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Curriculum Vitae

1 Personal Data.

Name, surname: Aris Daniilidis
Date of birth: 15.04.1970
Place of birth: Athens, Greece

Nationality: Greek (Identity card X655100 ; Passport no: AP5152164)
Citizenship: Chile (Permanent Residence; ID. 24.207.738-5)
Military service: 24.05.1996–23.05.1997 (Greece)

Personal address: Almirante Latorre 602, dpto 810, Santiago, Chile, CL-8370459
Professonal address: Department of Mathematical Engineering, University of Chile
Beauchef 851 (Edif. Norte), Santiago, Chile, CL-8370348.

E-mail: `arisd@dim.uchile.cl` ; `aris.daniilidis@gmail.com`
Web page: `http://www.dim.uchile.cl/~arisd/`

Research gate: `https://www.researchgate.net/profile/Aris_Daniilidis`
Orcid profile: `http://orcid.org/0000-0003-4837-694X`
Researcher ID (Publons): `I-6737-2013`

Languages: English, French, Catalan, Spanish (written/spoken very fluently); Greek (native);
Italian (good knowledge); German, Portuguese (notions)

2 Education

(26.03.2002) Habilitation in Applied Mathematics, University of Pau, Bordeaux Academy, France.
HDR Thesis: *Convex and Quasiconvex analysis. Applications in Optimization* (in French)

(17.12.1997) PhD Dissertation in Mathematics, University of the Aegean, Greece.
PhD Thesis: *Applications of Generalized Convexity and Monotonicity to Variational Inequalities and Vector Optimization* (in Greek)

(19.11.1992) Bachelor Degree in Physics, University of Athens, Greece.
Bachelor Thesis: *Determination and extension of measures* (in Greek)
Graduate grade: 8,66 (out of 10); Graduation Rank 1 (Valedictorian: Best marks of the generation);

(July 1988) Admitted (after national competition) at the University of Athens (studies in Physics). Entrance Rank 2 (Score: 606 out of 640)

(June 1988) High School Diploma. Grade: 9,1 (out of 10) (Best marks of the class).

3 Employment history

(since 2017) Deputy Director, Centre for Mathematical Modelling (CNRS IRL 2807)
Research Center of Excellence, Santiago, Chile (`http://www.cmm.uchile.cl/`)

(since 2013) Full Professor (Profesor Titular)
Department of Mathematical Engineering, University of Chile[1].

(2007–2013) Tenure Associate Professor (Professor Agregat)
Department of Mathematics, University Autonomous of Barcelona, Spain.

(2004–2007) Tenure-track researcher (investigador Ramon y Cajal)
Department of Mathematics, University Autonomous of Barcelona, Spain.

(Automne 2003) Post-doctorate researcher, INRIA, Rhône-Alpes, France.
BIPOP Team (Non-regular Mechanics). Scientific responsible: Bernand Brogliato.

(2002–2003) Post-doctorate researcher
Department of Economics, University Autonomous of Barcelona, Spain.

(2001–2002) Post-doctorate researcher, INRIA, Rhône-Alpes, France.
NUMOP Team (Numerical Optimization). Scientific responsible: Claude Lemaréchal.

(2000–2001) Assistant Professor (fixed term contract) (ATER)
Laboratory of Applied Mathematics, University of Pau, France.

(1998–2000) Post-doctorate researcher (Marie-Curie Fellow), CNRS Talence, France.
Laboratory of Applied Mathematics, University of Pau, France.

4 List of publications

(*) indicates that this author was graduate student at the time of the work.

4.1 ArXiv preprints

A convex function satisfying the Łojasiewicz inequality but failing the gradient conjecture both at zero and infinity (with O. Ley and M. Haddou). Preprint arXiv 2102.05342 (18p, February 2021).

Extending the Choquet Theory: Trace convexity (with M. Bachir)
Preprint arXiv 2004.02453 (29p, April 2020).

Ubiquitous algorithms in convex optimization generate self-contracted sequences (with A. Böhm*),
Preprint `arXiv 2003.04201` (12p, March 2020) (to appear in *J. Convex Anal.*)

Asymmetric Free spaces and canonical asymmetrization (with JM Sepulcre and F. Venegas*)
Preprint `arXiv 2002.02647` (26p, February 2020) (to appear in *Studia Matematica*)

[1] In 2020, the University of Chile is ranked #180 world wise and it is among the top–100 in mathematics, see `https://www.topuniversities.com/universities/universidad-de-chile#wurs`

4.2 Articles in WoS journals

Characterization of Filippov representable maps and Clarke subdifferentials
Math. Program. (published online: July, 2020) (with M. Bivas and M. Quincampoix)
`https://doi.org/10.1007/s10107-020-01540-y`

Smooth semi-Lipschitz functions and almost isometries between Finsler manifolds,
J. Funct. Anal. **279** (2020), 1–29 (with J. Jaramillo and F. Venegas*)

Pathological Subgradient systems
SIAM J. Optim. **30** (2020), 1327—1338 (with D. Drusvyatskiy)

Metric and geometric relaxations of self-contracted curves
J. Optim. Theory Appl. **182** (2019), 81–109 (with R. Deville, E. Durand-Cartagena).

Linear structure of functions with maximal Clarke subdifferential
SIAM J. Optim. **29** (2019), 511–521 (with G. Flores*)

Gradient flows, second order gradient systems and convexity
SIAM J. Optim **28** (2018), 2049–2066 (with T. Boulmezaoud, P. Cieutat)

Explicit formulas for $\mathcal{C}^{1,1}$ Glaeser-Whitney extensions of 1–Taylor fields in Hilbert spaces
Proc. Amer. Math. Soc. **146** (2018), 4487–4495 (with O. Ley, M. Haddou, E. Le Gruyer)

Self-contracted curves in Riemannian manifolds
J. Math. Anal. Appl. **457** (2018), 1333–1352 (with R. Deville, E. Durand, L. Rifford)

Sweeping by a tame process
Ann. Inst. Fourier **67** (2017), 2211–2223 (with D. Drusvyatskiy)

A partial answer to the Demyanov-Ryabova conjecture
Set-Valued Var. Anal. **26** (2018), 143–157 (with C. Petitjean)

Sard theorems for Lipschitz functions and applications
Israel J. Math. **212** (2016), 757–790 (with L. Barbet, M. Dambrine, L. Rifford)

Spectral (Isotropic) Manifolds and Their Dimension
J. Anal. Math. **128** (2016), 369–397 (with J. Malick, H. Sendov)

On the structure of locally symmetric manifolds
J. Convex Anal. **22** (2015), 399–426 (with J. Malick, H. Sendov)

Cut-generating functions and S-free sets
Math. Oper. Res. **40** (2015), 276–391 (with M. Conforti, G. Cornuéjols, C. Lemaréchal, J. Malick)

Stability in linear optimization under perturbations of the left-hand side coefficients
Set-Valued Var. Anal. **23** (2015), 737–758 (with M.-A. Goberna, M. Lopez, R. Lucchetti)

Rectifiability of self-contracted curves in the Euclidean space and applications
J. Geom. Anal. **25** (2015), 1211–1239 (with G. David, E. Durand, A. Lemenant).

Orbits of geometric descent
Canad. Math. Bull. **58** (2015), 44–50 (with D. Drusvyatskiy, A. S. Lewis)

Orthogonal Invariance and Identifiability
SIAM J. Matrix Anal. Appl. **35** (2014), 580–598 (with D. Drusvyatskiy, A. S. Lewis)

Morse-Sard theorem for Clarke critical values
Adv. Math. **242** (2013), 217–227 (with L. Barbet, M. Dambrine).

Lower semicontinuity of the feasible set mapping of linear systems relative to their domains
Set-Valued Var. Anal. **21** (2013), 67–92 (with M.-A. Goberna, R. Lucchetti, M. Lopez).

Continuity and differentiability of set-valued maps revisited in the light of tame geometry
J. London Math. Soc **83** (2011), 637–658 (with J. C.-H. Pang*)

Generic identifiability and second-order sufficiency in tame convex optimization
Math. Oper. Res. **36** (2011), 55–70 (with J. Bolte, A. S. Lewis).

Generalized Hessians of C1,1-functions and second-order viscosity subjets
SIAM J. Optim. **20** (2010), 340–358 (with L. Barbet, P. Soravia)

On the asymptotic behavior of Planar Curves
J. Math. Pures Appl. **94** (2010), 183–199 (with O. Ley, S. Sabourau)

Characterizations of Lojasiewicz inequalities: subgradient flows, talweg, convexity
Trans. Amer. Math. Soc. **362** (2010), 3319–3363 (with J. Bolte, O. Ley, L. Mazet)

Identifying Structure of Nonsmooth Convex Function by the Bundle Techniques
SIAM J. Optim. **20** (2009), 820–840 (with C. Sagastizabal, M. Solodov).

Subdifferential characterization of approximate convexity: the lower semi-continuous case
Math. Program. **117** (2009), 5–19 (with F. Jules, M. Lassonde)

Tame functions are semismooth
Math. Program. **116** (2009), 115–127 (with J. Bolte, A. Lewis)

On the first Integral Conjecture of René Thom
Bull. Sci. Math. **132** (2008), 625–631 (with J. Cresson, M. Shiota)

Prox-regularity of spectral functions and spectral sets
J. Convex Anal. **15** (2008), 547–560 (with A. Lewis, J. Malick, H. Sendov).

Clarke subgradients of stratifiable functions
SIAM J. Optim. **18** (2007), 556–572 (with J. Bolte, A. Lewis, M. Shiota)

Periodic solutions obtained via the averaging method for Lipschitz systems
Proc. Amer. Math. Soc. **135** (2007), 3317–3327 (with A. Buică).

Remarks on the class of (semi)strictly quasiconvex functions
J. Optim. Theory Appl. **133** (2007), 37–48 (with Y. Garcia*).

The Lojasiewicz inequality for nonsmooth subanalytic functions
with applications to subgradient dynamical systems
SIAM J. Optim. **17** (2006), 1205–1223 (with J. Bolte, A. Lewis).

On the equivalence between complementarity systems and unilateral differential inclusions
Systems & Control Letters **55** (2006), 45–51 (with V. Acary, B. Brogliato, C. Lemaréchal)

The Morse-Sard theorem for nondifferentiable subanalytic functions
J. Math. Anal. Appl. **321** (2006), 729–740 (with J. Bolte, A. S. Lewis)

Geometrical interpretation of the proximal-type algorithms in structured optimization problems
Optimization **55** (2006), 481–503 (Special issue for D. Pallaschke) (with W. Hare, J. Malick*)

On a primal-proximal heuristic in discrete optimization
Math. Program. **104** (2005), 105–128 (with C. Lemaréchal)

Subsmooth sets: functional characterizations and related concepts
Trans. Amer. Math. Soc. **357** (2005), 1275–1301 (with D. Aussel, L. Thibault)

Clarke-critical values of subanalytic Lipschitz continuous functions
Ann. Pol. Mat. **87** (2005), 13–25 (Memorial issue for S. Lojasiewicz) (with J. Bolte, A. Lewis, M. Shiota)

Filling the gap between lower-C^1 and lower-C^2 functions
J. Convex Anal. **12** (2005), 315-329 (with J. Malick*).

Subdifferential Representation of Convex functions: Refinements and Applications
J. Convex Anal. **12** (2005) 255–265. (with J. Benoist)

Cyclic hypomonotonicity, cyclic submonotonicity and integration
J. Optim. Theory Appl. **291** (2004), 292–301 (with P. Georgiev).

Approximate convexity and submonotonicity
J. Math. Anal. Appl. **291** (2004), 292–301 (with P. Georgiev).

Integration of multivalued operators and cyclic submonotonicity
Trans. Amer. Math. Soc. **355** (2003), 177–195 (with P. Georgiev, J.-P. Penot)

Characterizations of evenly convex sets and evenly quasi-convex functions
J. Math. Anal. Appl. **273** (2002), 58–66, (with J.E. Martinez-Legaz).

Coincidence theorems for convex functions
J. Convex Anal. **9** (2002), 259–268, (with J. Benoist).

Lower subdifferentiability and integration
Set-Valued Anal. **10** (2002), 89–108 (with M. Bachir*, J.-P. Penot).

Integration of Fenchel Moreau subdifferentials of epi-pointed functions
SIAM J. Optim. **12** (2002), 575–582 (with J. Benoist).

