

# Curriculum vitæ of Jean-Baptiste Caillau

Born May 24, 1973 (France)  
Professor of applied mathematics  
Université Côte d'Azur, CNRS, Inria, LJAD  
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## Scientific interests

Optimisation and control: geometry, algorithms, applications

## Academic positions

Since September 2017, Professor Univ. Côte d'Azur  
Member of the CNRS team Géométrie, Analyse et Dynamique, LJAD<sup>1</sup>  
Member of the Inria team McTAO,<sup>2</sup> Sophia Antipolis  
Member of the department Math. Applis & Modélisation, Polytech Nice Sophia  
2022-2023 On partial leave (Inria) at Sophia Antipolis  
2016-2017 On leave (Inria) at Sophia Antipolis  
2013-2014 On leave (CNRS) at Lab. J.-L. Lions, Sorbonne Université  
2008-2017 Professor Univ. Bourgogne Franche-Comté  
2001-2007 Assistant professor ENSEEIHT<sup>3</sup>, Univ. Toulouse

## Education

2006 Habilitation applied math. Univ. Toulouse  
2000 PhD applied math. Univ. Toulouse (supervisor J. Noailles)  
1997 Master math. Univ. Toulouse  
1996 Master scientific comp. Univ. Toulouse  
1996 Ingénieur ENSEEIHT<sup>3</sup> applied math. & sci. computing (major)

## Distinctions

2022 Prix Défi Défense, Assises des mathématiques du CNRS  
2001 Prix Maury, Académie des Sciences de Toulouse  
2000 Prix Léopold Escande, Institut National Polytechnique de Toulouse

## 1 Publications

### Journal papers

[1a] Sensitivity analysis for time optimal orbit transfer. *Optimization* **49** (2001), no. 4, 327–350 (with Noailles, J.)

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<sup>1</sup>Labo. J. A. Dieudonné

<sup>2</sup>Mathematics for Control, Transport and Applications

<sup>3</sup>École Nationale Supérieure d'Électronique, Électrotechnique, Informatique, Hydraulique et Télécommunications

- [2a] Coplanar control of a satellite around the Earth. *ESAIM Control Optim. and Calc. Var.* **6** (2001), 239–258 (with Noailles, J.)
- [3a] 3D Geosynchronous Transfer of a Satellite: continuation on the Thrust. *J. Optim. Theory Appl.* **118** (2003), no. 3, 541–565 (with Gergaud, J.; Noailles, J.)
- [4a] Geometric optimal control of elliptic Keplerian orbits. *Discrete Contin. Dyn. Syst. Ser. B* **5** (2005), no. 4, 929–956 (with Bonnard, B.; Trélat, E.)
- [5a] Energy minimization of single input orbit transfer by averaging and continuation. *Bull. Sci. Math.* **130** (2006), no. 8, 707–719 (with Bonnard, B.; Dujol, R.)
- [6a] Averaging and optimal control of elliptic Keplerian orbits with low propulsion. *Systems Control Lett.* **55** (2006), no. 9, 755–760 (with Bonnard, B.; Dujol, R.)
- [7a] Second order optimality conditions in the smooth case and applications in optimal control. *ESAIM Control Optim. and Calc. Var.* **13** (2007), no. 2, 207–236 (with Bonnard, B.; Trélat, E.)
- [8a] Riemannian metric of the averaged energy minimization problem in orbital transfer with low thrust. *Ann. Inst. H. Poincaré Anal. Non Linéaire* **24** (2007), no. 3, 395–411 (with Bonnard, B.)
- [9a] Optimality results in orbit transfer. *C. R. Acad. Sci. Paris, Ser. I* **345** (2007), 319–324 (with Bonnard, B.)
- [10a] Geodesic flow of the averaged controlled Kepler equation. *Forum Math.* **21** (2009), no. 5, 797–814 (with Bonnard, B.)
- [11a] Conjugate and cut loci of a two-sphere of revolution with application to optimal control. *Ann. Inst. H. Poincaré Anal. Non Linéaire* **26** (2009), no. 4, 1081–1098 (with Bonnard, B.; Sinclair, R.; Tanaka, M.)
- [12a] Geometric and numerical techniques in optimal control of two and three-body problems. *Commun. Inf. Syst.* **10** (2010), no. 4, 239–278 (with Bonnard, B.; Picot, G.)
- [13a] Convexity of injectivity domains on the ellipsoid of revolution: the oblate case. *C. R. Acad. Sci. Paris, Ser. I* **348** (2010), 1315–1318 (with Bonnard, B.; Rifford, L.)
- [14a] Differential pathfollowing for regular optimal control problems. *Optim. Methods Softw.* **27** (2012), no. 2, 177–196 (with Cots, O.; Gergaud, J.)
- [15a] Minimum time control of the restricted three-body problem. *SIAM J. Control Optim.* **50** (2012), no. 6, 3178–3202 (with Daoud, B.)
- [16a] Minimum fuel control of the planar circular restricted three-body problem. *Celestial Mech. Dynam. Astronom.* **114** (2012), no. 1, 137–150 (with Daoud, B.; Gergaud, J.)

