GEOMETRY OF DYNAMICAL SYSTEMS: FROM THEORY TO APPLICATIONS

This research project belongs to the area of mathematics as it is focused on developing relevant aspects of the geometry of dynamical systems and applications.

Dynamical systems are the core of evolutionary problems and pervade the entire literature in applied mathematics for both finite and infinite dimensional systems and from continuous to discrete evolution. Dynamical systems are typically classified into two main categories. In the first case, time is a continuous variable and the dynamical system under study is described by differential equations. In the second case, time is a discrete variable and the dynamical system is described by difference equations. In this project we plan to study fundamental problems on geometric and numerical analysis of dynamical systems that require the combination of the continuous and discrete points of view in order to tackle problems with impact in the real-world.

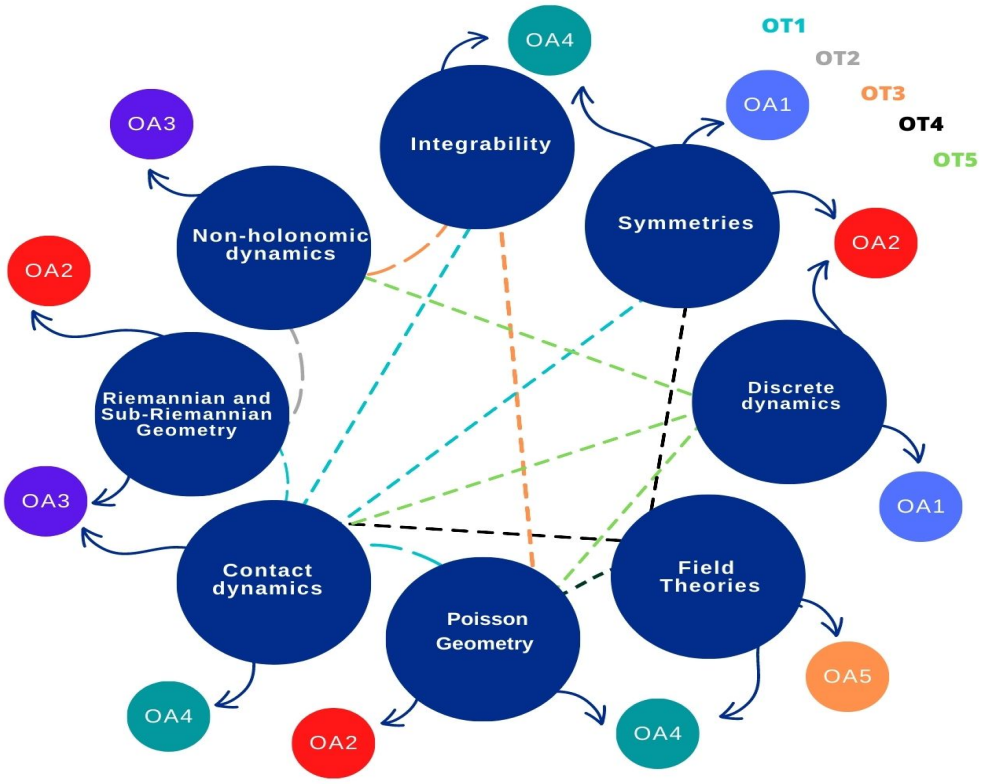
Thus, our interdisciplinary project clearly fits into the area of Geometric Mechanics using techniques of Differential Geometry, Applied Mathematics and Mathematical Physics. It goes beyond theoretical developments, by including relevant applications to Engineering.

The project includes two senior researchers (Manuel de León and David Martín De Diego) with a long scientific career, who are both international references in the field, together with a group of younger researchers with very promising careers (María Barbero, Leonardo Colombo, Cédric M. Campos, Miguel Vaquero, Victor Jimenez, Alexandre Anahory Simoes, Manuel Lainz…) and in cooperation with the coordinated project GEOMETRY, MECHANICS AND FIELD THEORIES research group located at Universidad de La Laguna (IP: Juan Carlos Marrero).

In addition, this project has the collaboration of some foreign scientists with expertise in some of the objectives: A Van der Schaft (Groningen), E. Celledoni (NTNU), A. Bloch (Michigan), M. Epstein (Calgary), etc

Main Research objectives.