Appropriate subdifferentials in quasiconvex analysis
SIAM J. Optim. **12** (2001), 407–420 (with N. Hadjisavvas, J.-E. Martinez-Legaz).

Dual characterizations of relative continuity of convex functions
J. Austral. Math. Soc. (Series A) **70** (2001), 211–223 (with J. Benoist).

A dual characterization of the Radon-Nikodym property
Bull. Austral. Math. Soc. **62** (2000) 379–387 (with M. Bachir*).

On generalized cyclically monotone operators and proper quasimonotonicity
Optimization **47** (2000), 123–135 (with N. Hadjisavvas).

Normal characterization of the main classes of quasiconvex functions
Set-Valued Anal. **8** (2000), 219–236 (with D. Aussel).

Subdifferentials of convex functions and σ-cyclic monotonicity
Bull. Austral. Math. Soc. **61** (2000), 269–276.

Characterization of nonsmooth semistrictly quasiconvex and strictly quasiconvex functions
J. Optim. Theory Appl. **102** (1999), 525–536 (with N. Hadjisavvas).

On the subdifferentials of quasiconvex and pseudoconvex functions and cyclic monotonicity
J. Math. Anal. Appl. **237** (1999), 30–42 (with N. Hadjisavvas).

Coercivity Conditions and Variational Inequalities
Math. Program. **86** (1999), 433–438 (with N. Hadjisavvas).

Connectedness of the efficient set for three objective quasiconcave maximization problems
J. Optim. Theory Appl. **93** (1997), 517-524 (with N. Hadjisavvas, S.Schaible).

Existence Theorems for Vector Variational Inequalities
Bull. Austral. Math. Soc. **54** (1996), 473–481 (with N. Hadjisavvas).

4.3 Articles in conference proceedings

Characterizations of Super-regularity and its Variants Splitting Algorithms, Chapter 6 (pp. 137–152) in: Lecture Notes of the BIRS Conference "Splitting Algorithms, Modern Operator Theory and Applications" (Springer, Cham 2019). Print ISBN: `978-3-030-25938-9` (with R. Luke and M. Tam).

Cut Generation Functions
Integer Programming and Combinatorial Optimization (IPCO 2013), M. Goemans and J. Correa (Eds), Lecture Notes on Computer Sciences **7801**, Springer Heidelberg (2013) 123–132
(with M. Conforti, G. Cornuéjols, C. Lemaréchal, J. Malick).

Normal cones to sublevel sets: an axiomatic approach
Lecture Notes in Econom. and Math. Systems **502** (2001), 88–101 (Springer, Berlin) (with D. Aussel).

Arrow-Barankin-Blackwell theorems and related results in cone duality: a survey
Lecture Notes in Econom. and Math. Systems **481** (2000), 119-131 (Springer, Berlin).

4.4 Edition of Books, Monographs

I authored the following Monograph in Mathematics (undergraduate level):

Metric Spaces (in Spanish), IMCA Monographs, EDUNI, 171 p., ISBN: 978-612-47971-1-8 (Oct. 2020)

I edited (together with J.-E. Martinez-Legaz) the following book:

Modern Optimization Modelling Techniques (authors: J.-B. Lasserre, F. Facchinei, R. Cominetti)
Advanced Courses in Mathematics (CRM Barcelona), Birkhäuser Verlag, Basel, 2011
ISBN 978-3034802901

4.5 Dissertations, theses

Habilitation Thesis (March 2002)

Convex and Quasi-convex Analysis: Applications in Optimization
(301 p., in French) University of Pau, Bordeaux Academy., France

PhD Thesis (December 1997)

Applications of Generalized Convexity and Generalized Monotonicity to Variational Inequalities and Vector Optimization
(85 p. in Greek), University of the Aegean, Greece.

Bachelor Thesis (June 1992)

Determination and Extension of Measures
(40 p. in Greek), University of Athens, Greece.

5 Academic responsibilities, Administration

5.1 Recent responsibilities

Deputy Director, CMM-CNRS IRL 2807
Centre for Mathematical Modelling, Chile (since June 2017)

Head of the Department School ("Jefe Docente")
University of Chile (July 2014–June 2016)

Member of the Doctorate Committee (5 members)
Department of Mathematical Engineering (2013–2019)

Member of the evaluation committee in charge of internal promotions (3 members)
Department of Mathematical Engineering, University of Chile (since June 2018)

5.2 Editorial work

I am Associate Editor for the following WoS journals:

Mathematical Programming (Series A)
Member of the Editorial Board since 2005.

Journal of Mathematical Analysis and Applications
Member of the Editorial Board since 2008.

Journal of Global Optimization
Member of the Editorial Board since 2008.

Optimization (Taylor & Francis)
Member of the Editorial Board since 2013.

Journal of Optimization Theory and Applications
Member of the Editorial Board since 2014.

Mathematics of Operational Research
Member of the Editorial Board since 2016.

Journal of Nonsmooth Analysis and Optimization
Member of the Editorial Board since 2019.

I acted as "Guest Editor" in the following occasions:

Proceedings of the International conference (held at CRM, Spain; October 13–15, 2010)
Numerical Optimization and Applications in Engineering NUMOPEN
Special issue of TOP (Spanish journal of Operations Research) (co-edited with A. Ferrer and A. Juan).

Proceedings of the International conference (held at Santiago, Chile; January 5–10, 2014)
2nd International conference on Variational Analysis and Optimization
Special issue of *Set-Valued Variational Analysis* (co-edited with R. Correa and B. Mordukhovich)

5.3 Evaluation Panels, committees

Member of an ad-hoc *Selection Committee* (10 members) for the programs:
"*Ramon y Cajal*" (5 years tenure-track positions) and "*Juan-de-la-Cierva*" (3 years post-doct):
Recruitement competition in Mathematics (98 candidates) May 23–24, 2011
ANEP (National Agency for Academic Evaluations), Madrid, Spain.

Member of an ad-hoc International[2] *Interdisciplinary Expert Panel* (10 members)
(representing mathematics) for the evaluation of the Conicyt program "Anillos" (Team grants in Chile).
Labor: Evaluate the impact of 16 executed projects (of various areas)
Evaluation period: September 3–11, 2011, Santiago, Chile.
Conicyt (National Agency for Research on Sciences and Technology), Chile.

Member (representing mathematics) of a National *Interdisciplinary Panel* (12 members)
for the evaluation of proposals of the program MEC-PCI-Conicyt (International Cooperation).
Annual Nomination: Years 2018 and 2019 (different committees)
Evaluation period: May–August 2018 and June–September 2019.
Labor: Assignment of referees (110 proposals); Final decision. PCI-Conicyt, Chile

Member of the Fondecyt *Expert Panel in Mathematics* (16 members)
Competitions: "Research initiation grants" (March–May), 'Regular grants" (July–September)
and "Post-doctorate grants" (October–December).
Labor: Evaluation of curricula; assignment of referees; 3 committee meetings (per competition)
Fondecyt, Conicyt, Chile (Annual Nomination: Year 2019)

Hellenic Authority for Higher Education: *Expert Panel in Mathematics* (3 members);
Accreditation of the Department Mathematics of the Aristotle University of Thessaloniki
February 15-20, 2021.

Member of the International Scientific Board (5 members)
GDR 3273 MOA, CNRS, France (2017–2020) (Mathématiques de l'Optimisation et Applications)
`https://gdrmoa.math.cnrs.fr/`

Member of the selection committee (5 members) of the Department of Mathematical Engineering for recruiting on tenure-track positions: competitions 2014, 2016*, 2018* [(*):= Chair of the committee.]

Chair of the selection committee (5 members) for the "CMM-CNRS positions of Excellence" competition advertised by the Center for Mathematical Modelling (June 2019).

[2] In 2011, I was Associate Professor at the UAB (Spain) and participated as foreign expert.

I participated in ad-hoc committees for academic evaluations (7 members) for the following universities:
School of Architecture, Technical University of Creta (12/2014–3/2015) and
School of Economics, Business and International Studies, University of Piraeus (11/2017–2/2018)

External evaluator, referee

I acted as external evaluator for the following competitions:

Austrian Science Fundation (FWF), Grant competition 2016

Czech Sciences Foundation, Funding proposal competition (CSF-GASP)
Grant competition 2007

Greek funding proposal competition (APELLA)
Grant competition 2019

Israel Foundation Institute (ISF)
Grant competition 2009

Spanish National Agency for Evaluation of Research Projects
Team grant competitions 2009 & 2011

Romanian National Research Council (CNCS)
Grant competitions 2012 & 2020.

I acted as external evaluator in several competitions in Chile:

Master scholarships; Doctorate fellowships;

Fondecyt individual grants; Team grants "Anillos";

Consolidated team grants "Millennium Science" (MSI)

Reviewer for *Mathematical Reviews* (AMS) (133 articles, 3 books), *Zentralblatt MATH* (68 articles, 1 book), *Canadian Mathematical Society Reviews* (1 book), *TOP Commentator* (Spanish Journal in Operational Research)

Referee for Springer, Berlin (monographs in Mathematics), CRC Press (Taylor & Francis group), as well as for several international journals (including *Bull. London Math. Soc., Math. Annalen, Trans. Amer. Math. Soc., Proc. Amer. Math. Soc., Amer. Math. Monthly*, etc.).

5.4 Organization of events. Scientific committees.

The symbol (★) in front of an activity indicates that I was chairing of the local committee.

(★) *Dynamical Aspects in Variational Analysis* (30 participants)
Workshop co-organized with S. Gaubert (INRIA, Polytechnique) and S. Tapia (my PhD student)
CMAP, École Polytechnique, Palaiseau, France (December 13, 2018)
`http://www.cmap.polytechnique.fr/~gaubert/VariationalAnalysisWorkshop/`

2^{nd} International Conference on Variational Analysis and Optimization
(in honor of Lionel Thibault) (80 participants)
Member of the organizing and scientific committee.
University of Chile, Santiago, Chile (January 5–10, 2014)
`http://eventos.cmm.uchile.cl/thibault2014/organizing-committee/`

(★) *XIII Escuela de Primavera* (Spring School, 22 participants)
(co-organized with J. Fontona and J. Ortega)

Department of Mathematical Engineering (October 14–25, 2013)
University of Chile, Santiago, Chile.

(★) *Research Programme* (4–months) on:
Variational Analysis and OptimizationTheory and Applications
Main organizer. Chair of the scientific committee.
CRM, Barcelona, Spain (September–December 2010)

(★) *Optimization: Theory, Algorithms and Applications in Economics* (OPT2011, 70 participants)
(a tribute to Juan-Enrique Martinez-Legaz on the occasion of his 60^{th} birthday)
Chair of the organizing committee. Chair of the Scientific committee.
CRM, Barcelona, Spain. `http://mat.uab.cat/~opt/opt2011/`
`http://www.dim.uchile.cl/~arisd/OPT2011_Poster.pdf`

(★) *Advances in Optimization and Related Topics* (ADORT, 69 participants)
Chair of the organizing committee. Chair of the scientific committee.
CRM, Barcelona, Spain (November 29 – December 3, 2010)
`http://www.dim.uchile.cl/~arisd/Leaflet_ADORT2010.pdf`

(★) *Numerical Optimization and Applications in Engineering* (NUMOPEN, 24 participants)
Chair of the organizing committee. CRM, Barcelona, Spain (October 13–15, 2011)
`http://www.dim.uchile.cl/~arisd/Leaflet_NUMOPEN2010.pdf`

(★) *Advanced Course on Optimization: Theory, Methods, and Applications*
Summer School (70 participants) Main organizer. Chair of the scientific committee.
CRM, Campus UAB, Spain (July 20–24, 2009)
`http://www.dim.uchile.cl/~arisd/Leaflet_OPT2009.pdf`

6th International Symposium on Generalized Convexity and Generalized Monotonicity
Member of the organizing committee (50 participants)
University of the Aegean, Greece (August 1999).

I have been (external) member of the *scientific committee* for the following events:

XIII Global Optimization Workshop (GOW'16)
Braga, Portugal (September 4–8, 2016)
`http://apolo.dps.uminho.pt/gow16/committees.html`

Approximation and Optimization (MATRIX)
Melbourne, Australia (July 10–22, 2016)
`https://www.matrix-inst.org.au/events/approximation-and-optimisation-3/`

XII International Seminar on Optimization and Related Areas
Lima, Peru (October 5-9, 2015)
`http://isora2015.imca.edu.pe/committees.php`

XIII Conference on Function Theory on Infinite Dimensional Spaces
University Complutense of Madrid (February 4-7, 2014).
`https://www.icmat.es/congresos/2014/ftida/`

Congress SMAI 2013 (French Society for Applied and Industrial Mathematics)
Seignosse, France (May 27-31, 2013).

