

Tangi Migot  
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# Tangi Migot

## Doctor in Applied Mathematics

My research interest lies at the interface between theoretical and computational mathematical analysis and include the following themes.

- **Mathematical Theory:** bilevel optimization; continuous optimization; equilibrium problems (complementarity problems, variational and quasi-variational inequalities); generalized Nash equilibrium problems; Stackelberg games; optimization model with complementarity constraints and cardinality constraints; non-smooth dynamical systems; sparse and large scale optimization.
- **Computational Mathematics:** development of algorithms for degenerate optimization models and equilibrium problems; implementation, complexity and benchmarking of algorithms; coding of optimization tools in Julia.

These interests are connected, but not limited, to applications in equilibrium and kinetics **geochemistry**, **biology** and non-cooperative **game theory**.

From 2015 to 2019, I taught **230 hrs** in various level of the university program both in Europe, in french, and in North America, in english. This includes being **the main lecturer in two classes** with above 100 students and the supervision of teaching assistants (8 overall).

My research activities have been supported by research grants in the amount of approx. **29 000 \$CAN** for mobility grants, support to attend summer school and conferences, and organization of a workshop at the Fields Institute.

## Education

### 2014 - 2017, IRMAR-INSA de Rennes

PhD in Applied Mathematics.

**Advisors:** Mounir Haddou and Jean-Pierre Dussault.

**Title:** Contributions to numerical methods for complementarity problems and mathematical programs with complementarity constraints.

**Reviewers:** S. Adly (Université de Limoges) and C. Kanzow (University of Würzburg).

**Jury:** S. Adly (Université de Limoges), J. Erhel (INRIA Rennes), J. C. Gilbert (Président du jury, INRIA Paris), O. Ley (INSA de Rennes) and C. Sagastizabal (Rio de Janeiro).

### 2011 - 2014, INSA de Rouen

Engineer diploma " Génie mathématique".

**End-of-study internship** at INRIA Rennes.

**Title of the thesis:** Mathematical analysis of geochemical models.

**Advisor:** Jocelyne Erhel.

### 2013 - 2014, University of Rouen

Master 2 in Fundamental and Applied Mathematics.

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## Positions

### Current position since October 1th, 2018, University of Guelph

Postdoctoral research associate in the department of Math. & Statistics.

**Subject:** Generalized Nash equilibrium problems and applications.

Principal investigator: M.-G. Cojocaru.

### 2018 July. - 2018 Sep., Université de Sherbrooke

Postdoctoral research associate financially supported by a grant of excellence for foreign researches from the FRQNT.

**Subject:** Coding a solver for degenerate non-linear optimization problems.

Principal investigator: J.-P. Dussault.

### 2018 Apr. - 2018 Jun., INRIA de Rennes

Postdoctoral research associate in the team FLUMINANCE.

**Subject:** Numerical aspects of dynamical complementarity problems.

Principal investigator: J. Erhel.

### 2017 Oct. - 2017 Dec., IETR-INSA de Rennes

Postdoctoral research associate financially supported by Thales and in a collaboration with IRMAR.

**Subject:** Synthesis and optimization of metasurfaces.

Principal investigators: R. Loison and R. Gillard.

### 2014 Oct. - 2017 Sep., IRMAR-INSA de Rennes

PhD student with teaching over the period (2015 Sep.-2017 Jun.).

Graduate Internships during the PhD:

- **June-July 2017, in Sherbrooke (Canada)** invited by Jean-Pierre Dussault in Université de Sherbrooke.
- **Sep.-Dec. 2016, in Sherbrooke (Canada)** invited by Jean-Pierre Dussault in Université de Sherbrooke.
- **Nov. 2015, in Beyrouth (Lebanon)** invited by Lina Abdallah in Université Libanaise.

### 2014 May - 2014 Sep., INRIA de Rennes

Internship in the team SAGE.

