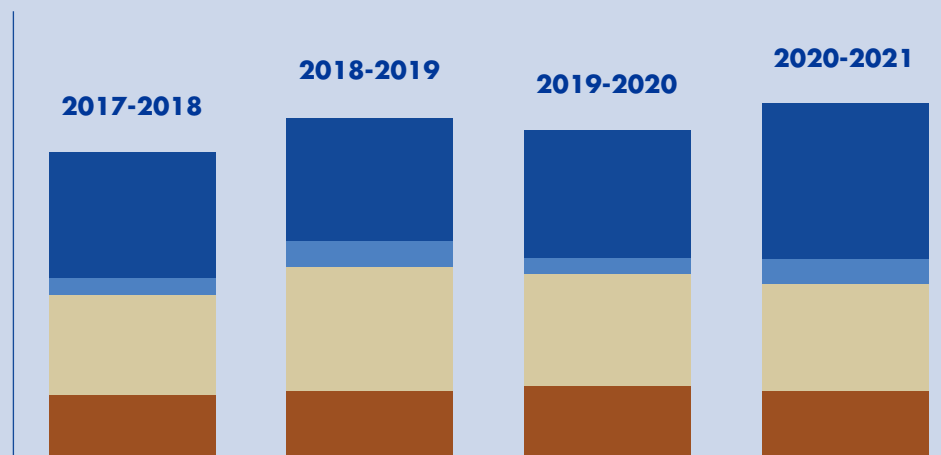
STUDENTS

STUDENTS ENROLLED AND GRADUATES BY UNIVERSITY



MSc AND PHD

	2017-18	2018-19	2019-20	2020-21
MSc graduates	116	124	132	123
MSc enrolled	179	221	200	192
PhD graduates	30	46	29	44
PhD enrolled	224	219	228	277



WHAT HAPPENED LAST YEAR



Quebec Strategy for Research and Innovation

GERAD made available its thinking on the future of research and innovation, which was developed within the framework of a call for contributions by the MEI: **Quebec Strategy for Research and Innovation 2022.**



A GERAD team, made up of **Dounia Lakhmiri, Christophe Tribes, Sébastien Le Digabel** along with Mahdi Zolnouri and Eyyüb Sari from Huawei Noah's Ark Lab, won 2nd place in the Hardware Aware Efficient Training competition, which took place during the ICLR 2021 workshop.



Andrea Lodi and Guy Desaulniers were called upon to help improve the distribution of molecular and serological tests for COVID-19 across Canada in January 2021.

A GERAD team obtained an NSERC Alliance Grant. Congratulations to Professors Sébastien Le Digabel, Charles Audet, Andrea Lodi and Dominique Orban! This grant, totalling \$781,500 is a partnership with Huawei Technologies and will focus on “Numerical Optimization and Machine Learning.”

GERAD researchers developed models to identify the most economically efficient GHG-reduction scenarios and the optimal time to implement them.

Telecommunications network reliability, availability and sustainability: As telecommunications move forward, significant technical and governance questions arise, which governments and society will have to address. By Brunilde Sansò, April 2021.

Ten fundamental research projects involving a total of 19 GERAD members were funded by IVADO.

An [article](#), published in the prestigious journal Nature, showed that, in France, many COVID-19 patients did not consult or alert public health regarding their condition, leading to a problematic under-detection of cases. This study was based on a mathematical model, the parameters of which were optimized using the NOMAD software developed at GERAD by the team of professors [Charles Audet](#) and [Sébastien Le Digabel](#) and research associates Viviane Rochon Montplaisir and [Christophe Tribes](#). This blackbox optimization software has been in continuous development for over 20 years and represents the state of the art in derivative-free optimization.

SPECIAL 40TH ANNIVERSARY ISSUE

Claudia Archetti, **Jean-François Cordeau** and **Guy Desaulniers** published a special issue to celebrate GERAD's 40th anniversary, “Combining optimization and machine learning: applications in vehicle routing, network design and crew scheduling,” *EURO Journal on Transportation and Logistics*, Volume 19, Number 4, December 2020.