I coordinated, together with Bruno Bongioanni (Conicet, Santa Fe, Argentina) the section "Analysis" (including real and functional analysis, complex and harmonic analysis and approximation theory) held at the conference SUMA2019, co-organized by UMA (Argentinean Mathematical Society) and SOMACHI (Chilean Mathematical Society), held in Buenos Aires (September 2019).
`http://www.union-matematica.org.ar/suma2019/sesiones_cientificas.html`

6 Research grants.

I use (★) to indicate individual grants, as well as team proposals and grants for complementary actions for which I acted as Principal Investigator (P.I.) or leading researcher. In case of international projects the symbol (★) means that I acted as coordinator (direct scientific responsible) of the national group.

6.1 Center for Mathematical Modelling (Deputy director)

Since July 2017 I am Deputy Director of the Center for Mathematical Modelling (CMM), for a total period of 4 years. CMM is a National Research *Center of Excellence* for Chile and an International Research Unit (CNRS UMI 2807) for France. CMM was the first CNRS research unit in mathematics outside the French territory created in 2000. This label is always granted for a fixed period (5 years) and is renewed after evaluation.

CMM has maintained constantly, until today, this CNRS–UMI status. Together with A. Maass (Director of the center), I represented the center to the French delegation (April 2019) during the last evaluation process (January–May 2019) and I was in charge of preparing the report of activities of the center.

As Deputy Director, together with an executive committee, I prepared, during July–October 2017, the last 3-years public funding proposal, eventually approved under the reference:

(★) AFB170001 (2019–2021) Center for Mathematical Modelling, CNRS UMI 2807 (131 members)
Budget (per year): 2.151.332.000 CLP (≅ 2.400.000€) `http://www.cmm.uchile.cl/`

6.2 Individual grants

(★) Fondecyt Regular 1211217, (2021–2024, 4 years) (ranked 1 out of 93)
Self-contractedness and KŁ-property
Individual research grant (ANID, Chile)
Budget: 61.500.000 CLP.

(★) Fondecyt Regular 1171854 (2017–2020, 4 years) (ranked 19 out of 89)
Unifying paradigms, models and structure in Optimization
Individual research grant (Conicyt, Chile)
Budget: 90.341.000 CLP.

(★) Fondecyt Regular 1130176 (2013–2016, 4 years) (ranked 2 out of 61)
Exploring Structure in Variational Analysis: Self-contractedness, permutation invariance and o-minimality
Individual research grant (Conicyt, Chile)
Budget : 88.320.000 CLP.

(★) MEC129163 (2004–2005, 1 year)
Nonsmooth Analysis and Integration of multi-valued operators
Individual research grant (RyC programme, MEC, Spain)
Budget: 6.000€

(★) ERBFMBICT983381 (1998-2000, 2 years)
Subdifferentials and applications to generalized convexity
Budget: 327.427FF (≅ 4.900€) (TMR programme, European Commission, EU)

6.3 Team grants

ECOS-Conicyt C18E04 (2019–2021, 3 years)
Dynamics, optimization and geometry: theory and numerics
Chile-France research cooperation grant (14 persons)
Budget (per year): 3.640.000 CLP (Chilean part) ; 3.470€ (French part[3])

(★) ECOS-Conicyt C14E06 (2015–2017, 3 years)
Intrinsic properties of Functional Analysis: convexity, geometry and nonlinear mappings
Chile–France research cooperation grant (10 persons)
Budget (per year): 3.160.000 CLP (Chilean part) ; 4.470€ (French part[2])

REDES–Conicyt 180032 (2019–2020, 18 months)
Stability of Optimization and Variational Systems with Applications to Natural Resources Management
Australia–Chile research cooperation grant (10 persons)
Budget: 36.000.000 CLP

(★) REDES–Conicyt 150040 (2016–2017, 18 months)
Hamiltonian Dynamics and Differential Inclusions
Chile–France research cooperation grant (8 persons)
Budget: 24.000.000 CLP

(★) MathAmSud 20-MATH-02 (2020–2021, 2 years)
Algebraic Real Geometry and Optimization (ARGO)
Argentina–Brazil–Chile–France (26 persons)
Budget (per year): 2.300€ (Conicyt, Chile) ; 4.112€ (Capes, Brazil); 2.500€ (CNRS, France)

MathAmSud 17-MATH-06 (2017–2018, 2 years)
From monotonicity to dynamics and equilibrium: structures and applications (MODYNE)
Brazil–Chile–France–Peru (22 persons)
Budget (per year): 4.400€ (Conicyt, Chile) ; 6.000€ (Capes, Brazil);
5.200€ (MAEDI & CNRS, France)
11.500€ (Conicet & IMCA, Peru)

PGC2018-097960-B-C22 (2019–2022, 4 years)
Contributions to variational analysis: fundamentals, duality, robustness and algorithms
Budget: 107.883€ (MICINN, Spain and ERDF, EU) (10 persons)

MTM2014-59179-C2-1-P (2015–2018, 3 years)
Fundamentals, methods and applications of continuous optimization
Budget: 118.338€ (MICINN, Spain) (9 persons)

(★) MTM2011-29064-C03-01 (2012–2014, 3 years)
Variational Optimization: Structure and Duality
Budget : 42.800€ (MEC, Spain) (5 persons)

(★) MTM2008-06695-C03-03 (2009–2011, 3 years)
Models of Convex Analysis, Tame Optimization and Applications
Budget : 52.400€ (MEC, Spain) (6 persons)

[3]Financed by ECOS/Sud (France)

MTM2005-08572-C03-03 (2005–2008, 3 years)
Convexity and Monotonicity. Applications to Optimization (3 persons)
Budget: 25.000€ (MEC, Spain) (3 persons)

EDF R&D (MOS) & INRIA (2001–2002)
Primal-Dual heuristic in combinatorial optimization
Budget: 30.000€ (French Electricity company, France) (2 persons)

RUUA-328 (1996–1998)
Variational Inequalities and Equilibrium problems
Budget: 1.600.000 DRH (≅ 4.800 €) (U. Aegean, Research Unit, Greece) (2 persons).

6.4 Grants for complementary actions

(★) SARE-CEXT-0464
Project "Consolider" for conferences–events:
Optimization Theory: Algorithms and Applications in Economics (October 24-28, 2011)
Budget: 7.800€ (i-math Consolider, Spain)

(★) MTM2011-14208E
Complementary action: Organization of an International Conference
Optimization Theory: Algorithms and Applications in Economics (October 24-28, 2011)
Budget: 8.000€ (Ministry of Education, Spain)

(★) ARCS-DGR2011
Complementary action: Organization of an International Conference
Optimization Theory: Algorithms and Applications in Economics (October 24-28, 2011)
Budget: 4.000€ (AGAUR, Catalonia, Spain)

(★) PMII-C5-0333
Project Consolider for the Research Program:
Variational Analysis and Optimization (September 1 - December 31, 2010)
Budget: 47.329€ (i-math Consolider, Spain)

(★) MTM2009-08146E
Complementary action: Organization of an International Conference:
Recent Advances in Optimization and Related Topics (November 29 - December 3, 2010)
Budget: 6.200€ (Ministry of Education, Spain)

(★) ORG2010-36
University grants for organization of conferences:
Recent Advances in Optimization and Related Topics (November 29 - December 3, 2010)
Budget: 3.000€ (UAB, Catalonia, Spain)

(★) MIGS-C4-0212
Project "Consolider" for conferences–events
Advances in Optimization: Theory, Methods and Applications (July 20-24, 2009)
Budget: 22.325€ (i-math Consolider, Spain)

(★) MTM2008-04356E
Complementary action: Organization of a Summer school at the CRM
Advances in Optimization: Theory, Methods and Applications (July 20-24, 2009)
Budget: 5.870€ (Ministry of Education, Spain)

7 Research profile, invited talks, colloquia, dissemination

My research area is *Variational Analysis and Optimization*, with main contributions in convex and nonsmooth analysis, in semialgebraic optimization and in variational inequalities. I have also contributed in other domains: functional analysis, dynamical systems, classical analysis/geometric measure theory and combinatorial optimization.

7.1 Publication record (in numbers)

I have currently published[4] **59** articles in journals, **4** articles in Lecture Notes (conference proceedings) and I have co-edited one book (with J.-E. Martinez-Legaz).

I publish regularly in the "top-3" optimization journals:

Math. Program. (5 times), *SIAM J. Opt.* (9 times) and *Math. Oper. Res.* (2 times),

as well as in classical journals of my area:

J. Convex Anal. (5 times), *J. Optim. Th. Appl.* (5 times), *J. Math. Anal. Appl.* (5 times).

Some of my articles appear in prestigious journals of mathematical analysis:

J. Anal. Math., *Israel J. Math.*, *J. Funct. Anal., J. Anal. Pure Appl.* and *J. Geom. Anal.*

Last but not least, my publication list includes generic top-rank journals:

J. London Math. Soc., *Adv. Math.*, *Trans. Amer. Math. Soc.* (3 times),
*Annales Inst. Fourier, Proc. Amer. Math. Soc. (*2 times).

Citations. According to MathSciNet (10.03.2021), my works have received **1143** citations from **946** authors (h-index **18**). My first three most-cited articles are above **100** citations. In GoogleScholar (10.03.2021) my research profile appears with **2801** citations and h-index **26**.

7.2 Plenary talks at international conferences.

(*China*) Advances in Nonsmooth Analysis and Applications, December 6-9, 2019, SUSTech, Shenzhen.
Plenary talk: *Critical points for Lipschitz functions.*
`http://www.dim.uchile.cl/~arisd/Poster_SUSTech.pdf`

(*Spain*) Function Theory on Infinite Dimensional Spaces XV, November 18–21, 2019, Madrid.
Plenary talk: *Lipschitz continuous functions and criticality.*

(*France*) Geometry of Banach spaces and Optimization, June 16-21, 2019, Métabief.
Plenary talk: *Spaceability of the space of Clarke-saturated Lipschitz functions.*
(Conference on the occasion of R. Deville's 60th birthday.)

(*Iran*) Conference on Nonlinear Analysis and Optimization (NAOP2018), June 18–20, 2018, Zanjan.
Plenary talk: *Paradigms of gradient systems: asymptotic study.*
(Conference on the occasion of N. Hadjisavvas 65th birthday.)

(*Spain*) Function Theory on Infinite Dimensional Spaces XV, UCM, February 6-9, 2018, Madrid.
Plenary talk: *Gradient flows, second order gradient systems and convexity.*
(Conference on the occasion of J. Jaramillo's 60th birthday.)
`http://www.dim.uchile.cl/~arisd/Poster_Madrid18.pdf`

(*Germany*) Nonsmooth Optimization and its Applications, May 15-19, 2017, HCM, Bohn.
Plenary talk: *Self-contracted curves: recent developments and applications.*
`http://www.dim.uchile.cl/~arisd/Poster_Bonn.pdf`

[4] See Section 4 (List of Publications) for details.

(*Australia*) Mathematical Optimization Down-Under (MODU2016), July 18-22, 2016, Melbourne.
Plenary talk: *Self-contracted curves: recent developments and applications* (**keynote**)
`http://www.dim.uchile.cl/~arisd/Poster_MODU.pdf`

(*France*) Variational Analysis, Optimization and Quantitative Finance, May 18-22, 2015, Limoges.
Plenary talk: Nonsmooth critical values and Sard type results
(Conference on the occasion of T. Rockafellar's 80th birthday.)

(*Spain*) Function Theory on Infinite Dimensional Spaces XII, February 7-10, 2012, Madrid.
`http://www.dim.uchile.cl/~arisd/Confe_12.pdf`

(*France*) Convex Analysis, Optimization and Applications. January 5-9, 2010, Les Houches.
Plenary Talk: *Genericity of partial smoothness in semialgebraic optimization*
(Conference on the occasion of C. Lemarechal's 65th birthday.)

