

CURRICULUM VITÆ

Pierre Maréchal

June 2016

1 Current position and address

Professor of mathematics at Université Paul Sabatier, Toulouse, France.

Address:

Institut de Mathématiques de Toulouse
Université Paul Sabatier
31 062 Toulouse Cedex 9, France

Email:

pierre.marechal@math.univ-toulouse.fr

2 Education

1. Engineering diploma, ENSICA, Toulouse, in June 91.
2. Master's *Signal and Image Processing*, Toulouse (with honors, valedictorian), in June 93.
3. PhD Thesis at University of Toulouse, with honors, in May 1997. Title: *On the regularisation of ill-posed problems. Applications in signal and image science for astronomy.*
4. Accredited to supervise research (Habilitation à Diriger des Recherches) in applied mathematics, at the University of Montpellier, in 2002. Title of the thesis: *Contributions to convex analysis, to entropy optimization and to tomography.*

3 Positions

1. Assistant lecturer at University of Toulouse - Paul Sabatier, from September 1996 to August 1997.
2. Postdoctoral fellow at Simon Fraser University, Vancouver, Canada, from June 1997 to August 1999.

3. Associate professor at University of Montpellier, from September 1999 to January 2005.
4. Professor at University of Toulouse - Paul Sabatier, from February 2005.
5. Provisional Assignment at ISAE (Institut Supérieur de l'Aéronautique et de l'Espace), from September 2012 to December 2014.

4 Research domains

1. Inverse problems. *Keywords:* ill-posed problems, regularization theory, variational methods, Fourier analysis, aperture synthesis, tomography (SPECT, PET, thermoacoustic tomography, MRI), econometrics (nonparametric instrumental regression, deconvolution with unknown variance, consumer demand estimation)
2. Optimization, convex analysis and applications. *Keywords:* moment problems, entropy optimization, convex programming, calculus of variations, spectral convex functions, duality, condition number optimization, applications (signal and image, aeronautics, econometrics).

5 Supervision of PhD theses

1. [2003-2007] Yaowaluk SAESOR (University of Montpellier). Title: *Quelques contributions aux problèmes inverses de synthèse de Fourier*. Co-supervision with H. Attouch.
2. [2006-2011] Abdelhadi ELASMAI (University of Toulouse - Paul Sabatier). Title: *Sur la correction d'atténuation en tomographie d'émission tridimensionnelle*. Co-supervision with P. Gantet.
3. [2007-2010] Xavier BONNEFOND (University of Toulouse - Paul Sabatier). Title: *Sur les problèmes de reconstruction d'image en tomographie thermoacoustique*.
4. [2009-2012] Thomas REYTIER (University of Toulouse - Paul Sabatier). Title: *Modélisation du spectre de fatigue des structures d'aéronefs soumises à des chargements complexes*. Co-supervision with C. Bès.
5. [2011-2014] Bang Giang NGUYEN (University of Toulouse - Paul Sabatier). Title: *Classification en espaces fonctionnels utilisant la norme BV avec applications aux images ophtalmologiques et à la complexité du trafic aérien*. Co-supervision with Daniel Delahaye.
6. [2011-2014] Laureline GUYS (University of Toulouse - Paul Sabatier). Title: *Fonctions de navigation biharmoniques: application à la planification stratégique de trajectoires avion*. Co-supervision with Stéphane Puechmorel.

7. [2012-2015] Sylvain PRIGENT (University of Toulouse - Paul Sabatier). Title: *Approche innovante et intégrée pour le design et l'opération environnementalement efficace d'avions*. Co-supervision with Aude Rondepierre.
8. [2015-2018] Man LIANG (University of Toulouse - Paul Sabatier). Titre: *Optimization du réseau de route en zone terminale*. Co-supervision with Daniel Delahaye.