- [17a] Riemannian metrics on two-spheres and extensions with applications to optimal control. *ESAIM Control Optim. and Calc. Var.* **19** (2013), no. 2, 533–554 (with Bonnard, B.; Janin, G.)
- [18a] Metrics with equatorial singularities on the sphere. *Ann. Mat. Pura Appl.* **193** (2014), no. 5, 1353–1382 (with Bonnard, B.)
- [19a]  $L^1$ -minimization for mechanical systems. *SIAM J. Control Optim.* **54** (2016), no. 3, 1245–1265 (with Chen, Z.; Chitour, Y.)
- [20a] Solving chance-constrained optimal control problems in aerospace via Kernel Density Estimation. *Optimal Control Appl. Methods* **39** (2018), no. 5, 1833–1858 (with Cerf, M.; Sassi, A.; Trélat, E.; Zidani, H.)
- [21a] Non-integrability of the minimum time Kepler problem. *J. Geom. Phys.* **132** (2018), 452–459 (with Comboto, T.; Féjóz, J.; Orioux, M.)
- [22a] Maximal determinants of Schrödinger operators. *J. Ec. polytech. Math.* **7** (2020), 803–829 (with Aldana, C.; Freitas, P.)
- [23a] Optimal bacterial resource allocation: metabolite production in continuous bioreactors. *Math. Biosci. Eng.* **17** (2020), no. 6, 7074–7100 (with Yabo, A. G.; Gouzé, J.-L.)
- [24a] Dynamical analysis and optimization of a generalized resource allocation model of microbial growth. *SIAM J. Appl. Dyn. Syst.* **21** (2022), no. 1, 137–165 (with Yabo, A. G.; Gouzé, J. L.; de Jong, H.; Mairet, F.)
- [25a] Singularities of min time control affine systems. *SIAM J. Control Optim.* **60** (2022), no. 2, 1143–1162 (with Féjóz, J.; Orioux, M.; Roussarie, R.)
- [26a] Turnpike property in optimal microbial metabolite production. *J. Optim. Theory Appl.* **194** (2022), 365–407 (with Djema, W.; Gouzé, J. L.; Maslowskaya, S.; Pomet, J.-B.)
- [27a] Controllability properties of solar sails *J. Guidance Contr. Dyn.* **46** (2023), no. 5, 900–909 (with Herasimenka, A; Dell’Elce, L.; Pomet, J.-B.)
- [28a] Stability analysis of a bacterial growth model through computer algebra. *Maths in Actions* **12** (2023), 175–189 (with Yabo, A.; Safey el Dinh, M.; Gouzé, J. L.)
- [29a] On the controllability of nonlinear systems with a periodic drift, submitted (with Herasimenka, A; Dell’Elce, L.; Pomet, J.-B.)
- [30a] Optimal bacterial resource allocation strategies in batch processing, submitted (with Yabo, A. G.; Gouzé, J.-L.)
- [31a] Optimal control of a solar sail, submitted (with Dell’Elce, L.; Herasimenka, A.; Pomet, J.-B.)

### Edited volumes

- [1b] Special issue in the honor of Bernard Bonnard. Part I and II. *Math. Control Relat. Fields* **3** (2013), no. 3-4 (with Chyba, M.; Sugny, D.; Trélat, E.)
- [2b] Special issue on New trends in optimal control. *Discrete Contin. Dyn. Syst. Ser. A* **35** (2015), no. 9 (with Grüne, L.; do Rosario de Pinho, M.; Trélat, E.; Zidani, H.)
- [3b] *Variational methods in imaging and geometric control*, Radon Series on Comput. and Applied Math. **18**, de Gruyter, 2017 (with Bergounioux, M.; Peyré, G.; Schnörr, C.; Haberkorn, T.)
- [4b] FGS'2019 - 19th French-German-Swiss conference on Optimization *ESAIM Proc. Surveys* **71** (2021) (with Auroux, D.; Duvigneau, R.; Habbal, A.; Pantz, O.; Pronzato, L.; Rifford, L.)

### Proceedings and book chapters

- [1c] Continuous optimal control sensitivity analysis with AD. *Automatic Differentiation: from Simulation to Optimization*, 109–117, Springer, 2002 (with Noailles, J.) Proceedings of AD'2000, Nice, June 2000.
- [2c] Wavelets for adaptive solution of boundary value problems. *Proceedings of the 16th IMACS World Congress*, 1–6, Lausanne, August 2000 (with Noailles, J.)
- [3c] Numerical control and orbital transfers. *Sonderforschungsbereich 255: Transatmosphärische Flugsysteme*, 39–49, Hieronymus München, 2002 (with Gergaud, J.; Noailles, J.) Proceedings of the Optimal Control Workshop, Greifswald, October 2002.
- [4c] Minimum time control of the Kepler equation. *Unsolved Problems in Mathematical Systems and Control Theory*, 89–92, Princeton University Press, 2004 (with Gergaud, J.; Noailles, J.)
- [5c] Computation of conjugate times in smooth optimal control: the `cotcot` algorithm. *Proceedings of the 44th IEEE Conference on Decision and Control and European Control Conference ECC 2005*, 929–933, Seville, December 2005 (with Bonnard, B.; Trélat, E.)
- [6c] Introduction to nonlinear optimal control. *Advanced topics in control systems theory*, 1–60, Lecture Notes in Control and Inform. Sci. **328**, Springer, 2006 (with Bonnard, B.)
- [7c] Riemannian metric of the averaged controlled Kepler equation. *Systems, Control, Modeling and Optimization*, 79–89, IFIP Int. Fed. Inf. Process. **202**, Springer, 2006 (with Bonnard, B.; Dujol, R.) Proceedings of the 22nd IFIP TC 7 conference, Turin, July 2005.
- [8c] Averaging and optimal control of elliptic Keplerian orbits with low propulsion. *Int. J. Tomogr. Stat.* **5** (2007), no. W07, 20–25 (with Bonnard, B.; Dujol, R.) Proceedings of the 13th IFAC Workshop on Control Applications of Optimisation, Paris, April 2006.