(*France*) International Conference on Nonsmooth and Variational Analysis in Sciences and Engineering Limoges, June 2007. Plenary Talk: *Variational Analysis and Tame Optimization.*

(*France*) Calculus of Variations, Shape Optimization, June 10-13, 2003, Bourget-du-Lac.
Plenary Talk: *Subsmooth sets and related concepts.*

Invited talks at International Workshops

(*Austria*) Workshop on Numerical Algorithms in Nonsmooth Optimization, February 2019, ESI, Vienna
Talk: *Self-contracted curves and Applications.*

(*Austria*) Workshop on Nonsmooth and Variational Analysis, January 2019, ESI, Vienna.
Talk: *Detecting and controlling the size of critical values: from Classical to Nonsmooth Analysis.*

(*Chile*) Control of State-Constrained Dynamical Systems, September 24–27, 2019, Valparaiso.
International workshop and summer school.
Talk: *From the Gradient Dynamics to the Sweeping Process.*
`http://www.dim.uchile.cl/~arisd/Poster_Valpo.pdf`

(*Brazil*) XII Brazilian Workshop on Continuous Optimization, July 23–27, 2018, Foz do Iguaçu.
ICM 2018 Satellite Conference.
Semi-plenary talk: *Gradient flows and determination of convexity.*

(*Iran*) Workshop on Optimization, Institute of Physics and Mathematics, June 23, 2018, Isfahan.
Invited talk: *The Morse-Sard theorem for Lipschitz selections.*

(*Italy*) 71th Workshop "Advances in Convex Analysis and Optimization", June 2019, Erice.
Plenary talk: *Spaceability of Clarke saturated functions.*
`http://www.dim.uchile.cl/~arisd/Poster-Erice-2019.pdf`

(*Peru*) XIII International Seminar on Optimization and Related Areas, October 9-13, 2017, Lima
Plenary Talk: *Determining a function from partial data: The Gleaser-Whitney problem.*

(*Mexico*) Splitting Algorithms, Modern Operator Theory, and Applications.
BIRS conference (upon invitation), September 17-22, 2017, Oaxaca
Talk: *On the Glaeser-Whitney extension problem.* Video available at:
`http://www.birs.ca/events/2017/5-day-workshops/17w5030/videos/watch/201709181005-Daniilidis.html`

(*Italy*) 66th Workshop "Advances in Convex Analysis and Optimization", July 2016, Erice.
Plenary talk: *Interplay between geometric descent and structure in optimization.*
`http://www.dim.uchile.cl/~arisd/Poster_Erice16.pdf`

(*Saudi Arabia*) Weak Sharp Minima in Optimization, KFUPM, December 2015, Dhahran.
Plenary talk: *Clarke critical values and the Morse-Sard theorem.*

(*France*) Workshop on the Whitney problems.
CIRM conference (upon invitation), October 19–23, 2015, Luminy.
Talk: *Semialgebraic paradigms in structural optimization: dynamical considerations.*

(*Peru*) XII ISORA, October 5-9, 2015, Lima.
Plenary talk: *The convex paradigms in optimization.*
`http://www.dim.uchile.cl/~arisd/Poster_ISORA15.pdf`

(*France*) Real Analytic Geometry and Trajectories of Vector Fields.
CIRM conference (upon invitation), June 8–12, 2015, Luminy.
Talk: *Trajectory length of the tame sweeping process*

(*France*) Real singularities and applications,
CIRM conference (upon invitation), February 16–20, 2015, Luminy.
Talk: *Applications of Real Algebraic Geometry to Variational Analysis*

(*Uruguay*) Real Number Complexity Workshop[5], December 9–11, 2014, Montevideo
Invited talk: *Variational Analysis in the light of Semialgebraic Geometry.*

(*Peru*) IV Latin American Workshop on Optimization and Control (LAWOC), July 2014, Lima.
Invited talk: *Orbits of geometric descent.*

(*Peru*) XI ISORA, October 7-13, 2013, Lima.
Plenary talk: *The Sard theorem from the viewpoint of nonsmooth analysis.*

(*France*) Alicante-Elche-Limoges Workshop in Optimization (ALEL VI), July 2–4, 2012, Limoges.
Plenary talk: *Self-contracted curves and applications in dynamical systems.*
`http://www.dim.uchile.cl/~arisd/ALEL12_poster.pdf`

(*Italy*) Workshop on Optimization and Related Topics, May 10–11, 2012, Milano.
Invited talk: *Trajectories of gradient systems for functions with isolated singular values.*

(*Italy*) Workshop on Optimization and Related Topics (Università Cattolica), May 5-6, 2011, Milano.
Invited talk: *Genericity results in Convex Minimization problem.*

(*Chile*) III Latin American Workshop on Optimization and Control (LAWOC), January 2012, Viña.
Plenary talk: *Gradient orbits of smooth functions with isolated singular values.*

(*Spain*) Alicante-Elche-Limoges Workshop (ALEL III), June 23–25, 2011, Castro Urdiales.
Plenary talk: *Generalized Hessians and second-order viscosity subjets.*

(*France*) Workshop on Geometry and Algebra of Linear Matrix Inequalities (GeoLMI)
LAAS-CNRS, November 19–20, 2009, Toulouse.
Invited talk: *Linear Maximization over semialgebraic sets and partial smoothness.*

[5]This workshop is part of the main conference on *Foundations of Computational Mathematics* (FoCM 2014).

(*Italy*) 12th Workshop on Well-Posedness of Optimization and related topics, September 2009, Trento
Invited talk: *Genericity of partial smoothness in tame optimization.*

(*Bulgaria*) Workshop on Optimization and Applications, December 17–19, 2008, Sofia.
Invited talk: *Sard type theorems in Tame Variational Analysis: illustration of semialgebraic techniques.*

(*Spain*) 11th Workshop on Well-Posedness of Optimization and related topics, Alicante, September 2007.
Invited talk: *On the uniform finiteness of lengths of trajectories of gradient systems.*

(*Spain*) Workshop in Economics & Applied Mathematics, December 12–14, 2002, Barcelona.
Invited talk: *Convex Integration of Fenchel subdifferentials.*

Plenary talks at National Workshops

(*France*) Journées annuelles 2018 du GdR MOA, October 17-19, 2018, Pau (**keynote**)
Talk: *On functions that saturate the Clarke subdifferential.*

(*Chile*) Conference of the Chilean Mathematical Society (SOMACHI 2013), November 7–9, 2013, Olmué.
Semi-Plenary talk: *Asymptotic behavior of gradient orbits* (in Spanish).

(*France*) Journées du groupe MODE de la SMAI, March 28–30, 2012, Dijon (**keynote**)
Talk: *Genericity results on well-posedness and partly smoothness* (in French)

(*Spain*) Conference of the Spanish Royal Mathematical Society 2009
Session: Real Analytic and Algebraic Geometry (RAAG), February 4–7, 2009.
Invited talk: *Sard type theorems in Tame Variational Analysis.*

(*Spain*) Workshop on Nonsmooth Analysis and Applications, UCM, February 7–9, 2007, Madrid.
Talk: *Subdifferential Representation of Convex functions.*

7.3 Research colloquiums and research seminars

Research colloquiums:

Madrid, Spain (February 3, 2020)
Mathematical Analysis Colloquium, Interdisciplinary Mathematical Institute, University Complutense.

Vienna, Austria (December 4, 2019)
Mathematisches Kolloquium, Faculty of Mathematics, University of Vienna.

Gœttingen, Germany (July 4, 2017)
Kolloquien (Angewandte Mathematik), University of Gœttingen.

Buenos Aires, Argentina (June 23, 2016)
Mathematical Colloquim, University of Buenos-Aires (UBA).

Santiago, Chile (September 25, 2015)
Colloquium in Mathematics, Catholic University of Chile (PUC).

Grenoble, France (March 9, 2006)
Colloquium in Mathematics, IMAG, University of Grenoble.

Barcelona, Spain (April 21, 2004)
Department Colloquium, University Autonomous of Barcelona (UAB).

Distinguished seminars:

Séminaire CMAP (September 18, 2018)
École Polytechnique, Palaiseau, France

Séminaire Parisien d'Optimisation (SPO) (November 6, 2018) & (May 16, 2005)
Institut Henri Poincaré, Paris, France

101 Seminario Iberoamericano de Matemáticas (February 2018)
Centro Tordesillas de relaciones con Iberoamérica, Universidad de Valladolid, Spain

Seminario Mischa Cotlar (June 24, 2016)
Mathematical Institute of Argentina (IAM).

90 Seminario Iberoamericano de Matemáticas (February 2016)
Centro Tordesillas de relaciones con Iberoamérica, Universidad de Valladolid, Spain

Optimization and Applications Seminar (Fall 2008)
ETH Zurich and University of Zurich, Switzerland

Webinars:

One World Optimization Seminar (October 5, 2020)
OWOS Series, University of Vienna, Vienna, Austria

Singularity seminar UFC (August 4, 2020)
Federal University of Ceara, Fortaleza, Brazil

Other seminars classified by countries:

(Australia) Melbourne (25/07/2016, Seminar RMIT).

(Belgium) Université Catholique de Louvain-la-Neuve (March 12, 2007).

(Brazil) Universidade Federal da Rio (March 30, 2007), IMPA, Rio de Janeiro (April 13, 2007).

(Canada) CECM, University of Simon Fraser, Vancouver (July 2, 2003).

(Chile) Universidad de Concepción (June 12, 2013), Center of Matematical Modeling (June 30, 2004).

(France)

Paris Orsay (2/2/2017, séminaire géométrie-topologie; 7/2/2017, séminaire d'analyse harmonique), Paris University "Pierre et Marie-Curie" (3/2/2017, séminaire de géométrie et systèmes dynamiques).

(Center/North of France) Chambéry (13/11/2018 & 15/4/2011, séminaire de géométrie; 11/4/2005, 7/11/2003 & 16/04/2002, séminaire d'EDP)Tours (20/3/2008 & 1/6/2006), Limoges (3/3/2006, 26/4/2002 & 28/5/1999), Brest (13/10/2020, 5/4/2011 & 2/12/2003). INRIA Rhône-Alpes (April 21, 2011), IMAG (5/6/2008), Lyon I (25/11/2003, 19/12/2001)

(South of France) Bordeaux (6/11/2017, 7/7/2008, 4/6/2007 & 9/11/1998), Pau (28/6/2012, 29/6/2009, 16/6/2009, 8/7/2008, 28/5/2007 & 15/10/2002) , Montpellier II (8/3/2006, 9/12/2003, 21/3/2000), Avignon (8/11/2001), Marseille (May 9, 2011 & May 12, 2011).

(French Antilles) Pointe-à-Pître (9/12/2011, 23/9/2010, 13/12/2008, 13/4/2006, 10/2/2005 & 24/2/2005).

(Greece) Salonica (27/5/2003), Crete (3/9/2002), Athens (15/03/2004 & 4/9/2001), NTUA (20/5/2014, 9/12/2009, 11/2/2009, 9/9/2008, 29/5/2002, 29/5/2001), Samos (14/3/2001).

(Israel) The Technion University of Haifa (March 7, 2010)

(Italy) Università di Pisa (February 23, 2011), Università Cattolica di Sacro Cuore, Brescia (February 22, 2011), Politecnico di Milano (February 16, 2011), Università degli Studi di Padova (February 28, 2007).

(Japan) University of Saïtama, Tokyo (December 3, 2004)

(Mexico) Benemérita Universidad Autónoma de Puebla (March 24, 2010)

(Spain) Universitat Politècnica de Catalunya (29/5/2009), Universidad de Murcia (11/5/2009), Centre de Recerca Matemàtica (24/4/2007), Universidad Complutense de Madrid (15/9/2005), Universitat Autònoma de Barcelona (4/6/2010, 26/2/2010, 21/12/2009, 4/12/2006, 5/7/2005, 18/10/2004, & 1/3/1004), Universidad de Alicante (20/9/2005 & 27/2/2004), Universidad de Elche (19/9/2005 & 26/2/2004).

7.4 Dissemination activities

Exceptional lecture (90 minutes, in French) about *Chess and Mathematics* within the course (*Jeux Mathématiques*) for third-year students of the University of Tours (March 2008).

Interview (in Spanish) for the Magazine "Beauchef" (No 5, 2013). (Periodic edition —two volumes per year— with news on Sciences and Engineering related to the activities of the University of Chile.)

Interview (in English) for the newsletter of the Center of Mathematical Modelling, on the topic *When science moves the chess pieces*. Link: `http://www.cmm.uchile.cl/?p=23376`

Organization (together with Axel Osses) of the production (and active participation to the recording) of the Video *Beautiful Concepts, a poetic walk through mathematics* (in Spanish), released on January 13, 2016, in the occasion of the 50th anniversary of the department.
Link available at `http://www.dim.uchile.cl/videos/118736/video-bellos-conceptos-un-paseo-poetico-por-las-matematicas`

Active participation to an "open-day dissemination activity" (*Jornada de puertas abiertas*) organized by the Engineering Faculty of the University of Chile for schoolchildren (March 12, 2016).