6 Managerial activities

1. Member of the organizing committee of the *cours de DEA intensif: Problèmes Inverses en Astrophysique*, CIRM (Centre International de Rencontres Mathématiques), Marseille, mars 1995
2. Member of recruitment committee (commission de spécialistes) at the University of Limoges, from 2000 to 2007.
3. Member of the organizing committee of the conference CANUM'2003, held in la Grande Motte, June 2003.
4. Member of the organizing committee of the workshop *Rencontres en Imagerie Mathématique* (franco-tunisian workshop), Toulouse, June 2007.
5. Editor of the *Lettre MODE*, a newsletter for the French Optimization community, from 2005 to 2007.
6. co-founder of the Group of Research *Mathematics of Optimization and Applications* (GDR Mathématiques de l'Optimisation et Applications), in 2009.
7. Member of the board of directors of the SMAI (Society for Applied and Industrial Mathematics), from September 2009 to September 2015.
8. Head of the Master 1 *Mathematical Engineering* at the University Paul Sabatier, from September 2009 to September 2012.
9. Member of the organizing committee of the *Joint French-Czech Workshop on Krylov Methods for Inverse Problems*, held in Prague, July 19-20, 2010.
10. Member of the organizing committee of the *Spring School on Image Processing*, held in Martel, April 18-23, 2011.
11. Chair of the organizing committee of the Austrian-French-German Conference on Optimization, held in Toulouse, September 19-23, 2011.
12. Member of the organizing committee of the *Séminaire Pluridisciplinaire d'Optimisation de Toulouse*, since September 2012.
13. Head of the *International Relations* for the Département of Mathematics of the University Paul Sabatier, since June 2015.

14. ERASMUS coordinator for the Departement of Mathematics of the University Paul Sabatier, since June 2015.

7 Conferences and seminars

1. August 1998, 7th Vilnius Conference on Probability and Statistics, Vilnius, contributed talk.
2. March 1999, Approximation and Optimization in the Caribbean, Pointe à Pitre, contributed talk.
3. October 1999, IEEE Nuclear Science Symposium and Medical Imaging Conference, Seattle, contributed talk.
4. May 2000, Optimization Days 2000, Montréal, plenary talk.
5. June 2000, International Conference on Advances in Convex Analysis and Global Optimization, Pythagorion, contributed talk.
6. September 2003, EMS Mathematical Week-end, Lisbon, invited talk.
7. May 2004, 8th European Conference on Computer Vision, Prague, contributed talk.
8. May 2006, Rencontres en Imagerie Mathématique, Tunis, invited talk.
9. July 2006, EURO XXI 2006, Reykjavik, invited talk.
10. July 2007, Mediterranean Conference on Biomathematics, Le Caire, contributed talk.
11. July 2007, ICIAM 07, Zurich, contributed talk.
12. September 2007, Czech-French-German Conference on Optimization, Heidelberg, plenary talk.
13. Novembre 2007, Workshop on Bioimaging, Linz, invited talk.
14. February 2008, First Congress of the SM2A, Rabat, invited talk.
15. April 2008, Mathematical Methods for Imaging, Orléans, invited talk.
16. April 2008, Seminary at King's College London, London, invited talk.
17. May 2008, Franco-Chilean Days on Optimization, Toulon, invited talk.
18. June 2008, Sparse days at CERFACS, Toulouse, invited talk.
19. October 2008, Seminar (VLTAVA Program), Prague, invited talk.

20. May 2009, International Conference on Engineering and Computational Mathematics (ECM2009), Hong Kong, invited talk.
21. June 2009, Rencontres en Imagerie Mathématique, Tunis, invited talk.
22. September 2009, Belgian-French-German Conference on Optimization, Leuven, contributed talk.
23. October 2009, meeting of the GDR Mathematics of Optimization and Application, Porquerolles, contributed talk.
24. January 2010, Conference in Honour of Claude Lemaréchal, Les Houches, invited talk.
25. February 2010, International conference on optimization and its applications (ICOIA-BHU 2010), Benares, invited talk.
26. May 2010, 5th International Conference on Inverse Problems, Antalya, invited talk.
27. June 2010, workshop Optimization and Learning, Metz, invited talk.
28. July, 2010, French-Czech Workshop on Krylov Methods, Prague, contributed talk.
29. November 2010, Colloquium, Saarbrücken, invited talk.
30. June 2011, Computational and Analytical Mathematics (conference in Honour of J. Borwein), Vancouver, invited talk.
31. February 2012, Franco-Thai Symposium, Bangkok, invited talk.
32. March 2012, Seminar, Victoria, invited talk.
33. April 2012, ESI Workshop on Computational Inverse Problems, Vienne, invited talk.
34. June 2012, Seminar, Kelowna, invited talk.
35. July 2012, Workshop on Nonnegative Matrices, Banff, invited talk.
36. October 2012, Seminar, Göttingen, invited talk.
37. November 2012, Symposium on Regularization, Canberra, invited talk.
38. June 2013, Seminar, Bordeaux, invited talk.
39. September 2013, 26th IFIP TC7 Conference on System Modeling and Optimization, Klagenfurt, invited talk.
40. September 2013, French-German-Polish Conference on Optimization, Cracovia, contributed talk.