- Objective T1 (OT1). **CONTACT GEOMETRY AND RELATED GEOMETRIC STRUCTURES**
- Objective T2 (OT2). **CONSTRAINED DYNAMICS**
- Objective T3 (OT3). **BIHAMILTONIAN SYSTEMS AND INTEGRABILITY**
- Objective T4 (OT4). **GEOMETRIC DESCRIPTION OF CLASSICAL FIELD THEORY**
- Objective T5 (OT5). **GEOMETRIC INTEGRATION AND DISCRETE MECHANICS**
- Objective A1 (OA1). **PARALLEL ITERATIVE METHOD FOR VARIATIONAL INTEGRATION AND APPLICATION TO MARITIME ROUTES**
- Objective A2 (OA2). R**ECENT APPLICATIONS TO MACHINE LEARNING AND ACCELERATED OPTIMIZATION**
- Objective A3 (OA3). **MATHEMATICAL DEVELOPMENTS FOR MULTIAGENT DYNAMICS**
- Objective A4 (OA4). **THE GEOMETRY OF THERMODYNAMICS AND APPLICATION**
- Objective A5 (OA5). **MATERIAL PROPERTIES AND EVOLUTION**



The following are some of the most representative articles of the Madrid research group in each of the objectives.

OT1. CONTACT GEOMETRY AND RELATED GEOMETRIC STRUCTURES

- de León, Manuel; Lainz, Manuel; Muñoz-Lecanda, Miguel C. Optimal control, contact dynamics and Herglotz variational problem. J. Nonlinear Sci. 33 (2023), no. 1, Paper No. 9, 46 pp.
- M. de León, J. Gaset, M. Lainz. Inverse problem and equivalent contact systems. J. Geom. Phys. 176 (2022), Paper No. 104500, 18 pp.
- O Esen; M Lainz; M de León; J C Marrero. Contact Dynamics: Legendrian and Lagrangian Submanifolds. Mathematics. 9, pp. 2704. 2021.
- M. de León, V. Jiménez, M. Lainz. Contact Hamiltonian and Lagrangian systems with nonholonomic constraints. J. Geom. Mech. 13 (2021), no. 1, 25–53.
- M. de León, J. Gaset, M. Laínz, M.C. Muñoz-Lecanda, N. Román-Roy. Higher-order contact mechanics. Ann. Physics 425 (2021), Paper No. 168396, 34 pp.
- Alessandro Bravetti, Manuel de León, Juan Carlos Marrero and Edith Padrón. Invariant Measures For Contact Hamiltonian Systems: Symplectic Sandwiches With Contact Bread. J. Phys. A: Math. Theor. 53 (2020) 455205 (24pp)
- de León, Manuel; Gaset, Jordi; Lainz, Manuel; Rivas, Xavier; Román-Roy, Narciso Unified Lagrangian-Hamiltonian formalism for contact systems. Fortschr. Phys. 68 (2020), no. 8, 2000045, 12 pp.
- de León, Manuel; Lainz Valcázar, Manuel Infinitesimal symmetries in contact Hamiltonian systems. J. Geom. Phys. 153 (2020), 103651, 13 pp.
- de León, Manuel; Lainz Valcázar, Manuel Contact Hamiltonian systems. J. Math. Phys. 60 (2019), no. 10, 102902, 18 pp.