- [9c] Smooth homotopies for single-input time optimal orbital transfer. *Int. J. Tomogr. Stat.* **5** (2007), no. W07, 26–31 (with Bonnard, B.; Dujol, R.) Proceedings of the 13th IFAC Workshop on Control Applications of Optimisation, Paris, April 2006.
- [10c] Smooth approximations of single-input controlled Keplerian trajectories: homotopies and averaging. *Taming heterogeneity and complexity of embedded control*, 73–95, International Scientific and Technical Encyclopedia, 2007 (with Bonnard, B.; Dujol, R.) Proceedings of the Joint CTS-HYCON Workshop on Nonlinear and Hybrid Control, Paris, July 2006.
- [11c] Second order optimality conditions in optimal control with applications. *Discrete Contin. Dyn. Syst. suppl.* (2007), 145–154 (with Bonnard, B.; Trélat, E.) Proceedings of the 6th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Poitiers, June 2006.
- [12c] Remarks on quadratic Hamiltonians in spaceflight mechanics. *Lagrangian and Hamiltonian Methods for Nonlinear Control*, 365–373, Lecture Notes in Control and Inform. Sci. **366**, Springer, 2007 (with Bonnard, B.; Dujol, R.) Proceedings of the 3rd IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control, Nagoya, July 2006.
- [13c] On some Riemannian aspects of two and three-body controlled problems. *Recent Advances in Optimization and its Applications in Engineering*, 205–224, Springer, 2010 (with Daoud, B.; Gergaud, J.) Proceedings of the 14th Belgium-Franco-German conference on Optimization, Leuven, September 2009.
- [14c] Discrete and differential homotopy in circular restricted three-body control. *Discrete Contin. Dyn. Syst. suppl.* (2011), 229–239 (with Daoud, B.; Gergaud, J.) Proceedings of 8th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Dresden, May 2010.
- [15c] Energy minimization in two-level dissipative quantum control: the integrable case. *Discrete Contin. Dyn. Syst. suppl.* (2011), 198–208 (with Bonnard, B.; Cots, O.) Proceedings of 8th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Dresden, May 2010.
- [16c] On the injectivity and nonfocal domains of the ellipsoid of revolution. *Geometric Control Theory and Sub-Riemannian Geometry*, 73–85, INdAM Series **5**, Springer, 2014 (with Royer, C. W.) Proceedings of the INdAM meeting on Geometric Control and sub-Riemannian geometry, Cortona, May 2012.
- [17c] On local optima in minimum time control of the restricted three-body problem. *Recent Advances in Celestial and Space Mechanics*, 209–302, Mathematics for industry **23**, Springer, 2016 (with Farrés, A.)
- [18c] Approximation by filtering in optimal control and applications. *IFAC PapersOnLine* **50** (2017), no. 1, 1649–1654 (with Dargent, T.; Nicolau, F.) Proceedings of the 20th IFAC world congress, Toulouse, July 2017

- [19c] Optimal control of slow-fast mechanical systems. *Proceedings of the Complex Systems Academy of Excellence* (2018), 105–116 (with Dell’Elce, L.; Pomet, J.-B.; Rouot, J.)
- [20c] Singular regimes for the maximization of metabolite production. *IEEE Conference on Decision and Control* (2019), 31–36 (with Gouzé, J.-L.; Yabo, A.) Proceedings of the 58th CDC, Nice, December 2019
- [21c] Zermelo-Markov-Dubins problem and extensions in marine navigation. *IEEE Conference on Decision and Control* (2019), 517–522 (with Maslovskaya, S.; Mensch, T.; Moulinier, T.; Pomet, J.-B.) Proceedings of the 58th CDC, Nice, December 2019
- [22c] Sufficient conditions for time optimality of systems with control on the disk. *IEEE Conference on Decision and Control* (2019), 2405–2409 (with Orioux, M.) Proceedings of the 58th CDC, Nice, December 2019
- [23c] Classification and feature selection using a primal-dual method and projection on structured constraints. *IEEE Conference on Pattern Recognition* (2021), 6538–6545 (with Barlaud, M.; Chambolle, A.) Proceedings of the 25th ICPR, Milan, January 2021
- [24c] On the convergence of time-optimal maneuvers of fast-oscillating control systems. *European Conference on Control* (2021), 2008–2013 (with Dell’Elce, L.; Pomet, J.-B.) Proceedings of ECC21, Rotterdam, July 2021
- [25c] Zermelo-Markov-Dubins problem with two trailers. *IFAC-PapersOnLine* **54** (2021), no. 19, 249–245. (with Sacchelli, L.; Combot, T.; Pomet, J.-B.) Proceedings of the 7th IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control, Berlin, October 2021
- [26c] Hierarchical MPC applied to bacterial resource allocation and metabolite synthesis. *IEEE Conference on Decision and Control* (2021), 667–672 (with Gouzé, J.-L.; Yabo, A.) Proceedings of the 60th CDC, Austin, December 2021
- [27c] Optimal allocation of bacterial resources in fed-batch reactors. *European Control Conference* (2022), 1466–1471 (with Yabo, A.; Gouze, J.-L.) Proceedings of ECC22, London, July 2022
- [28c] Controllability test for fast-oscillating systems with constrained control. Application to solar sailing. *European Control Conference* (2022), 2143–2148 (with Herasimenka, A.; Dell’Elce, L.; Pomet, J.-B.) Proceedings of ECC22, London, July 2022
- [29c] Two-phase averaging of time-optimal control systems. *IFAC PapersOnLine* **55** (2022), no. 16, 7–12 (best paper award) (with Dell’Elce, L.; Pomet, J.-B.) Proceedings of 18th IFAC Workshop on Control Applications of Optimization, Paris, July 2022
- [30c] The ct project: a toolbox for optimal control. *IFAC PapersOnLine* **55** (2022), no. 16, 13–18 (with Cots, O.; Martinon, P.) Proceedings of 18th IFAC Workshop on Control Applications of Optimization, Paris, July 2022