AWARDS AND HONORS

Yossiri Adulyasak

Recognized as one of the Canadian immigrants who have made the greatest contribution to enhancing the supply chain, 2020

Miguel F. Anjos

Finalist for the Best Paper Award in the field of energy systems at the IISE 2021 annual conference for “Increasing Electric Vehicle Adoption Through the Optimal Deployment of Fast-Charging Stations for Local and Long-Distance Travel”, 2021

Winner of the MOPTA 2020 Competition for “A Solution Approach for Multi-Trip Vehicle Routing Problems with Time Windows, Fleet Sizing, and Depot Location”, 2020

Leandro C. Coelho

Research medal, Université Laval, Faculty of Administration Sciences, 2021

Erick Delage

Member of the Royal Society of Canada (RSC), 2020

Michel Gamache

Teaching merit award, Polytechnique Montréal, 2021

Christian Genest

John L. Synge Award, Statistical Society of Canada (SSC), 2020

Abel-Gauthier award, Association mathématique du Québec (AMQ), 2020

Christian Genest, Jonathan Jalbert and Mélina Mailhot

Wiley-TIES award for best environmental science paper of 2020 for “Predicting extreme surges from sparse data using a copula-based hierarchical Bayesian spatial model”, 2021

Gilbert Laporte

Roger-Charbonneau award, HEC Montréal, 2020

Killam Prize, Canada Council for the Arts, 2021

Emeritus member, Canadian Operational Research Society, 2020

Pierre L’Ecuyer

Lifetime Professional Achievement Award, INFORMS, 2020

Wei Qi

Fetherstonhaugh Family Foundation Distinguished Teaching Award, McGill University, top undergraduate teacher of year 2019-2020

M&SOM Meritorious Service Award, 2020

Monia Rekik

Research medal, Université Laval, Faculty of Administration Sciences, 2021

Brunilde Sansò

Finalist for the 2020 innovation in partnership prize, ADRIQ

Here are the 17 GERAD professors who are among the most influential in research worldwide, according to a 2019 study by Mendeley (Elsevier).

1. **Charles Audet**
2. **François Bouffard**
3. **Peter E. Caines**
4. **Leandro C. Coelho**
5. **Jean-François Cordeau**
6. **Guy Desaulniers**
7. **Roussos Dimitrakopoulos**
8. **Christian Genest**
9. **Pierre Hansen**
10. **Alain Hertz**
11. **Minyi Huang**
12. **Brigitte Jaumard**
13. **Gilbert Laporte**
14. **Pierre L'Ecuyer**
15. **Sébastien Le Digabel**
16. **Andrea Lodi**
17. **Georges Zaccour**

GERAD AWARDED \$91,500 IN SCHOLARSHIPS AND PRIZES (3X\$30,000+\$1,500)

STUDENTS WHO OBTAINED SCHOLARSHIPS

FRQNT

Nima Akbarzadeh (McGill University),
doctoral research scholarship

Kwassi Joseph Dzahini (Polytechnique
Montréal), doctoral research scholarship

El Mehdi Er Raqabi (Polytechnique Montréal),
doctoral excellence scholarship

Solène Kojtych (Polytechnique Montréal),
2020 merit scholarship program for foreign
students (PBEEE) 2020

Utsav Sadana (HEC Montréal),
postdoctoral research scholarship

Amit Sinha (McGill University),
master's research scholarship

IVADO

Ludovic Bilodeau-Laflamme
(Polytechnique Montréal),
undergraduate introduction to research scholarship

Cheng Chen (McGill University),
undergraduate introduction to research scholarship

El Mehdi Er Raqabi (Polytechnique Montréal),
doctoral excellence scholarship

Marilou Farmer (Polytechnique Montréal),
undergraduate introduction to research scholarship

Mathilde Ricard (Polytechnique Montréal),
undergraduate introduction to research scholarship

Ludovic Salomon (Polytechnique Montréal),
doctoral excellence scholarship

Monssaf Toukal (Polytechnique Montréal),
undergraduate introduction to research scholarship

Yuan Yang (Polytechnique Montréal),
postdoctoral research scholarship

GERAD

Utsav Sadana (HEC Montréal),
postdoctoral fellowship

Shanshan Wang (HEC Montréal),
postdoctoral fellowship

Lingxiao Wu (HEC Montréal),
postdoctoral fellowship

Others

El Mehdi Er Raqabi (Polytechnique Montréal),
Vanier Canada graduate scholarship (waitlisted),
Government of Canada

Edward Hallé-Hannan (Polytechnique Montréal),
2020 Hydro-Québec excellence scholarship

Student awards

Chun Cheng (Polytechnique Montréal),
2020 best thesis award, GERAD

Masoud Chitsaz (HEC Montréal),
2020 best thesis award, HEC Montréal

Solène Kojtych (Polytechnique Montréal),
3rd prize during the Three-Minute Thesis (3MT)
competition at Polytechnique Montréal

Sanae Lotfi (Polytechnique Montréal),
best master's thesis award, Polytechnique Montréal

Tayeb Mhamedi (Polytechnique Montréal),
honorable mention at the 3rd edition of the scientific
writing activity, GERAD

Samuel Pelletier (HEC Montréal),
Academic Gold Medal, The Governor General of
Canada, 2021

Mathieu Tanneau (Polytechnique Montréal),
best thesis for 2020-2021, Polytechnique Montréal

FUNDING AND GRANTS

GERAD RECEIVED THE FOLLOWING IN INFRASTRUCTURE GRANTS:

\$502,085

FRQNT - Strategic Clusters

\$219,747

from IVADO

\$174,000

from academic institutions

\$55,453

in financing from external companies, as part of research work

\$30,000

from research chairs

\$30 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 by the number of researchers on a project by those who are GERAD members, the amount that is directly tied to members is approximately \$18,9 million annually.