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## Publications

### Journal Publications

1. with J.-P. Dussault, M. Haddou and A. Kadrani. *On approximate stationary points of the regularized mathematical program with complementarity constraints*, Journal of Optimization Theory and Applications, 186:2, pp. 504–522, 2020.
2. with M.-G. Cojocaru. *A dynamical system approach to the generalized Nash equilibrium problem*, Journal of Nonlinear and Variational Analysis, 4:1, pp. 27–44, 2020.
3. with M.-G. Cojocaru and A. Jaber. *Controlling infection in predator-prey systems with transmission dynamics*, Infectious Disease Modelling, 5:1, pp. 1–11, 2020.
4. with J. Omer. *Vertex ordering with optimal number of adjacent predecessors*, Discrete Mathematics and Theoretical Computer Science, 22:1, 2020, hal-02025298v3.
5. with M.-G. Cojocaru. *A parametrized variational inequality approach to track the solution set of a generalized Nash equilibrium problem*, European Journal of Operational Research, 283:3, pp. 1136–1147, 2020.
6. with M. Haddou. *A smoothing method for sparse optimization over convex sets*, Optimization Letters, 14, pp. 1053–1069, 2020.
7. with L. Abdallah and M. Haddou. *A sub-additive DC approach to the complementarity problem*, Computational Optimization and Applications, 73:2, pp. 509–534, 2019.
8. with J. Erhel. *Characterizations of solutions in geochemistry: existence, uniqueness and precipitation diagram*, Computational Geosciences, 23:3, pp. 523–535, 2019.
9. with J.-P. Dussault and M. Haddou. *Mathematical programs with vanishing constraints: constraint qualifications, their applications, and a new regularization method*, Optimization, 68:2-3, pp. 509–538, 2018.
10. with M. Haddou and J. Omer. *A generalized direction in interior point method for monotone linear complementarity problems*, Optimization Letters, 13, pp. 35–53, 2019, doi:10.1007/s11590-018-1241-2.
11. with L. Abdallah and M. Haddou. *Solving absolute value equation using complementarity and smoothing functions*, Journal of Computational and Applied Mathematics, 327, pp. 196–207, 2018.

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## Submitted Preprints

1. with M.-G. Cojocaru. *On Minty variational inequalities and evolutionary stable states of generalized stable games*, submitted, 2020.
2. with M.-G. Cojocaru. *A decomposition method for convex generalized Nash equilibrium problems*, submitted, 2019.
3. with M. Haddou and J.-P. Dussault. *The new butterfly relaxation method for mathematical program with complementarity constraints*, HAL, hal-01525399, 2016. Accepted as a book chapter in *Proceedings of the Indo-French Seminar*, Springer Nature.
4. with M. Haddou, J.-P. Dussault and A. Kadrani. *A Unified Framework of Regularization Methods for Degenerate Non-Linear Optimization Models* HAL, hal-01734832, 2018.

## Articles in preparation

1. with J.-P. Dussault and S. Goyette. *Stopping: A framework to implement iterative (optimization) algorithms*, to be submitted, 2020.
2. with B. Hamlat and J. Erhel. *A projected dynamical system approach to mineral precipitation-dissolution reactions in geochemistry*, to be submitted, 2020.
3. with J. B. Brust. *PLSSR: A Computationally efficient projected linear systems solver with randomization*, to be submitted, 2020.
4. with M.-G. Cojocaru. *Replicator dynamics and the Folk Theorem for generalized games*, to be submitted, 2020.
5. with M. Nahirniak and M.-G. Cojocaru. *A Leader-followers game of emergency preparedness for adverse events*, to be submitted, 2020.

## Peer Reviewed Conference Publications

1. with M.-G. Cojocaru. *Revisiting Path-Following to Solve the Generalized Nash Equilibrium Problem*, accepted in *Proceedings AMMCS 2019*.
2. with L. Abdallah and M. Haddou. *Solving mathematical programs with complementarity constraints with a penalization approach*, *World Congress on Global Optimization*, pp. 228-237. Springer, Cham, 2019.
3. with L. Abdallah and M. Haddou. *A sub-additive merit function for complementarity problems and application*, *Proceedings of the International Conference on Learning and Optimization Algorithms: Theory and Applications*. ACM, 2018.
4. with M. Haddou. *A smoothing method for sparse optimization over polyhedral sets*, Springer, *Modelling, Computation and Optimization in Information Systems and Management Sciences Proceedings of the 3rd International Conference MCO 2015 - Part I*, 359, pp.369-379, 2015, *Advances in Intelligent Systems and Computing*.