- [31c] Efficient clustering using alternating minimization and a projection-gradient method for dimension reduction. *IEEE International Conference on Image Processing (2022)*, 176–180 (with Gilet, C.; Deprez, M.; Barbry, P.; Barlaud, M.) Proceedings of 29th ICIP, Bordeaux, October 2022
- [32c] An algorithmic guide for finite-dimensional optimal control problems. *Handbook of numerical analysis*, in Numerical Control: Part B **24** (2023), 559–626 (with Ferretti, R.; Trélat, E.; Zidani, H.)

### Softwares

- [1d] `wasp`: Wavelet Adaptive Solver for boundary value Problems. [apo.enseeiht.fr/wasp](http://apo.enseeiht.fr/wasp)
- [2d] `tfmin`: Minimum time orbit transfer. [apo.enseeiht.fr/tfmin](http://apo.enseeiht.fr/tfmin)
- [3d] `cotcot`: Conditions of Order Two, CONjugate Times. [apo.enseeiht.fr/cotcot](http://apo.enseeiht.fr/cotcot) [apo.enseeiht.fr/cotcot](http://apo.enseeiht.fr/cotcot) (with Bonnard, B.; Trélat, E.)
- [4d] `hampath`: Path following for Hamiltonian boundary value problems. [hampath.org](http://hampath.org) (with Cots, O.; Gergaud, J.)
- [5d] `ct`: Control Toolbox (AMDT Inria Sophia Antipolis) [ct.gitlabpages.inria.fr/gallery](http://ct.gitlabpages.inria.fr/gallery) (with Cots, O.; Martinon, P.; Inria Sophia SED team)

## 2 Teaching and supervision

### Undergraduate

Since 1996, I have been teaching mathematics and scientific computing at all levels in various places (grandes écoles and university): ENSEEIHT (Univ. Toulouse), Univ. Bourgogne, ISAE,<sup>4</sup> ENAC,<sup>5</sup> ENSTA<sup>6</sup> ParisTech, Polytech Nice Sophia (Univ. Côte d’Azur), CNAM, classes préparatoires. I regularly deliver talks on mathematics and their applications in high schools or colleges.

### Graduate

- 2007-2008 Univ. Bourgogne, *Carnot Doctoral School*. Contrôle optimal et applications I.
- 2009-2010 Univ. Bourgogne, *Carnot Doctoral School*. Contrôle optimal et applications II.
- 2012-2013 *7ème école d’été de Peyresq en traitement du signal et des images*. Contrôle optimal : introduction au cas déterministe en dimension finie.

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<sup>4</sup>Institut Supérieur de l’Aéronautique et de l’Espace (previously Supaéro and ENSICA)

<sup>5</sup>École Nationale de l’Aviation Civile

<sup>6</sup>École Nationale Supérieure des Techniques Avancées

- 2013-2014 Institut Henri Poincaré, *Grivasco trimester*. Introduction to optimal control and application to space mechanics.
- 2020-2021 Arba Minch University, *CIMPA school Optimal Control and Applications in Engineering*. Geometric and numeric methods in optimal control.
- 2022-2023 University of the Philippines Diliman, *SEAMS-CIMPA School on modern trends in signal and data processing*. Optimisation for machine learning.
- 2022-2023 University of Seville, Ulysseus Spring School in PDEs. Optimisation of Sturm-Liouville determinants.

### PhD theses and postdocs

- 2003-2006 Romain Dujol, PhD Univ. Toulouse, (co-supervision B. Bonnard). Supported by French Ministry for Higher Education & Research. Now Lecturer at Cy-tech (Pau).
- 2008-2011 Bilel Daoud, PhD Univ. Bourgogne (co-supervision J. Gergaud). Supported by French Ministry for Higher Education & Research (grant no. 31716-2008). Now R & D engineer at NCR Corporation.
- 2009-2012 Olivier Cots, PhD Univ. Bourgogne (co-supervision J. Gergaud). Supported by Conseil Régional de Bourgogne (grant no. 2009-160E-160-CE-160T). Now Lecturer at Univ. Toulouse.
- 2012-2013 Ariadna Farrés, postdoc Univ. Bourgogne. Supported by Conseil Régional de Bourgogne (grant no. 9201AAO049S0273). Now visiting research scientist at NASA.
- 2013-2016 Zheng Chen, PhD Univ. Paris-Saclay (co-supervision Y. Chitour). Supported by Chinese Scholarship Council (grant no. 2013 0629 0024). Now Lecturer at Zhejiang Univ.
- 2013-2016 Achille Sassi, PhD Univ. Paris-Saclay (co-supervision E. Trélat and H. Zidani). Supported by Airbus Safran Launchers. Now Digital Technology Expert chez a2a.
- 2015-2016 Florentina Nicolau, postdoc Inria Sophia (co-supervision J.-B. Pomet). Supported by CNES (contract no. R-S13/BS-005-012). Now Lecturer at Univ. Cergy-Pontoise.aad
- 2015-2018 Michaël Orioux, PhD Univ. Paris-Dauphine (co-supervision J. Féjoz). Supported by French Ministry for Higher Education & Research (ENS Cachan). Now postdoc at Universitat Politècnica de Catalunya.
- 2017-2018 Lamberto Dell'Elce, postdoc Inria Sophia (co-supervision J.-B. Pomet). Supported by CNES (contract no. R-S13/BS-005-012), Inria, UCA MSI and Thalès Alenia Space. Now Researcher at Inria Sophia.