\$10,352,738
NSERC

\$4,735,891
Research chairs

\$3,550,573
MITACS

\$1,772,789
Contracts

\$1,094,866
IVADO

\$927,383
FRQ

\$362,922
University institutions

\$276,021
SSHRC

\$171,000
Scholarships

\$6,597,314
Others

- Members are receiving \$2.5 million in Discovery Grants this year
- Over \$5 million in NSERC research and development projects
- \$3.5 million in MITACS projects
- 2 NSERC Alliance Grants for a total of \$1.85 million
- \$1 million for 2 projects with the Department of National Defence IDEES program
- Roussos Dimitrakopoulos' COSMO - Stochastic Mine Planning Laboratory is receiving over \$400,000

PUBLICATIONS

248

published articles

77

papers in refereed conference proceedings

10

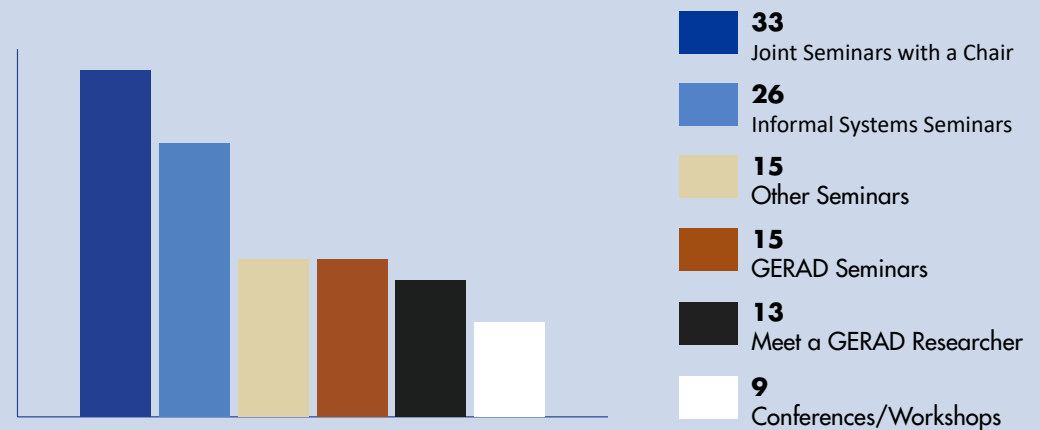
books and chapters

96

Cahiers du GERAD and revisions

ORGANIZED SCIENTIFIC ACTIVITIES

ACTIVITIES IN 2020-2021



WORKSHOPS

- Four Python for Operations Research workshops
- Communicating OR/MS: The Writing and Presenting Activities
- Presenting in times of COVID-19: How to give a good digital presentation?
- Introduction to multiobjective optimization
- Writing successful resumes + LinkedIn profiles

CONFERENCE

- GERAD co-organized with McGill University the 2020 Virtual Smart-City Operations and Analytics Conference



GROUP FOR RESEARCH
IN DECISION ANALYSIS

Visit our website for more information.