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# Scientific Communications

## Talks in Conferences

- *Nonsmooth dynamics of generalized Nash games*, online Workshop on Dynamics, Optimization and Variational Analysis in Applied Games, 2020.
- *Méthodes de régularisation pour les problèmes d'optimisation sous contraintes de complémentarité*, Séminaire du LAMPS , Université de Perpignan, 2020.
- *Méthodes de régularisation pour les problèmes d'optimisation sous contraintes de complémentarité*, Séminaire d'Analyse non linéaire et Optimisation , Université d'Avignon, 2020.
- *On numerical approaches to solve the generalized Nash equilibrium problem and their implementations in Julia*, Department colloquium seminar, Guelph, 2020.
- with T  rence Bayen, Olivier Bernard, Piernicola Bettiol, Jean-Luc Gouz  , Francis Mairet and Julien Salomon. *Optimal Resource Allocation in Micro-organisms: the Dynamics of Photoacclimation in Microalgae as a Case Study (Oracle Project)*, PGMO Days, Paris, 2019.
- with M. Cojocaru and A. Jaber. *Controlling infection in predator-prey systems with transmission dynamics*, Borders in Public Health Workshop, Toronto, 2019.
- with M. Cojocaru. *On decomposition methods for generalized Nash equilibrium problems*, MOPTA, Lehigh, 2019.
- with J.-P. Dussault, M. Haddou and A. Kadrani. *On a regularization-active set algorithm to solve the MPCC and its implementation*, IC-COPT, Berlin, 2019.
- with J. Erhel. *Optimization and Complementarity Problems in Geochemistry*, WCGO, Metz, 2019.
- with B. Hamlat and J. Erhel. *Optimization and Complementarity Problems in Geochemistry*, WCGO, Metz, 2019.
- with L. Abdallah and M. Haddou. *Solving mathematical programs with complementarity constraints with a penalization approach*, WCGO, Metz, 2019.
- with M. Cojocaru. *A Decomposition Method for Convex Generalized Nash Equilibrium Problems*, EURO, Dublin, 2019.
- with J. Erhel. *Optimization problems in geochemistry*, ETNA25, Santa Margherita di Pula, Italy, 2019.
- with J.-P. Dussault and S. Goyette. *Stopping.jl: A framework to implement iterative optimization algorithms*, Journ  es de l'optimisation 2019, Montr  al, Qu  bec.
- with M. Cojocaru. *On the KKT conditions of the GNEP*, CMS Winter Meeting, Vancouver, 2018.
- with J.-P. Dussault and M. Haddou. *On regularization methods for MPCCs and degenerate non-linear programs*, Variational Analysis Challenges in Energy, Castro Urdiales, 2018.
- with L. Abdallah and M. Haddou. *A sub-additive merit function for complementarity problems and application*, LOPAL, Rabat, 2018.
- *Optimisation avec contraintes de cardinalit   pour les statistiques*, s  minaire de l'  quipe de Statistique de l'IRMAR, Rennes, 2018.