- 2018-2021 Agustín Yabo, PhD Univ. Côte d’Azur (co-supervision J.-L. Gouzé). Supported by French Ministry for Higher Education & Research. PhD prize of STIC Doctoral school (ATSI mention, rank 2nd). Now Researcher at INRAE Montpellier.
- 2019-2020 Sofya Maslovskaya, postdoc Inria Sophia (co-supervision J.-B. Pomet). Supported by CGG and ANR Maximic. Now lecturer Univ. Paderborn.
- 2020-2023 Alesia Herasimenka, PhD Univ. Côte d’Azur (co-supervision L. Dell’Elce and J.-B. Pomet). Supported by French Ministry for Higher Education & Research. 2022 Pierre Laffitte PhD prize laureate, 2023 L’Oréal-Unesco Jeunes talents price.
- 2023-2026 Antonin Bavoil, PhD Univ. Côte d’Azur (co-supervision A. Nême). Supported by CNRS.

### 3 Dissemination of research

#### Projects

- 1998-2001 CNES Toulouse (contract no. 86/776/98/CNES/7462), Low thrust orbit transfer I (with J. Noailles and J. Gergaud)
- 2002-2005 CNES Toulouse (contract no. 02/CNES/0257/00), Low thrust orbit transfer II (with J. Noailles and J. Gergaud)
- 2004-2005 BQR INP Toulouse, Analysis of multi-fractal signals in electromagnetism (with D. Ruiz)
- 2005-2008 Thales Toulouse (contract no. 00778), Flight plan optimisation (with J. Noailles and J. Gergaud)
- 2006-2007 EADS-Astrium Space Transportation Les Mureaux, Min. consumption orbit transfer I (with B. Bonnard, J. Gergaud, E. Trélat and C. Zayane)
- 2006-2008 CNES Évry, Jacobi approaches for discontinuous extremals (with J. Gergaud and G. Janin)
- 2009-2010 EADS-Astrium Space Transportation Les Mureaux, Minimum consumption orbit transfer II (with B. Daoud and J. Gergaud)
- 2009-2012 Conseil Régional de Bourgogne (contract no. 2009-160E-160-CE-160T), programme FABER
- 2009-2013 ANR programme blanc (project no. NT09 504490), Geometric Control Methods (PI U. Boscain)
- 2010-2012 ADT Inria, BOCOP optimal control toolbox (PI P. Martinon)
- 2011-2012 BQR Univ. Bourgogne, Contrôle optimal des spins et applications en imagerie par résonance magnétique nucléaire (PI D. Sugny)

- 2011-2014 SADCO Initial Training Network (FP7 grant no. 264735-SADCO), Sensitivity Analysis for Deterministic Controller Design (PI H. Zidani)
- 2014-2017 CNES Toulouse (contract no. R-S13/BS-005-012), Perturbations & averaging for low thrust (with J.-B. Pomet)
- 2015-2016 AMIES Labex (PEPS), Mathematics for smart energy at home (with C. Prud'homme and an industrial partner)
- 2016-2017 AMIES Labex (PEPS), Dealing with exclusion constraints in orbital transfer (with Thales Alenia Space Cannes)
- 2016-2018 PGMO (Fondation Mathématique J. Hadamard) grant no. 2016-1753H on "Metric approximation of minimizing trajectories and applications"
- 2016-2019 FCT grant no. PTDC/MAT-CAL/4334/2014, Extremal spectral quantities and related problems (PI P. Freitas)
- 2017-2018 UCA MSI (PEPS), Effet des résonances sur la moyennisation en contrôle optimal appliqué à la mécanique spatiale (with Inria and Thales Alenia Space Cannes)
- 2017-2023 ANR Maximic, Optimal control of microbial cells by natural and synthetic strategies (PI H. De Jong)
- 2018-2019 CGG contract, Trajectory optimisation for marine exploration (with L. Giraldi, J.-B. Pomet)
- 2019-2022 InriaHUB ct, Control Toolbox (with O. Cots, P. Martinon, Inria SED)
- 2020-2022 PGMO (Fondation Mathématique J. Hadamard) grant on "Extremal determinants" (with Y. Chitour, P. Freitas, Y. Privat)
- 2020-2024 ESA contract on "Optimal control of solar sails" (with A. Herasimenka, L. Dell'Elce, J.-B. Pomet)
- 2022-2023 CIMI grant on "Singular control and numerical optimisation in Julia" (with J. Gergaud, O. Cots)
- 2023-2026 CNRS & AID grant on "Kite Electrical Energy Production" (with C. Jochum, J.-B. Leroux, A. Nême, M. Sacher)
- 2023-2028 PEPR IA, projet ciblé "PDE-AI: numerical analysis, optimal control and optimal transport for AI" (PI A. Chambolle)

### Conference organization

- 09/2007 Mini-sympos. "Optimal control", *13th Czech-Franco-German conference on Optimization*, Heidelberg (with Gergaud, J.)
- 01/2008 Séminaire Résonances, *CCT mécanique orbitale*, CNES Toulouse (with Lamy, A.)