WWW.GERAD.CA

ANNÉE PROCHAINE

**CHANGER LA PAGE 18
POUR LES DEUX SUIVANTES**

PUBLICATIONS

248

Articles publiés

77

Comptes rendus de conférences
avec arbitrage

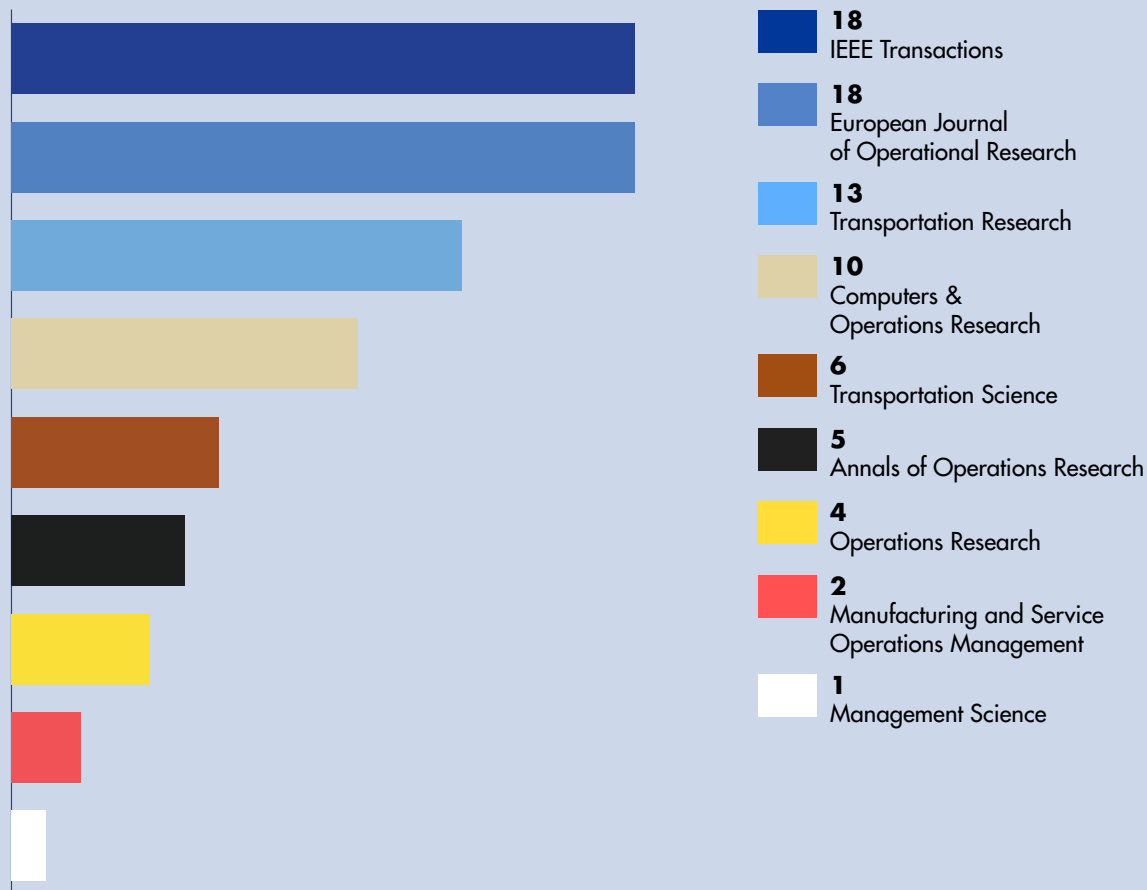
10

Livres et chapitres

96

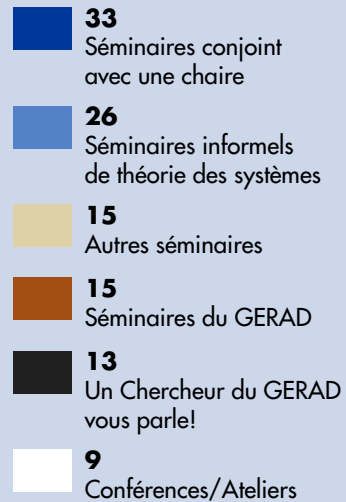
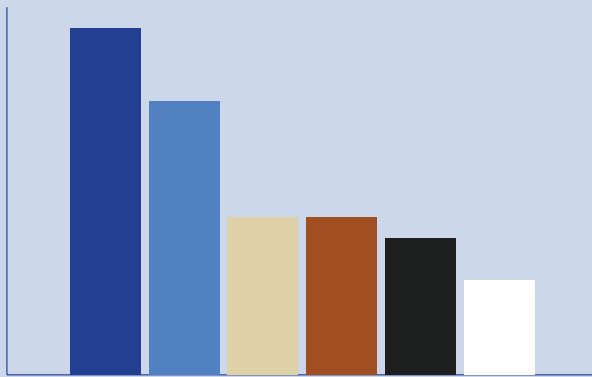
Cahiers du GERAD
et révisions

PALMARÈS DES PUBLICATIONS DU GERAD PAR REVUE SCIENTIFIQUE



ACTIVITÉS SCIENTIFIQUES ORGANISÉES

ACTIVITÉS 2020-2021



ATELIERS

- 4 ateliers Python for operations research
- Activités de rédaction et de présentation scientifiques en sciences de la décision
- Presenting in times of COVID-19: How to give a good digital presentation?
- Introduction to multiobjective optimization
- Writing successful resumes + LinkedIn profiles

CONFÉRENCE

- Le GERAD a coorganisé avec l'Université McGill le *2020 Virtual Smart-City Operations and Analytics Conference*