OT2. CONSTRAINED DYNAMICS

- A. Anahory Simoes; JC Marrero; D. Martín de Diego. Jacobi Fields in Nonholonomic Mechanics. J. Phys. A: Math. Theor. 55 045202 (2022).
- A. Anahory Simoes; JC Marrero; D. Martín de Diego. Radial Kinetic Nonholonomic Trajectories are Riemannian Geodesics! Annal Math Phys. 11 - 4, pp. Paper No. 152, 28 pp. 2021.
- Prince, G. E.; Farré Puiggalí, M.; Saunders, D. J.; Martín de Diego, D. Linear connections and shape maps for second order ODEs with and without constraints. J. Geom. Phys. 170 (2021), Paper No. 104390, 18 pp.
- D Iglesias Ponte; VM Jiménez. Automorphisms for connections on Lie algebroids. Mediterr. J. Math. 15, no. 3, Art. 104, 16 pp., 2018.
- María Barbero Liñán; David Iglesias Ponte; David Martín de Diego. Morse families in Optimal Control Problems. SIAM Journal on Control and Optimization. 53, pp.414-433, 2015.
- Bloch, Anthony; Colombo, Leonardo; Gupta, Rohit; de Diego, David Martín A geometric approach to the optimal control of nonholonomic mechanical systems. Analysis and geometry in control theory and its applications, 35–64, Springer INdAM Ser., 11, Springer, Cham, 2015.
- M. Barbero-Liñán, M. Farré Puiggalí, D. Martín de Diego. Isotropic submanifolds and the inverse problem for mechanical constrained systems. J. Phys. A 48 (2015), no. 4, 045210, 35 pp.
- M de León; JC Marrero; D Martín de Diego; M Vaquero. On the Hamilton-Jacobi Theory for Singular Lagrangian Systems. J Math Physics. 54, pp. 032902 – 32 pages. 2013.

OT3. BIHAMILTONIAN SYSTEMS AND INTEGRABILITY

- Esen, O.; de León, M.; Lainz, M.; Sardón, C.; Zając, M.; Reviewing the geometric Hamilton-Jacobi theory concerning Jacobi and Leibniz identities. J. Phys. A 55 (2022), no. 40, Paper No. 403001, 62 pp.
- M. de León, D. Martín de Diego, M. Vaquero. Hamilton-Jacobi theory, symmetries and coisotropic reduction. J. Math. Pures Appl. (9) 107 (2017), no. 5, 591–614.
- S Ferraro; M de León; JC Marrero; D Martin de Diego; M Vaquero. On the Geometry of the Hamilton-Jacobi Equation And Generating Functions. Archive for Rational Mechanics and Analysis. 226 – 1, pp. 243 – 302. 2017.
- M. Barbero-Liñán, M. de León, D. Martín de Diego. Lagrangian submanifolds and the Hamilton-Jacobi equation. Monatsh. Math. 171 (2013), no. 3-4, 269–290.
- M Barbero Liñán; M de León; JC Marrero; D Martín de Diego; MC Muñoz Lecanda. KINEMATIC
- REDUCTION AND THE HAMILTON-JACOBI EQUATION. J Geom Mech. 4 – 3, pp. 207 – 237. 2012.

OT4. GEOMETRIC DESCRIPTION OF CLASSICAL FIELD THEORY

- Esen, Oğul; de León, Manuel; Sardón, Cristina; Zając, Marcin Cauchy data space and multisymplectic formulation of conformal classical field theories. Ann. Physics 434 (2021), Paper No. 168616, 26 pp.
- de León, Manuel; Zając, Marcin Hamilton-Jacobi theory for gauge field theories. J. Geom. Phys. 152 (2020), 103636, 18 pp.
- de León, Manuel; Prieto-Martínez, Pedro Daniel; Román-Roy, Narciso; Vilariño, Silvia Hamilton-Jacobi theory in multisymplectic classical field theories. J. Math. Phys. 58 (2017), no. 9, 092901, 36 pp.
- Búa, Lucia; Bucataru, Ioan; de León, Manuel; Salgado, Modesto; Vilariño, Silvia Symmetries in Lagrangian field theory. Rep. Math. Phys. 75 (2015), no. 3, 333–357.
- Campos, Cédric M.; de León, Manuel; de Diego, David Martín; Vaquero, Miguel Hamilton-Jacobi theory in Cauchy data space. Rep. Math. Phys. 76 (2015), no. 3, 359–387.
- D Iglesias; JC Marrero; M Vaquero. Poly-Poisson structures. Letters In Mathematical Physics. 103 - 10, Pp.1103-1133, 2013.
- CM Campos; E Guzmán; JC Marrero. Classical Field Theories of First Order and Lagrangian Submanifolds of Premultisymplectic Manifolds. J Geom Mech. 4 – 1, pp. 1 – 26, 2012.

OT5. GEOMETRIC INTEGRATION AND DISCRETE MECHANICS

- Colombo, Leonardo; Fernández, Manuela Gamonal; Martín de Diego, David; Variational integrators for non-autonomous Lagrangian systems. J. Comput. Appl. Math. 424 (2023), Paper No. 114966.