- 06/2008 *Workshop on space and quantum dynamics*, Dijon (with Bonnard, B.; Sugny, D.)
- 03/2011 *SADCO Workshop on aerospace applications of control and optimization*, Paris (with Cerf, M.; Zidani, H.)
- 05/2011 Mini-symposium "Optimisation de trajectoires en mécanique spatiale", *Congrès SMAI*, Guidel (with Haberkorn, T.)
- 09/2011 Mini-symposia "Analytic and geometric optimal control I-II", *IFIP 2011*, Berlin (with Boscain, U.)
- 03/2012 Session Industrielle, *Journées SMAI-MODE*, Dijon
- 04/2012 *Spring school and Workshop on Numerical Methods in Control*, Paris, (with Bonnans, J. F.; Trélat, E.; Zidani, H.)
- 06/2012 *Contrôle optimal géométrique*, Dijon (with Chyba, M.; Sugny, D.; Trélat, E.)
- 05/2013 Mini-symposium "Optimisation en aéronautique et mécanique spatiale", *Congrès SMAI*, Seignosse
- 07/2014 *New trends in optimal control (NETCO'2014)*, Tours (with Barles, G.; Briani, A.; Cardaliaguet, P.; Ley, O.; Trélat, E.; Zidani, H.)
- 11/2014 *Geometric control and related fields*, Linz (with Bergounioux, M.; Haberkorn, T.)
- 01/2015 *Journée équipe McTAO*, Dijon (with Bonnard, B.; Pomet, J.-B.; Rifford, L.)
- 06/2015 Mini-symposium "Contrôle et applications", *Congrès SMAI*, Les Karellis
- 06/2015 *17th British-French-German Conference on Optimization*, London (member of Scientific Committee)
- 06/2015 *Journée du GT Programmation Mathématique du GdR RO*, Dijon (with Barbara, A.; Cabot, A.; Jourani, A.)
- 12/2015 *Journées du GdR MOA*, Dijon (with Barbara, A.; Cabot, A.; Jourani, A.; Vaïter, S.)
- 01/2016 *10th International Young Researcher Workshop on Geometry, Mechanics and Control*, Paris (IHP) (with Gay-Balmaz, F.; Jean, F.; Marco, J.-P.)
- 01/2016 *Journée équipe McTAO*, Sophia Antipolis (with Bonnard, B.; Giraldi, L.; Pomet, J.-B.; Rifford, L.)
- 08/2016 *The cut locus: a bridge over differential geometry, optimal control and transport*, Bangkok (with Bonnard, B.; Kondo, K.; Rifford, L.; Tanaka, M.)

- 10/2016 *Journée équipes MokaPlan-McTAO*, Paris (with Carlier, G.; Pomet, J.-B.)
- 01/2017 *Première journée SMAI MAS-MODE*, Paris (with Le Pennek, E.)
- 09/2017 Mini-symposium "Geometric control & applications", *18th French-German-Italian conference on optimization*, Paderborn
- 11/2017 Mini-symposium "Optimal control & applications to biology", *PGMO days 2017*, Paris Saclay
- 07/2018 Session on "Optimal Control and PDE Constrained Optimization", *ISMP 2018*, Bordeaux (with Zidani, H.)
- 09/2018 *The cut locus 2018*, Sapporo (with Kondo, K.; Ohta, S.-I.; Rifford, L.; Sabau, S.; Tanaka, M.)
- 11/2018 Mini-symposia "Optimal control and applications I and II", *PGMO days 2018*, Palaiseau (with Zidani, H.)
- 07/2019 Mini-symposium "Computational methods and applications in optimal control", *ICIAM 2019*, Valencia (with Cots, O.; Martinon, P.)
- 09/2019 *19th French-German-Swiss conference on optimization*, Nice (with Auroux, D.; Duvigneau, R.; Habbal, A.; Malot, C.; Pantz, O.; Pronzato, L.; Rifford, L.; Ruelle, R.; Soresi, C.)
- 06/2021 *Journées de la Statistique*, Nice (with Auroux, D.; Bouveyron, C.; Burette, S.; Catellier, R.; Corneli, M.; Descombes, S.; Diel, R.; Dreyfuss, P.; Gautero, F.; Laloe, T.; Malot, C.; Mary, D.; Muzy, A.; Precioso, F.; Pronzato, L.; Reynaud-Bouret, P.)
- 11/2021 *SEME / MSGI AI & companies week*, Sophia Antipolis (with Auroux, D.; Barret, M.; Bouali, A.; Bouveyron, C.; Busé, L.; Descombes, S.)
- 11/2021 Mini-symposia "Optimal control and applications I and II", *PGMO days 2021*, Palaiseau (with Chitour, Y.)
- 10/2022 *Journées du GdR MOA*, Nice (with Habbal, A.; Vaiter, S.)
- 11/2022 Mini-symposia "Optimal control applied to life sciences I and II", *PGMO days 2022*, Palaiseau (with Djema, W.)
- 01/2023 Half-day on Julia, Inria centre at Université Côte d'Azur (with Veltz, R.)
- 08/2023 Optimal control: methods and applications, *ICIAM 2023*, Tokyo (with Dell'Elce, L.; Moreau, C.)