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- with J. Erhel. *Modèles de géochimie à l'équilibre*, Journée Rennes-Nantes d'Analyse, ENS Rennes, 2018.
- with J.-P. Dussault and M. Haddou. *Regularization methods for degenerate non-linear programs*, 4th Conference on OMS, Havana, 2017.
- with J.-P. Dussault and M. Haddou. *The new butterfly relaxation method for mathematical program with complementarity constraints*, Control and Optimization conference on the occasion of Frédéric Bonnans 60th birthday, Paris, 2017.
- with J.-P. Dussault and M. Haddou. *Computation of a local minimum of the MPCC*, PARAOPT XI, Prague, 2017.
- with J.-P. Dussault, M. Haddou and A. Kadrani. *How to compute a stationary point of the MPCC ?*, EUROPT, Montréal, 2017.
- *Problèmes d'optimisation sous contraintes et parcimonie*, séminaire informatique de l'Université de Sherbrooke. Sherbrooke, 2017.
- with J.-P. Dussault, M. Haddou, E. Joannopoulos and A. Kadrani. *Some convergence properties of regularization and penalization schemes for MPCCs*, SIAM Conference on Optimization, Vancouver, 2017.
- *Une méthode numérique pour les problèmes d'optimisation bi-niveaux*. Séminaire LANDAU des jeunes doctorants en analyse, Rennes 2017.
- with J.-P. Dussault, M. Haddou and A. Kadrani. *Sur de nouvelles méthodes numériques pour les problèmes d'optimisation avec contraintes de complémentarité*, Journée Rennes-Nantes d'Analyse, Nantes, 2017.
- with J.-P. Dussault and M. Haddou. *A new relaxation method for Mathematical Program with Complementarity Constraint*, INFORMS Annual Meeting, Nashville, 2016.
- with J.-P. Dussault and M. Haddou. *A new relaxation method for Mathematical Program with Complementarity Constraint*, poster in HJNET, Rennes, 2016.
- with J. Erhel and S. Sabit (INRIA Rennes). *Reactive transport simulations using a global approach*. Computational Methods in Water Resources, Toronto 2016.
- *Méthodes numériques pour l'optimisation non-linéaire*. Séminaire LANDAU des jeunes doctorants en analyse, Rennes 2016.
- with M. Haddou. *A new direction in polynomial time interior-point methods for monotone linear complementarity problem*. Journées SMAI-MODE, Toulouse, 2016.
- *Problèmes de complémentarité en optimisation non lisse*, séminaire LANDAU des jeunes doctorants en analyse, Rennes, 2015.
- with J. Erhel. *About Some Numerical Models for Geochemistry*. Workshop MoMas on reactive transport, 2015.
- with F. Monteiro et al. (Luxembourg Centre for Systems Biomedicine, University of Luxembourg, Luxembourg). *Robust Prediction of Minimal Medium Composition Using Sparse Optimization*, poster in 4th Conference on Constraint-Based Reconstruction and Analysis, Heidelberg 2015.
- with M. Haddou. *A Smoothing Method for Sparse Optimization over Polyhedral Sets*, Groupe de Travail Programmation Mathématiques, Dijon, 2015.
- with M. Haddou. *A Smoothing Method for Sparse Optimization over Polyhedral Sets*, MCO Metz, 2015.
- with J. Erhel (INRIA Rennes). *About Some Numerical Models for Geochemistry*. HPSC Hanoi, 2015.

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# Teaching and Mentoring

## Teaching

- **2019-20: 48 hrs at University of Guelph.**  
Responsible for the course MATH 2000 *Proofs, Sets and Numbers*, 36 hrs of lectures and 12 hrs of labs, with 2 teaching assistants. Course for undergraduate students in mathematics (approx. 100 students) introducing mathematical logic, techniques for proofs, and sets. The course uses TopHat active learning tools.
- **2018-19: 56 hrs at University of Guelph.**
  - Guest lecturer in the course *Optimization I*, 8 hrs of lectures. Introduction to numerical optimization for graduate students in mathematics;
  - Responsible for the course MATH 2080 *Elements of Calculus II*, 36 hrs of lectures and 12 hrs of labs, with 6 teaching assistants. Calculus course for science undergraduate students (approx. 150 students) covering integration techniques, geometry and introduction to differential equations.
- **2017-18: INSA de Rennes.**  
Mentoring of an interdisciplinary project with graduate students.
- **2016-17: 64 hrs at INSA de Rennes.**
  - Geometry: 48 hrs of tutorials with 2nd year undergraduate students;
  - Optimization: 16 hrs of labs with graduate students.
- **2015-16: 64 hrs at INSA de Rennes.**  
64 hrs of tutorials in bachelor, 1st year calculus.

## Undergraduate projet

- **2019-20:** Co-supervision of Sarah Smook, 4th year undergraduate project, on a project entitled *Controlling the infection in a predator-prey-SISV system*.

## Teaching Assistants

- **2019-20:** Supervision of 2 teaching assistants for the class *MATH 2000*. Pavel Zarva and Momina Dar: labs, preparation of the midterms, exams and office hours.
- **2018-19:** Supervision of 6 teaching assistants for the class *MATH 2080*. Thomas Kielstra, Comfort Mintah labs, preparation of the midterms, exams and office hours. Katrina Olfert, Eric Fernandes, Pavel Zarva, David Mammarella: invigilating and grading.