- Anahory Simoes, Alexandre; Ferraro, Sebastián J.; Marrero, Juan Carlos; Martín de Diego, David A nonholonomic Newmark method. J. Comput. Appl. Math. 421 (2023), Paper No. 114873, 13 pp.
- Barbero-Liñán, María; Martín de Diego, David: Retraction Maps: A Seed of Geometric Integrators, Foundations of Computational Mathematics (2022).
- Anahory Simoes; JC Marrero; David Martin de Diego. Exact Discrete Lagrangian Mechanics for Nonholonomic Mechanics. Numer. Math. 151 (2022), no. 1, 49–98
- JC Marrero; D Martín de Diego; E Martínez. Local convexity for second order differential equations on a Lie algebroid. J Geom Mech. 13 - 3, pp. 477 - 499. 2021.
- Anahory Simoes, Alexandre; Martín de Diego, David; Lainz Valcázar, Manuel; de León, Manuel On the geometry of discrete contact mechanics. J. Nonlinear Sci. 31 (2021), no. 3, Paper No. 53, 30 pp.
- Martín de Diego, D.; Martín de Almagro, R. T. Sato Variational order for forced Lagrangian systems II. Euler-Poincaré equations with forcing. Nonlinearity 33 (2020), no. 8, 3709–3738.
- Celledoni, Elena; Farré Puiggalí, Marta; Høiseth, Eirik Hoel; Martín de Diego, David Energy-preserving integrators applied to nonholonomic systems. J. Nonlinear Sci. 29 (2019), no. 4, 1523–1562.
- Martín de Diego, D.; de Almagro, R. Sato Martín: Variational order for forced Lagrangian systems. Nonlinearity 31 (2018), no. 8, 3814–3846.
- Barbero-Liñán, María; Farré Puiggalí, Marta; Ferraro, Sebastián; Martín de Diego, David The inverse problem of the calculus of variations for discrete systems. J. Phys. A 51 (2018), no. 18, 185202, 39 pp.
- Colombo, Leonardo; Ferraro, Sebastián; Martín de Diego, David Geometric integrators for higher-order variational systems and their application to optimal control. J. Nonlinear Sci. 26 (2016), no. 6, 1615–1650.
- Colombo, Leonardo; Martín de Diego, David Second-order variational problems on Lie groupoids and optimal control applications. Discrete Contin. Dyn. Syst. 36 (2016), no. 11, 6023–6064.
- JC Marrero; D Martín de Diego; A Stern. Symplectic Groupoids and Discrete Constrained Lagrangian Mechanics. Discrete Continuous Dynamical Systems-Serie A. 35 – 1, pp. 367 – 397. 2015.
- Colombo, Leonardo; Jiménez, Fernando; Martín de Diego, David Variational integrators for mechanical control systems with symmetries. J. Comput. Dyn. 2 (2015), no. 2, 193–225.
- Ferraro, Sebastián; Jiménez, Fernando; Martín de Diego, David New developments on the geometric nonholonomic integrator. Nonlinearity 28 (2015), no. 4, 871–900.
- JC Marrero; D Martín de Diego; E Martínez. The Local Description of Discrete Mechanics. Geometry, Mechanics, and Dynamics, Fields Institute Communications. 73, pp. 285 – 317. 2015.
- D Iglesias; JC Marrero; D Martín de Diego; E Padrón. Discrete Dynamics in Implicit Form. Discrete Continuous Dynamical Systems – Series A. 33 – 3, pp. 1117 – 1135. 2013.
- Jiménez, Fernando; Kobilarov, Marin; Martín de Diego, David Discrete variational optimal control. J. Nonlinear Sci. 23 (2013), no. 3, 393–426.
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OA1. PARALLEL ITERATIVE METHOD FOR VARIATIONAL INTEGRATION AND APPLICATION TO MARITIME ROUTES

- Ferraro SJ., Martin De Diego D., Sato Martin de Almagro R.: Parallel iterative methods for variational integration applied to navigation problems. conference, 7th IFAC Workshop on Lagrangian and Hamiltonian Methods for Nonlinear Control (LHMNC) (Berlin) In: IFAC PAPERSONLINE, AMSTERDAM: 2021