Dissemination purpose visit (April 14, 2016), together with Axel Osses, to the high-school "Instituto Nacional Barros Arana" (Santo Domingo #3535, Santiago). Projection of the video for the 50th anniversary of DIM to approximately 150 pupils. Discussion/questions/responses concerning the labor of a researcher in Mathematical Engineering. Link of the activity:
`http://www.dim.uchile.cl/noticias/120757/bellos-conceptos-matematicos-al-inba.`

Exceptional lecture (90 minutes, in French) within the course MAP557 (*Recherche opérationnelle: aspects mathématiques et applications*) for third-year students of "École Polytechnique" interested in Operations Research (November 6, 2018).

Participation in the organization of the celebration fest (May 16, 2019) for the 100th graduate of the Doctoral programme of DIM and Chairman of the closing section. Link of the activity:
`http://ingenieria.uchile.cl/noticias/153913/dim-celebro-sus-primeros-100-doctorados`

Chairman of a session at the dissemination activity *Le mois de l'optimisation* organized by IRMAR (Rennes) and the GDR 3273 CNRS (Mathématiques de l'Optimisation et Applications) (November 2020).
`https://mois-optim.math.cnrs.fr/`

8 Collaborators, visiting positions

I have **54** co-authors in WoS journals. Throughout these years I have consolidated an extensive network of collaborations involving researchers and centers from Chile, France and Spain, countries where I hold/held research positions for several years. I also maintain close connections with researchers from Austria (R. Bot), Australia (R. Burachic (Adelaide), V. Roschina (Sydney), Brazil (M. Solodov, C. Sagastizabal (Rio) and P. Kaufmann (Sao Paolo)), Peru (Eladio Ocana (IMCA) and USA (P. Combettes (NCSU), D. Drusviatskiy (University of Washington), A. S. Lewis (Cornell University).

Invited professor (official assignment)

(in Austria)

University of Vienna (December 2017 – January 2018, 2 months)
Lectures: Elective Module, Master AMaSciCo (Applied mathematics and scientific computing)

(in France)

University of Sorbonne-Panthéon (Paris 1) (February 2019, 2 weeks).

Gaspard Monge invited professor[6], École Polytechnique, Palaiseau (September-December 2018, 4 months).
Lectures: Elective Module, Master COCV (Contrôle, Optimisation et Calcul des Variations).

University Paris-Sud (Orsay) (February 2017)

INSA-Rennes (PR1-03, November 2020), (PR1-03, November 2016)

University of Toulouse 1 (Capitole) (PR1-03, May 2012, 1 month)

University of Versailles (Saint Quentin) (PR1-03, March 2012, 1 month)

University of Pau (4 times, 1 month)
(December 2011, PR1-03) (June 2009, PR1-03), (June 2008, PR1-03), (May 2007, PR2-03)

University of Tours (January-May 2008, PR1-01, 5 months)

University of Antilles-Guyana DOM (2 times, 1 month)
(April 2006, MCF-08, 1 month), (February 2005, MCF-05, 1 month)

University of Savoy (March-May 2005, CRA-07, 3 months)

(in Greece)

University of the Aegean, Samos (Spring 2001, Adjutant Lecturer).

(in Italy)

Politecnico di Milano (INDAM, GNAMPA, February 2011, 1 month)

Invited research stays (via grants)

(*in Australia*)

University of Ballarat (November 2013, 2 weeks) (invited by Alexander Kruger)

(*in Brazil*)

IMPA (Institute for Pure and Applied Mathematics), Rio de Janeiro, Brazil
(February 2007, 1 month) (invited by Mikhail Solodov and Claudia Sagastizabal)
(in Canada)

Simon Fraser University (June 2003, 1 month) (invited by Adrian S. Lewis)

[6]The program included a financial support for my PhD student S. Tapia (4 months salary).

(in France)

University of Bretagne Occidentale (Brest) (October 2020, 3 weeks) (invited by Marc Quincampoix)

University of Nice (June 2016, 1 week) (invited by Ludovic Rifford)

University of Franche-Comté, France (December 2016, 2 weeks) (visiting Gilles Lancien)

University of Bordeaux 1, France (October 2015, 2 weeks) (visiting Robert Deville)

University of Tours (February 2006, 2 weeks) (invited by Olivier Ley)

University of Provence, Marseille, France (May 2011, 1 week) (invited by Nicolas Dutertre)

University Paris 6 (May 2010, 6 weeks) (invited by Jerome Bolte)

(in Israel)

The Technion University of Haifa (February 2010, 10 days) (invited by Alexander D. Ioffe)

(in Italy)

University of Padova (February 2007, 2 weeks) (invited by Giovanni Colombo)

(in Japon)

University of Saïtama (December 2004, 1 week) (invited by Toshi Fukui)

University of Nagoya (November 2004, 2 weeks) (invited by Masahiro Shiota)

(in Mexico)

University 'Las Americas' of Puebla (March 2010, 10 days) (invited by Maxim Todorov)

(in Peru)

IMCA (Institute for Mathematics and related sciences), Lima, Peru (October 2019, 3 weeks)
Lectures at the Doctorate programme. (The lecture notes will be published by EDUNI (in press))

(in Spain)

UNED, Madrid (2018, 2017, 2015) (invited by Estibalitz Durand)

(in USA)

University of Washington, Seattle (July 2019, 3 weeks) (invited by Dmitriy Drusviatskiy)

University of Cornell, USA (December 2012, 1 week) (invited by Adrian S. Lewis)

9 Awards, Qualifications, Hobbies

Fellowships–Awards.

Awards from the Greek Mathematical Society: National Olympiads 1985 (2nd award), 1987 (Distinction)

Awards from the Municipality of Athens: Best school performance (1985, 1986, 1987, 1988)

Rank admission awards (1988), Physics Department (Entrance Rank 2)

Papadakis Foundation Fellow (1989-1992)

Valedictorian (1992), Physics Department, University of Athens

Bodossakis Foundation Fellow (1993-1996)

Marie-Curie Fellow (1998-2000)

Distrinction for publishing in a best-10 journal (University of Chile, 2013).

Gaspard Monge invited professor (École Polytechnique, 2018).

Accreditations.

Accreditation ANECA – CU ("Catedrático de Universidad") (Spain 2011)

Accreditation of Advanced Research (AQU, Catalonia, 2010)

Accreditation of the Program I-3 (Distinguished Researcher Trajectory) (ANEP, Spain 2007)

Accreditation of Professorship Level in Applied Mathematics (Qualification PR-26) (2003, CNU, France)

Hobbies.

Chess: FIDE Master (Best ELO 2345), Junior (sub-20) Champion of Greece (1988), Greek National Junior Team (Balkan championship 1988, 1989, 1990), Greek National Team (Olympiad 1988), European Junior Championship, Arnhem, Netherlands, 1988 (13th position), Student Champion of Greece with the team of University of Athens (1989)

Bridge: Occasional competitions at the St Egrève Club (2002-2003)

10 Training and supervision of students

10.1 Supervision of Post-doctorate fellows.

I was scientific responsible of David Salas during his post-doctorate stay at the University of Chile (2019–2020), financed by Fondecyt after a joint application. Since March 2020, David is hired by the UOH University (Chile) as (tenure-track) Assistant Professor.

I was scientific responsible of Pham Duy Khanh, during his first post-doctorate stay at the University of Chile (2016–2017, financed by the CMM–Basal project), as well as during his current post-doctorate stay (2018–2021) as Fondecyt fellow (grant obtained after a joint application).

10.2 Supervision of PhD Thesis

Gonzalo Flores Garcia, University of Chile (Defense, April 26, 2021).

Title: *Integration of essentially bounded functions and classification of Asymmetric spaces.*

During his thesis Gonzalo Flores has been financed by ANID (4 years). The thesis contains three articles (including a joint paper published by *SIAM J. Opt.* in 2019).

I am currently supervising the PhD thesis of the following students:

Sebastian Tapia Garcia (ANID fellowship, University of Chile) (defense expected December 2021)

(Provisional) Title: *Dynamics: Asymptotic behaviour and rectifiability.*
This thesis is co-directed by R. Deville (Bordeaux Institute of Mathematics). So far, the thesis gave rise to one publication and two preprints.

Claudia Soto (ANID fellowship, University of Chile) (expected December 2021)

(Provisional) Title: *Inf-convolutions and convexifications via the lemma Shapley-Folkman.*
This thesis is co-directed with A. Hantoute.

Diana Narvaez (CMM fellowship, University of Chile) (expected December 2021)

(Provisional) Title: *Algorithms and sweeping process dynamics: variational aspects*
This thesis is co-directed with E. Vilches.

Francisco Venegas Martinez (ANID fellowshipUniversity of Chile) (expected December 2022)
(Provisional) Title: *Asymmetric structures in Analysis and Geometry*
The thesis contains a joint work published by *J. Funct. Anal.* in 2020.

In the past, I was informally involved in the following PhD thesis:

Mohammed Bachir (University of Bordeaux, 2000, director Robert Deville)

He is now Associate Professor at the University Paris-Sorbonne (France). His thesis contains two joint articles (published by *Bull. Austral. Math. Soc.* in 2000 and *Set-Valued Anal.* in 2002), both prepared during the period of my post-doctorate stay at Talence (1998–2000).

Jerome Malick (INRIA, Grenoble, 2005, director Claude Lemarechal).

He is now CNRS senior researcher at the University of Grenoble (France). His thesis contains two joint articles (published by *J. Convex Anal.* in 2005 and *Optimization* in 2006). These works have been prepared during my post-doctorate stays at INRIA (2001–2002 and Automne 2003) as well as 10-days visit of J. Malick in Barcelona (June 2004).

Yboon Garcia (University of Antilles, 2008, director Marc Lassonde).

She is now Professor at the Pacific University (Lima, Peru). Her thesis contains a joint article (published by *J. Optim. Th. Appl.* in 2007). This work has been prepared during my research stay at the University of Antilles as invited professor (April 2006) as well as a one-month research stay of Yboon at the CRM (University Autonomous of Barcelona) two months later (June 2006).

Jeffrey Pang (Cornell University, 2009, director Adrian S. Lewis).
He was appointed Assistant Professor at NUS (Singapore). His thesis contains a joint article (published by *J. London Math. Soc.* in 2011) prepared during his 3–months research stay at the CRM (University Autonomous of Barcelona) in Automne 2008.

Dmitriy Drusviatskiy (Cornell University, 2013, director Adrian S. Lewis).
He is now Associate Professor at the University of Washington (USA). His thesis contains two joint articles (published by *SIAM J. Matrix Anal.* in 2014 and *Canad. J. Math.* in 2015) prepared during his stay at the University Autonomous of Barcelona in Automne 2011 (within the 4–months Research programme on Variational Analysis that I organized at the CRM), as well as my research visit at Cornell University in November 2012.

Axel Böhm (University of Vienna, 2020, director Radu Bot):
Axel assisted to my lectures at the University of Vienna (December 2017–January 2018) and made a 3–months research stay at the University of Chile (March-May 2019). During his stay we prepared a joint article (to appear in *J. Convex Anal.*).

Direction of Master Thesis

Guillaume Grelier (University of Chile, August 2018)
Thesis: *On the geometry of compact convex sets* (in Spanish).

Francisco Venegas Martinez (University of Chile, March 2018)
Thesis: *A Banach–Stone theorem for Finsler Manifolds* (in Spanish).

Sebastian Tapia García (University of Chile, September 2017)
Thesis: *Self-contracted and λ-curves. Rectifiability and asymptotic behaviour* (in Spanish).

Roberto Bobadilla Solari (University of Chile, October 2017)
Thesis: *Geometry of descent systems: asymptotic study via desingularization* (in Spanish).

Gonzalo Flores Garcia (University of Chile, September 2016)
Thesis: *Lipschitz-Free spaces and a characterization for the finite-dimensional case* (in Spanish).