41. October 2013, Seminar at Université Libre de Bruxelles, Bruxelles, invited talk.
42. November 2013, Seminar Optimisation 3EP, Toulouse, invited talk.
43. December 2013, Seminar at Centre for Medical Image Computing, UCL, London, invited talk.
44. March 2014, Seminar at ISBA, Université Catholique de LLN, Louvain la Neuve, invited talk.
45. April 2014, Seminar at EPFL, Lausanne,, invited talk.
46. May 2014, Seminar at TSE, Toulouse, invited talk.
47. September 2014, Conference MaxEnt 2014, Amboise, contributed talk.
48. November 2014, Seminar at Université d'Avignon, Avignon, invited talk.
49. November 2015, Workshop iTomoMulti, Gif-sur-Yvette, invited talk.
50. February 2016, National Conference on Analysis, Benares, invited talk.
51. March 2016, Workshop Inverse Problems in the Alps, Obergurgl, invited talk.
52. June 2016, Conference ISNPS, Avignon, invited talk.

8 Invitations and visits

1. From September 2003 to December 2003, invited lecturer at CMM, Universidad de Chile, Chile.
2. From September 2004 to August 2005, invited researcher and lecturer at EPFL, Lausanne, Switzerland.
3. From February 2012 to August 2012, visiting researcher at University of Victoria (PIMS-CNRS program), Victoria, Canada.
4. From March 2014 to April 2014, invited professor at EFPL, Lausanne, Switzerland.

9 Distinction

September 2010, Prime d'Excellence Scientifique (PES).

10 Publications

Articles in scientific journals

- [1] P. Maréchal and A. Lannes, *Unification of some deterministic and probabilistic methodologies for the solution of linear inverse problems via the principle of maximum entropy on the mean*, Inverse Problems, Volume 13, 135-151 (1997).
- [2] A. Lannes, E. Anterrieu and P. Maréchal, *Clean and Wipe*, Astronomy and Astrophysics, Suppl. Series, Volume 123, 183-198 (1997).
- [3] P. Maréchal, D. Togane, A. Celler and J. M. Borwein, *Computation and stability analysis for regularized tomographic reconstructions*, IEEE, Transactions on Nuclear Science, Volume 46, 2177-2184 (1999).
- [4] P. Maréchal, D. Togane and A. Celler, *A new reconstruction methodology for Computerized Tomography: FRECT (Fourier Regularized Computed Tomography)*, IEEE, Transactions on Nuclear Science, Volume 47, 1595-1601 (2000).
- [5] D. Borwein, J. M. Borwein and P. Maréchal, *Surprise Maximization*, the American Mathematical Monthly, Volume 107(6), 517-527 (2000).
- [6] J. M. Borwein, P. Maréchal and D. Naugler, *Convex dual approach to the computation of NMR complex spectra*, Mathematical Methods of Operations Research, Volume 51(1), 91-102 (2000).
- [7] P. Maréchal, *On the convexity of the multiplicative potential and penalty functions and related topics*, Mathematical Programming, Series A, Volume 89, 505-516 (2001).
- [8] J.M. Borwein, R. Choksi and P. Maréchal, *Probability distributions of assets inferred from option prices via the principle of maximum entropy*, SIAM J. Optim., Volume 14(2), 464-478 (2003).
- [9] P. Maréchal, *On a functional operation generating convex functions. Part I: duality*, Journal of Optimization Theory and Applications, Volume 126(1), 175-189 (2005).
- [10] P. Maréchal, *On a functional operation generating convex functions. Part II: algebraic properties*, Journal of Optimization Theory and Applications, Volume 126(2), 357-366 (2005).
- [11] P. Maréchal, *On a class of convex sets and functions*, Set Valued Analysis, Volume 13(2), 197-212 (2005).
- [12] B. Dacorogna & P. Maréchal, *Convex $SO(N) \times SO(n)$ -invariant functions and refinements of Von Neumann's inequality*, Annales de la Faculté des Sciences de Toulouse, Volume XVI(1), 71-89 (2007).