## Talks

- 06/1998 *Séminaire CESAME*, Leuven  
06/1999 *Nonlinear Sciences on the Border of Milleniums*, Saint-Petersburg  
10/1999 *6th International Conference on Parametric Optimization and Related Topics*, Dubrovnik  
03/2000 *Journées SMAI-MODE*, Toulouse  
05/2000 *Nonlinear Analysis 2000*, New-York  
02/2001 *Séminaire MIP*, Toulouse  
05/2001 *3rd Workshop on Stability and Sensitivity of Optimal Control Problems*, Burg  
01/2002 *Journées Commande*, Orléans  
12/2003 *23rd Interdisc. Meeting on Anti-infectious Chemotherapy (RICAI)*, Paris (with Augot, A.; Bernier, M.; Noailles, J.; Philippon, A.)  
07/2004 *First joint Canada-France meeting of the mathematical sciences*, Toulouse (with Dujol, R.; Gergaud, J.; Haberkorn, T.; Martinon, P.; Noailles, J.; Preda, D.)  
05/2005 *Congrès SMAI*, Évian  
03/2006 *Séminaire Équa. diff. et contrôle*, Dijon  
03/2007 *Séminaire ERIM*, Nouméa  
04/2007 *Séminaire Équa. diff. et contrôle*, Dijon  
05/2007 *Workshop on Control, Optimization and Stability of Non-linear Systems: Geometric and Analytic Methods*, Trieste  
06/2007 *Mathematical Control Theory and Mechanics*, Suzdal  
09/2007 *13th Czech-Franco-German conference on Optimization*, Heidelberg  
05/2008 *Journées Bordeaux-Pau-Toulouse*, Anglet  
05/2008 *Aerospatial dynamics and Optimal Control*, Paris  
06/2008 *Differential equations and topology (dedicated to the centennial anniversary of L. S. Pontryagin)*, Moscow  
11/2008 *Séminaire Astronomie et Systèmes Dynamiques*, Observatoire de Paris  
03/2009 *Journées math. Besançon-Dijon*, Dijon  
09/2009 *14th Belgium-Franco-German conference on Optimization*, Leuven  
03/2010 *Colloquium Institut math. de Bourgogne*, Dijon  
02/2011 *Séminaire Commands*, Paris  
06/2011 *New Trends in Astrodynamics and Applications VI*, New-York  
07/2011 *SIAM Control*, Baltimore (with Cerf, M.; Daoud, B.)  
08/2011 *Equadiff*, Loughborough  
09/2011 *25th IFIP TC 7 Conference on System Modelling and Optimization*, Berlin  
10/2011 *Conférence du Laboratoire International Associé Franco-Maghrébin du CNRS*, Nice  
03/2012 *Journées SMAI-MODE*, Dijon  
02/2013 *Groupe de travail Contrôle*, Paris  
03/2013 *Séminaire de géométrie hamiltonienne*, Paris  
04/2013 *Séminaire Parisien d'Optimisation*, Paris  
09/2013 *Workshop on optimal and model predictive control*, Bayreuth  
09/2013 *CELMEC VI*, Viterbo (with Farrés, A.)  
12/2013 *Séminaire Stats, Contrôle, Opti. et Probas*, Dijon  
12/2013 *Séminaire Lab. J.-L. Lions*, Paris

03/2014 *Journées SMAI-MODE*, Rennes  
 05/2014 *Séminaire de géométrie sous-Riemannienne*, Paris  
 05/2014 *Séminaire ROMA de l'ISAE*, Toulouse  
 07/2014 *10th AIMS Conference on Dynamical Systems, Differential Equations and Applications*, Madrid  
 07/2014 *12th EUROPT Workshop on Advances in Continuous Optimization*, Perpignan  
 09/2014 *Séminaire "Temps et espace" de l'Observatoire*, Paris  
 11/2014 *Workshop "Non-holonomic Mechanics and Geometric Optimal Control", IHP trimester on "Geometry, Analysis and Dynamics on Sub-Riemannian Manifolds"*, Paris  
 06/2015 *17th British-French-German Conference on Optimization*, London  
 06/2015 *Rencontres mathématiques de Rouen*, Rouen  
 07/2015 *SIAM Conference on Control and its applications*, Paris  
 09/2015 *Séminaire SPOT*, Toulouse  
 03/2016 *Séminaire Dynamique et géométrie*, Nice  
 04/2016 *Séminaire de géométrie hamiltonienne*, Paris  
 05/2016 *Emerging Trends in Applied Mathematics and Mechanics*, Perpignan  
 06/2016 *Alicante-Limoges-Elche Meeting on Optimization*, Cartagena  
 08/2016 *The cut locus: a bridge over differential geometry, optimal control and transport*, Bangkok  
 09/2016 *Séminaire Astrogéo*, Sophia Antipolis  
 11/2016 *PGMO Days 2016*, Paris Saclay  
 02/2017 *Séminaire ENAC*, Toulouse  
 06/2017 *Mathematical Control Theory*, Porquerolles  
 07/2017 *New Horizons on Optimal Control*, Porto  
 09/2017 *68th International Astronautical Congress*, Adelaide (with Dargent, T.; Nicolau, F.)  
 09/2017 *CELMEC VII*, San Martino (with Dell'Elce, L.; Pomet, J.-B.)  
 11/2017 *PGMO Days 2017*, Paris Saclay (with Barlaud, M.; Gilet, C.)  
 12/2017 *10th NIPS Workshop on Optimization for Machine Learning*, Los Angeles (with Barlaud, M.; Deprez, M.; Gilet, C.)  
 01/2018 *UCA Complex days*, Nice  
 02/2018 *Recent advances in Hamiltonian dynamics and symplectic topology*, Padova  
 03/2018 *Journées SMAI-MODE*, Autrans (with Dell'Elce, L.; Pomet, J.-B.; also with Barlaud, M.; Deprez, M.; Gilet, C.)  
 06/2018 *20th European Conference on Mathematics for Industry*, Budapest (with Dollé, G.; Prud'homme, C.)  
 11/2018 *PGMO Days 2018*, Palaiseau (with Antonini, M.; Barlaud, M.; Zhou, Y.)  
 12/2019 *Learning week*, Air France Sophia  
 02/2020 *Groupe de travail Calcul scientifique et machine learning*, Nice  
 09/2020 *Journées SMAI-MODE*, Paris-Saclay  
 02/2021 *Dynamic Control and Optimization*, Aveiro  
 11/2021 *PGMO Days 2021*, Palaiseau (with Chitour, Y.; Freitas, P.; Privat, Y.)  
 05/2022 *FGP 2022*, Porto (with Chitour, Y.; Freitas, P.; Privat, Y.)  
 06/2022 *Journées SMAI-MODE*, Limoges (with Gouzé, J.-L.; Yabo, A.)