Ata Atur (UAB, July 2011)
Thesis: *Infinitely repeated zero-sum games with partial information.*

María del Mar Gómez Pujalte (UAB, September 2010).
Thesis: *Duality in convex optimization.* (co-supervised with JE Martínez-Legaz)

Direction of Bachelor Thesis

Guillaume Grelier[7] (University of Chile, August 2018)

Francisco Venegas Martinez[3] (University of Chile, March 2018)

Sebastian Tapia García[3] (University of Chile, September 2017)

Roberto Bobadilla Solari[3] (University of Chile, October 2017)

Gonzalo Flores Garcia[3] (University of Chile, September 2016)

Diana Garcia Fernandez (UAB, September 2012)

Sergi Benach (UAB, June 2011) (co-supervised with G. Seco)

Iain MacLellan Sladden (UAB, June 2011) (co-supervised with G. Seco)

Inga Ladleif (UAB, Erasmus student, June 2005)
(co-supervised with Andreas Fischer, University of Dresden)

I supervised four trainee internships of M.-J. Alfaro Herrera, B. Peralta Molina and R. Orellana Alarcón (University of Chile).

I was member of numerous Bachelor and Master committees held in UAB (2005–2013) and in the University of Chile (2013–today).

I participated to the examination committee for Master thesis defenses within the international Master *Erasmus Mundus* (Barcelona, 2011–2012).

As member of the Education Advisor Committee of the Department of Mathematical Engineering, during the period 2014–2017 I revised/developed courses syllabi of seven courses for Bachelor or Master Degree in Mathematical Engineering. I also revised the syllabi of three courses in the UAB.

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[7] Undergraduate students in Mathematical Engineering have the possibility to extend their studies by 6 months and opt for a simultaneous Master Degree. In this case, they defend a Master thesis which also counts as Bachelor thesis for a (simultaneous) graduation (same dissertation, but different Protocol and Minutes, and possibly different grades).

Teaching activities

I have a broad teaching experience in several countries, having lectured in five languages (Catalan, English, French, Greek, Spanish), at all levels (Undergraduate, Master or Doctorate), involving students with different background and type of studies: Mathematical Engineering, Mathematics, Applied Statistics, Actuarial Sciences, Chemistry and Technical Engineering. Since 2013, I am teaching regular courses and advanced seminars at the University of Chile as Full Professor. I have been Department Head for undergraduate studies for two years (2014–2016) and coordinator for all mathematical courses of the Faculty (5.700 students). I was previously teaching at the Autonomous University of Barcelona (UAB), between 2004–2013, as (tenure) Associate Professor. I have also taught as *part-time lecturer* at the University of the Aegean (Greece) and at the University of Grenoble (France), as (fixed-term) *Assistant Professor* (ATER) at the University of Pau (France) and as Invited professor at the University of Tours (France). I was invited to deliver a specialized course at Master/Doctorate level at an advanced Spring School in Paseky (Czech Republic), at the University of Vienna (Austria), at the Doctorate program of IMCA (Peru) and at École Polytechnique (France).

I give below the complete list of my teaching activities.

U1–**U3** = Undergraduate courses ; **M1**–**M2** = Master courses ; **D** = Module in a Doctorate program

1 Teaching activities at the University of Chile (2013–2021)

(*Regular courses*)

– *Calculus of Several Variables* (MA2001, **U2**, 6 ECTS, Mandatory) (Taught 7 times)

[*Syllabus*: Topology of $\mathbb{R}^n$, continuity, Lipschitz continuity, Banach fixed point theorem, differentiability, inverse function and implicit function theorems, Schwarz theorem, optimization, Lagrange method, higher order derivatives, Riemann integration, Fubini theorem, area calculation and volumes.]

Basic course in all Mathematical studies as well as all Bachelor curricula in Engineering at the University of Chile (100 students in average). I have been teaching continously (every year) this course since 2013.

– *Metric spaces and General Topology* (MA3801, **U3**, 9 ECTS, Mandatory) (Taught 2 times)

[*Syllabus*: (*Part 1*) Axiom of choice, Zorn lemma, ordinals, cardinals, Cantor Bendixson index, topology of metric spaces, convergence, continuity, compactness, completeness, Baire theorem, Variational Principle of Ekeland, product space, equivalent metrics and Mazurkiewicz theorem, completeness of a metric space, universal surjectivity of Cantor set ; (*Part 2*) General Topology, separability axioms, compactness, convergence of nets, Tychonoff theorem, filters et ultrafilters, Urysohn lemma, Unit partitions, Alexandroff compactification, Stone–Čech compactification, connectedness, Quotient topology, introduction to homotopy and fundamental group.]

Fundamental course of the Bachelor Curriculum in Mathematical Engineering at the University of Chile (45 students in average). This course is also prerequisite for our Master and Doctorate program. I taught this course in 2014 and 2016.

–*Functional Analysis* (MA4801, **M1**, 6 ECTS, Mandatory) (Taught 2 times)

[*Syllabus:* Locally convex topological vector spaces, semi-norms, Hahn-Banach theorem, Fréchet spaces, Banach spaces, Open mapping theorem, closed graph theorem, Banach-Steinhauss principle, dual spaces, week topologies, Alaoglou theorem, reflexive spaces, Krein-Milman theorem, separable isometric universality of $C[0,1]$. Hilbert spaces, Riesz representation theorem, Stampacchia and Lax-Milgram theorem, Compact operators, Spectral analysis of Auto-adjoint operators, Banach algebras, C^*-algebras, Gelfand-Naimark theorem, General duality theory, Polar topologies, abstract version of Alaoglou theorem.]

Fundamental course at a Master level (4th year in Mathematical Engineering). I taught this course in 2017 and 2018 (20 students in average).

Complex Analysis and Special Functions (MA4001, **U3**, 6 ECTS, Elective Module[8]) (Taught 2 times)

[*Syllabus*: Fundamental theorem of Algebra (d'Alembert), holomorphic functions, Cauchy–Riemann conditions, Analytic functions, Goursat theorem, Cauchy homotopic invariance theorem, simple connected spaces, Morera theorem, Liouville theorem, Zeros of holomorphic functions, special functions, Classification of isolated singularities, Laurent series, Residua, Rouché theorem, Weierstrauss theorem, Inverse mapping theorem, conformal mappings, automorphisms of the complex plane and of the Riemann sphere, Möbius mappings, Riemann conformal map theorem, homological version of Cauchy theorem.]

Elective course of the Bachelor curriculum in Mathematical Engineering at the University of Chile. I taught this course in 2019 and 2020 (25 students in average).

Differential and Variational Calculus (MA4002, **U3-M1**, 6 ECTS, Elective Module[1])

[*Syllabus*: Differential calculus in infinite dimensional spaces, Manifolds and submanifolds, Calculus of Variations, Lagrangien and Hamiltonian systems, Qualitative study of dynamical systems]

Elective course of the Bachelor curriculum in Mathematical Engineering at the University of Chile. I taught this course in 2013 (20 students).

Convex Analysis and Duality (MA5801, **M2-D**, 6 ECTS, Elective Module[1]) (Taught 2 times)

[*Syllabus*: Convex functions, Fenchel duality, polar cones, subdifferential, monotone operators, cyclic monotonicity and Rockafellar theorem, Fréchet/Gâteaux differentiability, bornologies, Variational principle of Deville-Godefroy-Zizler, Asplund spaces, strongly exposed points and Radon-Nikodym property, Variationnel principle of Stegall.]

Elective course at a Master level (5th year in Mathematical Engineering). I taught this course in 2014 and 2015 (20 students in average). The course is simultanesouly offered to our international Master and Doctorate program (under the code MA674).

(*Proposed modules and specialized seminars*)

Advanced Seminar in Mathematics I (MA693, **M2-D**, 9 ECTS, Elective)

[*Syllabus*: Special Topics in Operations Research: SDP and Conic Programming, Copositive Matrices, Spectral functions.]

Elective course (based on oral presentations of the students) for the Master and Doctorate programme of the Department of Mathematical Engineering of the University of Chile. I coordinated this course (together with Hector Ramirez) in 2013 (2 students).

Advances Topics in Functional and Variational Analysis (MA6093, **M2-D**, 9 ECTS, Elective)

[*Syllabus*: Special Topics in Optimization and Variational Analysis: Kakutani Fixed point theorem, Sperner lemma, Free Metric spaces, Monge-Kantorovitz theory, Brenier–McCann theorem in optimal transport.]

Elective course (based on oral presentations of the students) for the Master and Doctorate programme of the Department of Mathematical Engineering of the University of Chile. I coordinated this course (together with Abderrahim Hantoute) in 2016 (12 students).

Advances Topics in Tame Variational Analysis (MA6093, **M2-D**, 9 ECTS, Elective)

[*Syllabus*: Nonsmooth Morse-Sard theorems, Semialgebraic optimization, KL-inequality, asymptotic theory of tame subgradient systems.]

Elective course (based on oral presentations of the students) for the Master and Doctorate programme

[8]There are 12 elective modules and Mathematical Engineering students choose 6 out of them.

of the Department of Mathematical Engineering of the University of Chile. I coordinated this course in 2018 (6 students).

Weak KAM theory and Hamiltonian dynamics (MA5309, **M2-D**, 9 ECTS, Elective)
[*Syllabus*: Hamilton-Jacobi method, Tonelli Lagrangians, viscocity solutions for first-order PDE, Lax–Oleinik semigroup, weak-KAM solutions and Aubry sets, Pugh closing lemma, Mañé theorem.]

Elective course (based on oral presentations of the students) for the Master and Doctorate programme of the Department of Mathematical Engineering of the University of Chile. I coordinated this course (together with Ludovic Rifford, visiting professor) in 2016 (5 students).

Lecture Notes (in Spanish):
I prepared lecture notes (available at `http://www.dim.uchile.cl/~ arisd/notes.html`) for the following mandatory modules in Mathematical Engineering:

Analysis in Several Variables, Part 1, 60 pages (in Spanish). This corresponds to the first part of the course MA2001 (2nd year, common engineering plan, University of Chile).

Metric spaces, 140 pages (in Spanish). This corresponds to the first part of the course MA3801 (3rd year, Mathematical Engineering, University of Chile), as well as the Master course I delivered at IMCA (Peru). An enhanced version of these notes has eventually been published as a Lecture notes Monograph in Mathematics by EDUNI (Editions of the National Engineering University of Peru):
"Espacios Métricos" (171 p.), Monografías del IMCA, ISBN: 978-612-47971-1-8 (October 2020)

General Topology, 100 pages (in Spanish). This corresponds to the second part of the course MA3801 (3rd year, Mathematical Engineering, University of Chile).

Functional Analysis, 126 pages (in Spanish). This corresponds to the course MA4801 (4th year, Mathematical Engineering, University of Chile).

2 Teaching activities at the UAB (2004–2013)

Descriptive Statistics (**U1**, 6 ECTS, Mandatory) (4 times)
Basic course for the Bachelor Degree in Applied Statistics (35 students in average).
I had been teaching this course every year from 2010 to 2013.

Mathematics (**U1**, 6 ECTS, Mandatory) (4 times)
Basic course for the Bachelor Degree in Chemistry (group of 80 students in average).
I had been teaching this course every year from 2010 to 2013.

Linear Algebra and Differential Equations (**U1**, 6 ECTS, Mandatory) (2 times)
Basic course for the Bachelor Degree in Physics and Chemistry (group of 70 students in average).
I taught this course in 2008 and in 2009.

MAPLE (Formal Computation) (**U1**, 6 ECTS, Mandatory) (3 times)
Basic course for the Bachelor Degree in Technical Engineering (group of 45 students in average).
I had been teaching this course (laboratory) every year from 2008 to 2010.

Linear programming and continuous optimization (**U2**, 6 ECTS, Mandatory) (6 times)
Fundamental course for the Bachelor Degree in Applied Statistics (35 students in average).
I had been teaching this course every year from 2004 to 2009.

Operations Research (**U3**, 6 ECTS, Mandatory)
Fundamental course for the Bachelor Degree in Applied Statistics and elective module for the Bachelor Degree in Mathematics. I taught this course (30 students) in 2006, together with A. Alabert and P. Puig.

(*Specialized seminars*)

Modern Trends in Mathematics (**M1**, 6 ECTS, Elective) (4 times)

Elective module (based on oral presentations and written essays) for advanced undergraduate students of the Department of Mathematics (15 students in average). I coordinated this course from 2010 to 2013.

3 Teaching activities in other countries

Mathematics I (**U1**, 6 ECTS, Mandatory).

Basic course for a Bachelor Degree in Technical Engineering (group of 40 students). I taught this course at the University of Grenoble (France), in 2001, as part-time lecturer (during my post-doctorate stay at INRIA Rhône-Alpes).