- [13] D. Mariano-Goulart, P. Maréchal, L. Giraud, S. Gratton and M. Fourcade, *A priori selection of the regularization parameters in emission tomography by Fourier synthesis*, Computerized Medical Imaging and Graphics, Volume 31, 502-509 (2007).
- [14] B. Dacorogna & P. Maréchal, *The role of perspective functions in convexity, polyconvexity, rank-one convexity and separate convexity*, Journal of Convex Analysis, 15(2), 271-284 (2008).
- [15] P. Maréchal and D. Wallach, *Fourier synthesis via partially finite convex programming*, Mathematical and Computer Modelling, 49 (2009) 2206-2212.
- [16] N. Alibaud, P. Maréchal and Y. Saesor, *A variational approach to the inversion of truncated Fourier operators*, Inverse Problems 25 (2009).
- [17] X. Bonnefond and P. Maréchal, *A variational approach to the inversion of some compact operators*, Pacific Journal of Optimization, Volume 5(1), 97-110 (2009).
- [18] P. Maréchal and A. Rondepierre, *A proximal approach to the inversion of ill-conditioned matrices*, Comptes Rendus de l'Académie des Sciences, Paris, Serie I, Volume 347, 1435-1438 (2009).
- [19] P. Maréchal and J.J. Ye, *Optimizing condition numbers*, SIAM Journal of Optimization, Volume 20(2), 935-947 (2009).
- [20] P. Maréchal, *A convexity theorem for multiplicative functions*, Optimization Letters, Volume 6(2), 357-362 (2011).
- [21] T. Reytier, C. Bès, P. Maréchal, M. Bianciardi and A. Santgerma, *Generation of correlated stress time histories from continuous turbulence Power Spectral Density for fatigue analysis of aircraft structures*, International Journal of Fatigue, Volume 42, 147-152 (2012).
- [22] B. G. Nguyen, D. Delahaye, S. Puechmorel, P. Marechal, and P. Olle, *Using BV-norm to classify the vasculitis in multiple sclerosis fundus angiography for ophthalmologists*, Journal of Medical and Bioengineering, Volume 2(1), 11-15 (2013).
- [23] X. Bonnefond and P. Maréchal, *Convex spectral functions and approximate intertwining relationships*, Optimization Letters, Volume 8, 401-405 (2013).
- [24] X. Bonnefond and P. Maréchal, *Spectral convex functions of operators and approximate intertwining relationships*, Journal of Optimization Theory and Applications, Volume 160, 30-48 (2014).
- [25] F. Rigaud, M. Charlotte, C. Kerdreux and P. Maréchal, *Multi-objective optimization of rotary-wing aircrafts at the predesign stage*, Mechanics & Industry, Volume 15(4), 267-277 (2014).

- [26] P. Maréchal, J.J. Ye & J. Zhou, *K-optimal Design via semidefinite programming and entropy optimization*, Mathematics of Operations Research (2014).