## Master's Internship

- April to June 2017: *Relaxation methods for MPCC*, Cao Van Kien (Université Paris 13). After the master, he completed a PhD entitled *Modèles Multi-leader-follower : analyse théorique, numérique et application aux éco-parcs industriels* in the Université de Perpignan.
- April to June 2017: *Optimization methods for complementarity problems*, Nguyen Dinh Duong (Université Paris Est). After the master, he started a PhD entitled *Quelques résultats sur des modèles de turbulence* in the Université de Rennes.

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## Grants and Scholarships

### 2020, IVADO Canada

Post-doctoral grant of **140 000 CAN\$** for two years at IVADO (Institute for Data Valorization) on a project called *Large scale optimization solvers in Julia for data science*.

### 2019, Fields Institute

Grant of **10 550 CAN\$** (6 650 CAN\$ from the Fields Institute and 3 900 CAN\$ from the NSF) for logistical and funding support for workshop *dynamics, optimization and variational analysis in applied games* to be held at The Fields Institute April 30th-May 1st.

### 2019, ICCOPT 19 Berlin

Travel grant of **400€** to attend the conference and the summer school.

### 2019, PGMO Project

Research projet supported in the amount of **6500€**. The project entitled *ORACLE: Optimal Resource Allocation in micro-organisms under Changing Environment* supports 7 french researchers experts in biology, optimal control and optimization.

### 2018, Fonds de recherche du Québec - Nature et technologies (FRQNT)

Post-doctoral grant of excellence for foreign researches from the FRQNT of **12 000 CAN\$**.

### 2017, Groupe de Recherche en Recherche Opérationnelle

Mobility grant of **700€**.

### 2017, École des Docteurs de l'Université Bretagne-Loire et du Conseil Régional de Bretagne

Mobility grant of **1 000€**.

### 2016, École des Docteurs de l'Université Bretagne-Loire et du Conseil Régional de Bretagne

Mobility grant of **2 000€**.

### 2016, COST/MINO

Grant to join COST/MINO PhD School of **500€**.

### 2014 - 2017, Ministère Enseignement Supérieur et de la Recherche

PhD scholarship awarded by the country state of **68 811,96€**.



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# Administrative and Scientific Responsibilities

## Organization of Scientific Events

- Co-organizer of the online workshop *dynamics, optimization and variational analysis in applied games* with the Fields Institute in Toronto in Apr. 30-May 1st 2020
- Co-organizer of the session *Continuous optimization and applications* in AMMCS-19 conference in Waterloo (6 talks).
- Co-organizer of the stream *Variational analysis, games and intertwined optimization problems* in EURO 19 conference in Dublin (18 talks).
- Member of the organizing committee of the Groupe de Travail Programmation Mathématique du Groupe de Recherche en Recherche Opérationnel 2016 à Rennes, June 13-14.
- Member of the organizing committee of the conference HJNET 2016 in Rennes, May 30-June 3.

## 2014 - 2017, Administrative Responsibilities

Member of the council of IRMAR-INSA.

## Reviewers for specialized journals

Optimization Methods and Software (3); Computational Optimization and Applications (1); European Journal of Operational Research (1); Optimization (1); Journal of Optimization Theory and Applications (1); Mathematical Methods of Operations Research (1); Optimization and Engineering (1); Operations Research Letters (2); Mathematics (1); MathReviews (6); Numerical Algorithms (1)

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## Mathematics Outreach Activities

### 2019, Berlin (Germany)

Summer school at the TU Berlin: *Large scale and PDE constrained optimization* par J.-C. De los Reyes and T. Munson, *Optimization and Machine Learning* par P. Richtàrik.

### 2016, Rome (Italy)

COST/MINO PhD School on Advanced Optimization Methods: *Polyhedral Combinatorics* by S. Dey, *Interior Point methods* by J. Castro, *Structured Dantzig-Wolfe Decomposition* by A. Frangioni, *Semidefinite Programming* by V. Piccialli.

### 2016, Nice (France)

SEME (1 week math problem posed by a company) *Re-calibration de modèles pharmacocinétiques.* for ExactCure.

### 2014, Rouen (France)

SEME *Modelling Gas Regulators* for GCE group.

## Skills

### Languages

- French (native)
- English (fluent)
- German (academic)

### Programming

- Julia
- C/C++
- Java

### Scientific Software

- Matlab
- Maple
- Fluent

## Interests

### Personal

International Master of chess (best elo rating: 2407).