Calculus of one variable (**U1**, 6 ECTS, Mandatory) (2 times)

Basic course for a Bachelor Degree in Science or Engineering. I taught this course in Spring 2001 (40 students) at the Department of Actuarial Sciences of the University of the Aegean (Greece) as Adjunct Lecturer and in 2008 (40 students) at the Department of Physics and Mathematics at the University of Tours (France) as invited professor.

Lineal Algebra I (**U1**, 6 ECTS, Mandatory)

Basic course for a Bachelor Degree in Science or Engineering. I taught this course in 2000 (33 students) as fixed-term Assistant Professor (ATER) at the University of Pau (France).

Lineal Algebra II (**U2**, 6 ECTS, Mandatory) (2 times)

Basic course for the Bachelor Degree in Mathematics. I taught this course in 2000 (33 students) as fixed-term Assistant Professor (ATER) at the University of Pau (France) and in 2008 (group of 32 students) at the University of Tours (France) as invited professor.

Multivariable Calculus (**U2**, 6 ECTS, Mandatory)

Basic course for the Bachelor Degree in Mathematics. I taught this course in 2008 (group of 32 students) at the University of Tours (France) as invited professor.

Optimization (**M1**, 6 ECTS, Elective Module)

Elective course of the Master Degree in Applied Mathematics of the University of Pau. I taught this course in 2000 (4 students) as fixed-term Assistant Professor (ATER).

Invited modules in graduate programs and advanced schools

I have been invited to deliver a specialized course to the Master/Doctoral programs of the following institutions.

Variational Analysis and Structure in Descent Systems and Optimization (21 hours)

Master AMaSciCo (Applied mathematics and scientific computing)
Faculty of Mathematics, University of Vienna (December 2017 – January 2018, 2 months)

Variational Analysis and Structure in Descent Systems and Optimization (21 hours)

Master COCV (Contrôle, Optimisation et Calcul des Variations), University Paris-Sorbonne
École Polytechnique, Palaiseau (September-December 2018, 4 months)

Topics in Metric spaces (18 hours)

Lectures at the Doctorate programme, IMCA (Institute for Mathematics and related sciences), Lima,

Peru (October 2019, 3 weeks)

I also gave mini-courses in the following events:

Measure theory for Quantum mechanics (6 lectures, in Greek)

(National) Summer School in Mathematical Physics, University of the Aegean, Greece (August 1995)

Lecture Notes: Elements of Vector Measure Theory (in Greek), Proceedings of the 3rd Summer School on Analysis, Algebra and Mathematical Physics, ZITI Editions (Thessaloniki), pp. 57–94 (1997).

Gradient Dynamical Systems, Tame Optimization and Applications (6 lectures)

(International) Spring School in Variational Analysis, Paseky Nad Jizerou, Czech Republic (April 2009)

Lecture Notes: Gradient Dynamical Systems, Tame Optimization and Applications, Paseky Nad Jizerou, Czech Republic.

Optimization and Convex Analysis (6 lectures, in Spanish)

(Latin American) EMALCA School, National University of San Antonio, Cusco, Peru (October 2014).

Exploring structure in variational analysis and optimization (3 lectures)

Lecture Series on "Variational Analysis and Numerical Methods in Nonsmooth Optimization"
Vienna Doctoral School, ESI, Boltzmann Lecture Hall, Vienna (March 2019).

Research activities

I present below highlights of my research activities over the last 15 years. The presentation is divided in thematical sections. Most of my publications (and in particular all articles referenced below) are available, in a preprint version, at my web page: `http://www.dim.uchile.cl/~arisd/articles.html`

1 Semi-algebraic Variational Analysis

In recent years variational analysis —arguably full of pathologies outside the convex paradigm— is encountering an unexpected remedy, coming from the real semialgebraic and o-minimal geometry. Tarski–Seidenberg principle, or more generally the finiteness property of o-minimal structures, warrants a remarkable stability under most operations involved in optimization problems (max/min, inf-convolution, minimization, (sub)differentiation...) providing new tools and techniques to tackle challenges. One may arguably say that the works [1] and [3] are at the very origin of what is nowadays called *semialgebraic* (or *tame*) *optimization*. In particular, both articles are highly cited (**170** and respectively **106** MathSciNet citations; **518** and respectively **243** citations in GoogleScholar) and considered as pioneering in the topic. Related works are [2] (where we prove that every semialgebraic Lipschitz continuous function is semismooth in the sense of Mifflin) and the articles [4]–[5] containing genericity results for well-posedness of constrained optimization and tame multifunctions respectively.

A major achievement —which has chronologically been the first ever outcome of the incursion of real semialgebraic techniques into nonsmooth analysis— was to extend the famous Łojasiewicz inequality to nonsmooth semialgebraic functions, with important consequences in the asymptotic theory of (sub)gradient dynamical systems and in numerical or constrained optimization. The classical Łojasiewicz inequality states that if $f : \mathbb{R}^n \to \mathbb{R}$ is a real-analytic function and $\nabla f(\bar{x}) = 0$, then there exists $\theta \in [0, 1)$ such that the quantity

$$\frac{|f(\cdot) - f(\bar{x})|^\theta}{\| \nabla f(\cdot) \|} \qquad \text{remains bounded around } \bar{x}. \tag{1}$$

In [1] this result has been extended to the class of nonsmooth subanalytic functions which are continuous on their domain. The condition $\nabla f(\bar{x}) = 0$ is replaced by $0 \in \partial f(\bar{x})$, where ∂f denotes the limiting subdifferential of f, and the denominator of (1) by the remoteness $m_f(x) := \inf\{\|x^*\| : x^* \in \partial f(x^*)\}$ of the subdifferential. This result plays an important role in the asymptotic behavior of the subgradient evolution inclusion

$$\dot{x}(t) \in -\partial f(x(t)),$$

since it allows to establish that every (bounded) trajectory has finite length, and converges to some critical point of f. It can also be used to control the asymptotic behavior of discrete descent algorithms, via explicit convergence rates.

The above results can be generalized to (nonsmooth) functions that are definable in some o-minimal structure, giving rise to a nonsmooth version of the Kurdyka-Łojasiewicz inequality (in short, KŁ property), terminology introduced in [3] and nowadays widely used in the literature[9]. In the same article [3] (44 pages, published in *Trans. Amer. Math. Soc.*), a second important consequence has been revealed: the KŁ–property can be intrinsically characterized by means of a uniform control of the asymptotic behavior of the piecewise subgradient descent curves. This work contains an example of a C^2 smooth convex function failing to satisfy the KŁ property, revealing that the convex and the tame paradigms are of different nature.

Last but not least, in the recent work [6], published in *Ann. Inst. Fourier* we extended the KŁ–property from functions to *sweeping process mappings*. This extension recovers as a special case, the original work of K. Kurdyka (published in the same journal, in 1998) (concerning $\mathcal{C}^1$-smooth functions) as a particular case, associating to each function, the sweeping process determined by its sublevel sets.

[9] A Google search of the two-words string "Kurdyka-Łojasiewicz" returns around 20.000 entries.

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[1] J. Bolte, A. Daniilidis, A. Lewis, The Lojasiewicz inequality for nonsmooth subanalytic functions with applications to subgradient dynamical systems, *SIAM J. Optim.* **17** (2007), 1205–1223.

[2] J. Bolte, A. Daniilidis, A. Lewis, Tame functions are semismooth, *Math. Programming* (Series B) **116** (2009), 115–127.

[3] J. Bolte, A. Daniilidis, O. Ley, L. Mazet, Characterizations of Lojasiewicz inequalities: subgradient flows, talweg, convexity, *Trans. Amer. Math. Soc* **362** (2010), 3319–3363.

[4] A. Daniilidis, J. Pang, Continuity and differentiability of set-valued maps revisited in the light of tame geometry, *J. London Math. Soc* **83** (2011), 637–658.

[5] J. Bolte, A. Daniilidis, A. Lewis, Generic identifiability and second-order sufficiency in tame convex optimization, *Math. Oper. Res.* **36** (2011), 55–70.

[6] A. Daniilidis, D. Drusvyatskiy, Sweeping by a tame process, *Ann. Inst. Fourier* **67** (2017), 2201–2223.

2 Asymptotic theory in the convex paradigm

An important part of my recent research relates to the asymptotic study of orbits related to descent systems of a (quasi)convex potential. In [1] we introduce the notion of *self-contracted curve* to capture the behaviour of orbits of the gradient flows of a (quasi)convex function, or more generally, orbits orthogonal to a convex foliation ([3]). A curve γ is called self-contracted, if

$$||\gamma(t_2) - \gamma(t_3)|| \leq ||\gamma(t_1) - \gamma(t_3)||, \qquad \text{for } t_1 \leq t_2 \leq t_3. \tag{2}$$

In [2] we established that in $\mathbb{R}^n$, every self-contracted curve is rectifiable and satisfies the relation

$$\ell(\gamma) \leq k \operatorname{diam}(\Gamma),$$

where the constant k depends only on the dimension. The above result readily yields the following:

– All gradient orbits of a proper (quasi)convex function f have finite length.

– For any convex function f and any proximal sequence $\{x_i\}_{i\geq 1}$ —generated by applying to f the proximal algorithm with any parameters $\{\lambda_i\}_i$— we have

$$\sum_{i\geq 1} ||x_i - x_{i+1}|| \ \leq \ 2k \, ||x_0 - x_\infty||$$

where x_∞ is the limit of the proximal sequence $\{x_i\}_{i\geq 1}$. This yields a uniform control on the rate of convergence (which quite surprisingly is independent of the proximal parameters or the convex function). Other applications in optimization are discussed in my recent preprint (`arXiv`:2003.04201) with A. Böhn (PhD student at the University of Vienna) where we establish that the explicit gradient descent (with either constant or decreasing step-size) generates a self-contracted sequence, and that the same happens with the alternative projection algorithm over two closed convex sets. In the preprint (`arXiv`:1908.01089, Machine Learning) C. Gupta1, S. Balakrishnan and A. Ramdas used essentially the notion of self-contractedness for computer science related applications.

In a different line of research, the question of rectifiability of a self-contracted curve for a non-Euclidean norm has been recently resolved by Stepanov and Teplitskaya (*J. London Math. Soc.,* 2017). In a recent paper (*Proc. Amer. Math. Soc.*, 2019) Durand and Lemenant showed that under a mild condition any smooth self-contracted curve is a gradient curve of a smooth convex function. Since the definition (2) is of metric nature (no vector structure is needed), the question of rectifiability has an intrinsic interest and

can be addressed in Riemannian manifolds [4]. This last result inspired further extensions to CAT(0) spaces by S. Ohta (*J. Geom. Anal.*, 2017) and recent investigations in metric geometry, where the notion of self-contractedness played a crucial role in the study of bi-Lipschitz embeddings (see a series of recent ArXiv preprints by V. Zolotov, S. Ohta, S. Lebedeva y S. Buyalo).

Last but not least, in [5] we extended the notion of self-contractedness, for any $\lambda \in [-1, 1)$, to the metric notion of λ-curve and the (weaker) geometric notion of λ-cone property (λ-eel). In the Euclidean space $\mathbb{R}^d$ we established that for $\lambda \in [-1, 1/d)$ bounded λ-curves have finite length. For $\lambda \geq 1/\sqrt{5}$ it is always possible to construct bounded curves of infinite length in $\mathbb{R}^3$ which do satisfy the λ-cone property. This can never happen in $\mathbb{R}^2$ though: it is shown that all bounded planar curves with the λ-cone property have finite length. These results open the way of exploring asymptotic properties of trajectories for gradient dynamics not related to convexity (for instance, analytic potentials).

References

[1] A. Daniilidis, O. Ley, S. Sabourau, On the asymptotic behavior of Planar Curves, *J. Math. Pures Appl* **94** (2010), 183–199.

[2] A. Daniilidis, G. David, E. Durand, A. Lemenant, Rectifiability of self-contracted curves in the Euclidean space and applications, *J. Geom. Anal.* **25** (2015), 1211–1239.

[3] A. Daniilidis, D. Drusvyatskiy, A. S. Lewis, Orbits of geometric descent, *Canad. Math. Bull.* **58** (2015), 44–50.

[4] A. Daniilidis, R. Deville, E. Durand, L. Rifford, Self-contracted curves in Riemannian manifolds, *J. Math. Anal. Appl.* **457** (2018), 1333–1352.

[5] A. Daniilidis, R. Deville, E. Durand, Metric and geometric relaxations of self-contracted curves, *J. Optim. Theory Appl.* **182** (2019), 81–109.