Proceedings

- [1] B. Serre, P. Maréchal, S. Roques, B. Pfeiffer, G. Vauclair and A. Lannes, *Time-frequency analysis and observation synthesis of non-radial oscillations of white dwarfs*, Int. Symp. on Time-Frequency and Time-Scale Analysis, Philadelphia (1994) 25-28.
- [2] P. Maréchal, E. Anterrieu and A. Lannes, *Survey of Fourier synthesis methodologies*, ADASS'96, Charlottesville (1996).
- [3] L. Delage, F. Reynaud, E. Thiébaud, K. Bouyoucef, P. Maréchal and A. Lannes, *Démonstration de la faisabilité d'un dispositif d'imagerie à haute résolution utilisant des fibres optiques pour le transport des faisceaux*, GRETSI'97, Grenoble (1997) 829-832.
- [4] P. Maréchal, D. Togane, A. Celler and J. M. Borwein, *Numerical assessment of the performance of reconstruction processes for Computed Tomography*, IEEE Nuclear Science Symposium and Medical Imaging Conference, Toronto (1998).
- [5] P. Maréchal, D. Togane and A. Celler, *A new reconstruction methodology for Computerized Tomography: FRECT (Fourier Regularized Computed Tomography)* IEEE Nuclear Science Symposium and Medical Imaging Conference, Seattle (1999).
- [6] P. Maréchal, *On the principle of Maximum Entropy as a methodology for solving linear inverse problems*, in B. Grigelionis *et al.* (Editeurs), Probability Theory and Mathematical Statistics, VPS/TEV (1999) 481-492.
- [7] P. Maréchal, *A note on entropy optimization*, in M. Lassonde (Editeur), Approximation, Optimization and Mathematical Economics, Physica-Verlag (2001) 205-211.
- [8] P. Maréchal, *Generating convex function*, in N. Hadjisavvas & P. Pardalos (Editeurs), Advances in Convex Analysis and Global Optimization, Kluwer Academic Publishers (2001) 361-369.
- [9] P. Maréchal, D. Mariano-Goulart, L. Giraud et S. Gratton, *Towards automatic selection of the regularization parameters in emission tomography by Fourier synthesis*, Actes de CVAMIA, Prague (lecture notes in computer science), Springer.
- [10] B. Dacorogna & P. Maréchal, *A Note on Spectrally Defined Polyconvex Functions*, Proceedings of the workshop *New developments in the Calculus of Variations* Edizioni Scientifiche Italiane (2006) 259-274.

- [11] N. Alibaud, X. Bonnefond & P. Maréchal, *Analyse asymptotique de la régularisation par mollification*, Actes du colloque *Mathématiques pour l'image*, Presses Universitaires d'Orléans (2009).
- [12] T. Reytier, C. Bès, P. Maréchal, M. Bianciardi & A. Santgerma, *Modelling fatigue spectrum of aircraft structure under gust loads*, Actes du colloque *Fatigue Design 2011*.
- [13] S. Prigent, M. Belleville, T. Druot, A. Rondepierre and P. Maréchal, *Chance constrained business case of a three-engines hybrid aircraft*, 10th World Congress on *Structural and Multidisciplinary Optimization*, May 19 - 24, 2013, Orlando, Florida, USA.
- [14] P. Maréchal, *Duality for maximum entropy diffusion MRI*, in Ali Mohammad-Djafari & Frédéric Barbaresco, Editeurs, *Bayesian Inference and Maximum Entropy Methods in Science and engineering (MAXENT 2014)*, AIP Conference Proceedings 1641 (2015).

Book chapter

- [1] P. Maréchal and D. Aussel, chapter *Optimisation* in *Mathématiques L3, Tome 3* (Mathématiques Appliquées), Pearson Education.

Lecture notes, available on my webpage

- [1] P. Maréchal, *Introduction to Inverse Problems of Fourier Synthesis*, lecture notes.
- [2] P. Maréchal, *Eléments d'Analyse Convexe*, Notes de Cours.
- [3] P. Maréchal, *Analyse Fonctionnelle*, Note de Cours.

Submitted

- [1] X. Bonnefond & P. Maréchal, *Lagrange duality for the Morozov principle*.
- [2] P. Maréchal, S.K. Mischra and Y. Pandey, *Optimality conditions and duality for semi-infinite mathematical programming problems with equilibrium constraints, using convexifiers*.
- [3] P. Maréchal and S.K. Mischra, *Targeted solutions to linear ill-posed problems: a generalization of mollification*.