OA2. RECENT APPLICATIONS TO MACHINE LEARNING AND ACCELERATED OPTIMIZATION

- C. M. Campos, A. Mahillo, D. Martín de Diego: Discrete Variational Calculus for Accelerated Optimization, Journal of Machine Learning Research 24(25):1–33, 2023.
- M Vaquero, J Cortés, DM de Diego: Symmetry Preservation in Hamiltonian Systems: Simulation and Learning, arXiv:2308.16331, 2023.
- M. Gamonal, P. Moreno, L. Colombo. Learning shape control of multi-agent systems with Lagrangian Neural Networks. SIAM Conference on Control and Applications, 40-47, 2022.

- Beckers, Thomas; Colombo, Leonardo J.; Hirche, Sandra; Pappas, George J. Online learning-based trajectory tracking for underactuated vehicles with uncertain dynamics. IEEE Control Syst. Lett. 6 (2022), 2090–2095.
- G. Bianchin, M. Vaquero, J. Cortés, E. Dall'Anese. Online Stochastic Optimization for Unknown Linear Systems: Data-Driven Synthesis and Controller Analysis. Accepted in IEEE Trans. Automatic Control.
- M. Vaquero, P. Mestres, J. Cortés. Resource-Aware Discretization of Accelerated Optimization Flows in IEEE Trans. Automat. Control. (2022)

OA3. MATHEMATICAL DEVELOPMENTS FOR MULTIAGENT DYNAMICS

- Aranda-Escolástico, Ernesto; Colombo, Leonardo J.; Guinaldo, María Distributed event-triggered flocking control of Lagrangian systems. IEEE Control Syst. Lett. 6 (2022), 1946–1951.
- Goodman, Jacob; Colombo, Leonardo Geometric control of two quadrotors carrying a rigid rod with elastic cables. J. Nonlinear Sci. 32 (2022), no. 5, Paper No. 65, 31 pp.
- Goodman, Jacob R.; Colombo, Leonardo J. Collision avoidance of multiagent systems on Riemannian manifolds. SIAM J. Control Optim. 60 (2022), no. 1, 168–188.
- Colombo, Leonardo J.; García de Marina, Héctor Forced variational integrators for the formation control of multiagent systems. IEEE Trans. Control Netw. Syst. 8 (2021), no. 3, 1336–1347.
- Bloch, Anthony; Camarinha, Margarida; Colombo, Leonardo Variational point-obstacle avoidance on Riemannian manifolds. Math. Control Signals Systems 33 (2021), no. 1, 109–121.
- Colombo, Leonardo J.; García de Marina, Héctor, Barbero-Liñán,María, Martín de Diego, David: On the observability of relative positions in left-invariant multi-agent control systems and its application to formation control. 2019 IEEE 58th Conference on Decision and Control (CDC), 7333-7338

OA4. THE GEOMETRY OF THERMODYNAMICS AND APPLICATIONS

- Simoes, Alexandre Anahory; de Diego, David Martín; Valcázar, Manuel Lainz; de León, Manuel The geometry of some thermodynamic systems. Geometric structures of statistical physics, information geometry, and learning, 247–275, Springer Proc. Math. Stat., 361, Springer, Cham, [2021].
- Simoes, Alexandre Anahory; de León, Manuel; Lainz Valcázar, Manuel; de Diego, David Martín Contact geometry for simple thermodynamical systems with friction. Proc. A. 476 (2020), no. 2241, 20200244, 16 pp.

OA5. MATERIAL PROPERTIES AND EVOLUTION

- Jiménez, Víctor Manuel; de León, Manuel; Epstein, Marcelo Characteristic foliations of material evolution: from remodeling to aging. Math. Mech. Solids 27 (2022), no. 11, 2373–2403.
- de León, Manuel; Epstein, Marcelo; Jiménez, Víctor: Material geometry-groupoids in continuum mechanics. World Scientific Publishing Co. Pte. Ltd., Hackensack, NJ, [2021], xvi+209 pp.
- Jiménez, Víctor Manuel; de León, Manuel; Epstein, Marcelo Material distributions. Math. Mech. Solids 25 (2020), no. 7, 1450–1458.
- Epstein, Marcelo; Jiménez, Víctor Manuel; de León, Manuel Material geometry. J. Elasticity 135 (2019), no. 1-2, 237–260.
- Epstein, Marcelo; de León, Manuel Material groupoids and algebroids. Math. Mech. Solids 24 (2019), no. 3, 796–806.