3 Sard type theorems for generalized critical values

State-of-the-art. The classical Sard theorem (Sard, 1942) asserts that the critical values of a C^k smooth function $f : \mathbb{R}^n \to \mathbb{R}^m$ are contained in a null subset of $\mathbb{R}^m$, provided $k \geq \max\{1, n - m + 1\}$. The particular case $m = 1$ had been previously established by Morse in 1938 (and it is known as the Morse-Sard theorem). The result is essentially sharp in what concerns the degree of smoothness required. Known counterexamples (Norton, 1986, Bates, 1993) show that the degree of regularity cannot be lowered, unless an extra structural assumption is made over the function.

Contributions: We established extensions of the Sard theorem to nonsmooth functions (measuring the size of the generalized critical values). This obviously requires some extra regularity on the function, which stems either from the tame paradigm or from controlling the cardinality of the family on which a selection is taken. To this end, in [2] the Morse-Sard theorem is extended for (generalized) critical values of continuous selections over a compactly indexed *countable* family of C^k functions: it is shown that these functions are Lipschitz continuous and the set of their Clarke critical values has Lebesgue measure equal to zero. (The classical Morse-Sard theorem is recovered as particular case, corresponding to the case that the family consists of a single element.) The proof is based on geometrical arguments leading nonsmoothness to a kind of tractable smooth assumption in naturally arising manifolds, in which the classical Morse-Sard theorem applies. In [3], using a technique of Yomdin, we establish a "preparatory Sard theorem" for smooth functions with a partial affine structure and by means of this result, we establish a nonsmooth Sard theorem for the class of Lipschitz functions from $\mathbb{R}^d$ to $\mathbb{R}^p$ that can be expressed as finite selections of C^k functions (more generally, continuous selections over a compact countable set).

This recovers readily the classical Sard theorem. Applications to semi-infinite and Pareto optimization are obtained easily from our setting.

In [1] we establish the following result: if the graph of a lower semicontinuous real-extended-valued function $f : \mathbb{R}^n \to \mathbb{R} \cup \{+\infty\}$ admits a Whitney stratification (so in particular if f is a semialgebraic function), then the norm of the gradient of f at $x \in \operatorname{dom} f$ relative to the stratum containing x bounds from below all norms of Clarke subgradients of f at x. As a consequence, we obtain a Morse-Sard type theorem as well as a nonsmooth extension of the Kurdyka-Łojasiewicz inequality for functions definable in an arbitrary o-minimal structure. This work, highly cited (**86** MathSciNet citations; **255** citations in GoogleScholar), has inspired further investigations related to the property of *metric regularity* of multifunctions (see Ioffe, *Proc. Amer. Math. Soc.* 2008, e.g.).

In contrast to the above positive results, in [4] we studied the class of Lipschitz continuous functions (without additional assumptions) and obtained a result that reveals a serious failure of the nonsmooth Morse-Sard theorem in the general case. To describe the result let us recall that the Clarke subdifferential of a Lipschitz continuous function $f : \mathcal{U} \to \mathbb{R}$ ($\mathcal{U}$ nonempty open subset of ℓ^1_d) is a nonempty convex compact subset of $B(0, \|f\|_{\mathrm{Lip}})$, $\|f\|_{\mathrm{Lip}}$ denoting its Lipschitz constant. We say that a Lipschitz function is *Clarke saturated* whenever $\partial f(x) = B(0, \|f\|_{\mathrm{Lip}})$, for all $x \in \mathcal{U}$, that is, it is maximal at every point. Although it is quite easy to obtain examples of functions with maximal subdifferential at a specific point (or in a finite subset of points), it is quite difficult and counterintuitive to imagine a function with a maximal subdifferential at *each* point (Clarke saturated). In [4], together with my PhD student G. Flores, we established that the set of Clarke saturated Lipschitz functions contains a linear subspace of uncountable dimension (in particular, an isometric copy of $\ell^\infty(\mathbb{N})$). This result goes in the line of a previous result of Borwein-Wang (1998–2002) in which genericity of Clarke saturated function has been established in the complete metric space of Lipschitz functions of constant less or equal to 1, under the uniform convergence. The aforementioned result was based on Baire category theorem and was strongly linked to the uniform convergence (in particular, it is false for the $\|\cdot\|_{\mathrm{Lip}}$-topology). On the other hand, our approach in [4] is constructive and not linked to the uniform convergence. In particular we establish lineability (and spaceability for the Lipschitz norm) of the above set inside the set of all Lipschitz continuous functions.

Let us finally mention our recent work [5] which deals with the problem of detecting a Clarke critical point algorithmically, applying a first-order subgradient type method. These methods are known to work well in practice (in particular, in Machine Learning), but all theoretical results available so far do require some extra assumption. In this work, we justified the need for extra assumption, since we constructed examples of Lipschitz continuous functions, with pathological subgradient dynamics both in continuous and discrete time. In both settings, the iterates generate bounded trajectories, and yet fail to detect any (generalized) critical point of the function.

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4 Transfert principle in spectral analysis.

State–of–the–art. Let $\mathcal{S}^n$, O^n and Σ^n denote, respectively, the space of symmetric $n \times n$ matrices, the group of orthogonal matrices and the group of permutations of n elements. A function $f : \mathbb{R}^n \to \mathbb{R} \cup \{+\infty\}$ is called symmetric if $f(x) = f(\sigma x)$ for all $x \in \operatorname{dom} f$ and all permutations $\sigma \in \Sigma^n$ while a function $F : \mathcal{S}^n \to \mathbb{R} \cup \{+\infty\}$ is called *spectral* (or *isotropic*) if $F(\mathcal{U}^T X \mathcal{U}) = F(X)$ for all $X \in \operatorname{dom} F$ and $\mathcal{U} \in O^n$. It is well-known that spectral functions are in one-to-one correspondence with symmetric functions via the formulae:

$$F(X) = (f \circ \lambda)(X) \quad \text{and} \quad f(x) = F(\operatorname{Diag}(x)),$$

where $\lambda : \mathcal{S}^n \to \mathbb{R}^n$ associates to each matrix X the vector $(\lambda_1(X), \ldots, \lambda_n(X))$ of eigenvalues of X in nonincreasing order and $\operatorname{Diag}(x)$ is the diagonal matrix formed by the elements of x in a nonincreasing order. Convexity properties of a symmetric function f on $\mathbb{R}^n$ and the associated spectral function $F := f \circ \lambda$ on $\mathcal{S}^n$ are closely related: a symmetric function f is convex, if and only if $F = f \circ \lambda$ is convex (Davis, 1957). Further, even if the map $X \mapsto \lambda(X)$ is not everywhere differentiable, many problems are corrected by the invariance property of f (Lewis, 1996): $F = f \circ \lambda$ is (continuously) differentiable at the matrix X, if and only if, f is (continuously) differentiable at the vector $\lambda(X)$. An analogous result holds for twice (continuously) differentiable spectral functions (Lewis-Sendov, 1998) and for C^∞ spectral functions (Dadok, 1982). The above results form a *transfer principle* between convexity (resp. smoothness) of symmetric and spectral functions.

Contributions: My main contribution in this topic is to establish that the transfer principle (terminology we introduced in [2]–[3]) can be extended to include notions of variational analysis and differential geometry. In [1] we establish the analogue of Davis theorem for prox–regular funtions:

- $F = f \circ \lambda$ is prox-regular if and only if f is prox-regular.

Although prox-regularity is a natural generalization of convexity, the above result is not an easy adaptation of Davis' theorem, the reason being that the subdifferential of a prox-regular function is not a global concept. In [2], [3] we established the following results:

- A symmetric set $\mathcal{M} \subset \mathbb{R}^n$ is a smooth (resp. C^2, analytic) *submanifold* $\mathcal{M}$ of $\mathbb{R}^n$ if and only if $\lambda^{-1}(\mathcal{M})$ is a smooth (resp. C^2, analytic) *submanifold* $\mathcal{M}$ of $\mathcal{S}^n$.

An explicit formula for the dimension of the spectral manifold in terms of the dimension and the position of $\mathcal{M}$ with respect to the affine stratification is given in [3].

- A symmetric set $\mathcal{M}$ (respectively, a symmetric function $f : \mathbb{R}^n \to \mathbb{R}$) is partially smooth if and only if the spectral set $\lambda^{-1}(\mathcal{M})$ (respectively, the spectral function $F = f \circ \lambda$) is partly smooth.

These results, which have been established overcoming significant technical difficulties, show that the transfer principle remains valid in variational analysis, offering a clear panorama of the so-called spectral variational analysis. In addition, in [2] we introduce the idea of *stratification duality* (or *mirror stratification*) for convex polyhedral functions, which has been later used in works on sensibility analysis and pattern recognition in Machine Learning by J. Fadili, J. Malick and G. Peyré (*SIAM J. Optim.* 2018).

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5 Miscellaneous topics

In this part, I selected three works inscribed to independent lines of research. The first two are of combinatorial nature.

- M. Conforti, G. Cornuéjols, A. Daniilidis, C. Lemarechal, J. Malick, Cut-generating functions and $\mathcal{S}$-free sets, *Math. Oper. Res.* **40** (2015), 276-391.

In the above work we consider the separation problem for sets $\mathcal{X}$ that are inverse images of a given set $\mathcal{S}$ by a linear mapping. This setting encompasses classical examples in integer programming, complementarity problems and other optimization problems. One would like to generate valid inequalities that cut off some point not lying in $\mathcal{X}$, without reference to the linear mapping. Formulas for such inequalities can be obtained through cut-generating functions (Gomory cuts). The work (**18** MathSciNet and **48** Google scholar citations) presents a formal theory of minimal cut-generating functions and maximal $\mathcal{S}$-free sets, relying on tools of *Convex Analysis*.

- A. Daniilidis, C. Petitjean, A partial answer to the Demyanov-Ryabova conjecture, *Set-Valued Var. Anal.* **26** (2017), 143–157.

A *polytope* is any convex compact subset of $\mathbb{R}^N$ with a finite number of extreme points. In this work we consider a finite family $\Re = \{\Omega_1, \ldots, \Omega_\ell\}$ of polytopes of $\mathbb{R}^N$ together with an operation which transforms the initial family $\Re$ to a dual family of polytopes that we denote $\mathcal{F}(\Re)$. This operation relates to duality and has been defined by Demyanov under the name of converter. In this work we are interested in the Demyanov–Ryabova conjecture which asserts that after a finite number of iterations (successive dualizations), either a 1-cycle or a 2-cycle eventually comes up. We establish a strong version of this conjecture under the assumption that the initial family contains "enough minimal polytopes" whose extreme points are "well placed". This result is almost the only plausible positive result that can be established. Very recently, V. Roschina gave a negative answer to the general conjecture, via a computer–assisted counterexample, see `https://www.roshchina.com/a-counterexample-to-the-demyanov-ryabova-conjecture-paper-and-avocado-talk/` .

- A. Daniilidis, M. Haddou, E. Le Gruyer, O. Ley Explicit formulas for $\mathcal{C}^{1,1}$ Glaeser-Whitney extensions of 1-Taylor fields in Hilbert spaces, *Proc. Amer. Math. Soc.* **146** (2018), 4487–4495.

We give a simple alternative proof for the $\mathcal{C}^{1,1}$–convex extension problem which has been introduced and studied by D. Azagra and C. Mudarra. As an application, we obtain an easy constructive proof for the Glaeser-Whitney problem of $\mathcal{C}^{1,1}$ extensions on a Hilbert space. In both cases we provide explicit formulae for the extensions. This research goes along with investigations on the classical Whitney extension problem, back to 1935, in which researchers from various areas (harmonic analysis, metric geometry, PDE and semi-algebraic geometry) have been involved.

- T. Boulmezaoud, P. Cieutat, A. Daniilidis, Gradient flows, second-order gradient systems and convexity. *SIAM J. Optim.* **28** (2018), 2049–2066.

In this work we disclose an interesting connection between the gradient flow of a $\mathcal{C}^2$-smooth function f and evanescent orbits of the second order gradient system defined by the square-norm of ∇f, under adequate convexity assumption. As a consequence, we obtain the following surprising result for two $\mathcal{C}^2$, convex and bounded from below functions f, g: if $||\nabla f|| = ||\nabla g||$, then $f = g + k$, for some $k \in \mathbb{R}$, that is, every smooth, bounded below convex function is determined (up to a constant) by the modulus of its gradient. This result initiated further research on this topic and has been recently extended to the nonsmooth case.