- 06/2022 *Workshop on optimal control theory*, Rouen (with Chitour, Y.; Freitas, P.; Privat, Y.)
- 09/2022 *LJAD Colloquium*, Nice
- 11/2022 *PGMO days 2022*, Palaiseau
- 05/2023 *Optimization and Control in Burgundy*, Dijon
- 06/2023 *Journée contrôle optimal et applications*, Marseille
- 06/2023 *25th Euro AD Workshop*, Sophia
- 07/2023 *JuliaCon 2023*, Cambridge
- 08/2023 *ICIAM 2023*, Tokyo
- 10/2023 *Julia optimization day*, Paris
- 11/2023 *Aspects mathématiques de la mécanique céleste et newtonienne*, Avignon
- 12/2023 *New trends and challenges in optimization theory applied to space engineering*, L'Aquila

## Outreach

- 05/2011 *Lycée Stephen Liégeard*, Brochon
- 04/2012 *Lycée Eiffel*, Dijon
- 06/2013 Stage MathC2+ "Trop fort les maths", Institut math., Dijon
- 03/2014 *Lycée Hyppolite Fontaine*, Dijon
- 03/2015 *Lycée de Gaulle*, Dijon
- 05/2015 *Lycée Antoine*, Chenove
- 03/2016 *Lycée de Gaulle*, Dijon
- 06/2017 Stage MathC2+, Inria Sophia Antipolis
- 10/2017 *Lycée Amiral*, Grasse
- 07/2019 *Gymnase Bern-Neufeld*, en visite à Nice
- 12/2019 Stage collège, Inria Sophia Antipolis
- 01/2020 *Collège Klein*, La Colle sur Loup
- 02/2020 *Lycée Rouvière*, Toulon
- 03/2020 *Collège International de Valbonne*, Valbonne
- 03/2020 *Journée formation rectorat*, Nice
- 10/2020 *Remise prix Olympiades*, Nice
- 03/2022 "Regards de géomètre", *École Toreille*, Vence

Short notes in "Mathématiques de la planète terre":

- *Tout autour de la terre*  
[breves-de-maths.fr/tout-autour-de-la-terre](http://breves-de-maths.fr/tout-autour-de-la-terre)
- *Un ellipsoïde peut en cacher un autre*  
[breves-de-maths.fr/tout-autour-de-la-terre-2nde-partie](http://breves-de-maths.fr/tout-autour-de-la-terre-2nde-partie)
- *De la terre à la lune*  
[culturemath.ens.fr/breves/de-la-terre-a-la-lune](http://culturemath.ens.fr/breves/de-la-terre-a-la-lune)

## 4 Academic service

### Scientific

- 1999-2000 Conseil Scientifique Univ. Toulouse IV
- 2005-2007 Conseil de laboratoire IRIT
- 2010-2013 Comité direction Institut math. Bourgogne, responsable financier
- 2010-2013 Bureau Commission de proposition (math.) Univ. Bourgogne
- 2010-2017 Conseil de laboratoire Institut math. Bourgogne
- 2010— Comités de sélection 26ème section (Dijon, Marseille, Nice, Orléans, Paris, Toulouse...)
- 2011-2017 Groupe SMAI-MODE, responsable (2013-2016)
- 2012-2013 Séminaire Contrôle, Optimisation, Transport, Institut math. Bourgogne, organizer
- 2013-2016 Labex AMIES, industrial correspondent
- 2015-2017 Équipe CNRS Statistique, Probabilités, Optimisation & Contrôle, Institut math. Bourgogne, joint head



- 2016-2018 Séminaire de géométrie hamiltonienne de Sorbonne Université, co-organizer
- 2016-2019 Conseil scientifique de l'Institut de Mécanique Céleste et de Calcul des Éphémérides (Observatoire de Paris)
- 2016-2020 Conseil scientifique du GdR Calcul
- 2017-2023 Conseil scientifique PGMO, Fondation Mathématique Jacques Hadamard
- 2017— Centre Spatial Universitaire UCA (projet CubeSat)
- 2018 Jury du prix de thèse PGMO
- 2019— Conseil Scientifique 3IA Université Côte d'Azur
- 2020— Editorial board of ESAIM: M2AN
- 2022— Commission de Développement Technologique Inria Sophia, member

**Pedagogical**

- 2005-2007 3ème année math. ENSEEIHT internships, responsable
- 2006-2007 2ème année majeure math. ENSEEIHT, responsable
- 2009-2013 L2 math. Univ. Bourgogne, responsable
- 2014-2016 L1 math. Univ. Bourgogne, responsable
- 2014-2016 Master 2 math. applis Univ. Bourgogne, responsable
- 2014-2016 Conseil UFR Math. & Info. Univ. Paris I
- 2014-2017 Conseil pédagogique département math. Univ. Bourgogne
- 2018-2020 Jury de l'agrégation de mathématiques
- 2018-2022 Département de Mathématiques Appliquées & Modélisation Polytech Nice Sophia, directeur