TRAINING CAPACITY.

Our team brings together senior and young researchers, all of them supported by publications of high level in the best journals on the topics of the project and general mathematics. The proposed objectives covering theoretical and applied problems and the diversity of techniques necessary for their study (differential geometry, dynamical systems, numerical methods, mechanics...) constitute an excellent framework for the training of PhD students. Moreover, the international scientific relationship of the members of the team ensures an international projection of the Ph.D. students, as the record below shows.
The team that integrates the project is currently supervising 3 Ph. D students whose expected defense dates are listed below.

The students will be enrolled in one of the following Ph. D. programmes:
- Programa de Doctorado de Matemáticas, Universidad Autónoma de Madrid.
- Programa de Doctorado en Investigación Matemática, Universidad Complutense de Madrid.
- Programa de Doctorado en Ingeniería Matemática, Estadística e Investigación Operativa, Universidad Complutense de Madrid y Universidad Politécnica de Madrid.

New Ph.D students will have the options to do research stays at University of Michigan (Prof. Anthony Bloch), University of Groningen (Prof. A. van der Schaft and Prof. M. Seri), Chalmers University (Prof. Klas Modin), NTNU (Prof E. Celledoni), Imperial College (Prof. Darryl Holm), École Normale Supérieure (Prof. F. Gay-Balmaz),etc.

Our group organizes the Summer School on Geometry, Mechanics and Control and the Young Research Workshop on Geometry, Mechanics and Control. Both events are a great opportunity to interact with international researchers and young mathematicians with similar scientific interests.

The following topics would be appropriate to propose to new PhD students supervised by project members:
- Retraction and discretization maps for Geometric integration. Application to accelerated optimization (see Objective OT5 and OA2-1).
- Contact geometry or Material evolution (see Objective OT1 or OA5).
- Geometric description of classical field theories (see Objectives OT4-1, OT4-2; OT4-3).

Theses completed or in progress within the scope of the research team (last 10 years).

- **Omayra Yago Nieto** (in progress). Ph.D. in Mathematical Engineering, Statistics and Operative Research at Department of Mathematics, Science College, Universidad Complutense de Madrid. Title: Geometric and numerical methods for optimal control of mechanical systems. Advisor: Leonardo Colombo. Expected date of defense: July 2025.
- **Asier López Gordon** (in progress). Ph.D in Mathematics at Department of Mathematics, Science College, Universidad Autónoma de Madrid. Title: The Geometry of dissipation. Advisor: Manuel de León Rodríguez. Expected date of defense: July 2024.
- **Efstratios Stratoglou** (in progress). Ph.D. in Automation and Robotics, ETSI Industrial Engineering, Universidad Politécnica de Madrid. Title: On the geometry of nonholonomic virtual constraints. Advisor: Leonardo Colombo. Expected date of defense: July 2024.
- **Jacob Ryan Goodman**. Ph.D. in Mathematics at the Department of Mathematics, Science Faculty, Universidad Autónoma de Madrid. Title: Path planning on Riemannian manifolds: applications to cooperative aerial robotics. Advisor: Leonardo Colombo. Expected date of defense: September, 2023.
- **Manuel Lainz,** Ph.D. in Mathematics at Department of Mathematics, Science Faculty, Universidad Autónoma de Madrid. Title: Contact Hamiltonian Systems. Advisor: Manuel de León. Date of defense: September 20, 2022.
- **Alexandre Anahory Simoes**. Ph.D in Mathematics at Department of Mathematics, Science Faculty, Universidad Autónoma de Madrid. Title: Geometric and Numerical analysis of nonholonomic systems. Advisors: Juan Carlos Marrero and David Martín de Diego. Date of defense: November 26, 2021.

- **María Emma Eyrea Irazú.** Ph.D in Mathematics at Department of Mathematics, Faculty of Sciences, Universidad Nacional de La Plata, Argentina. Title: Geometric and numerical methods associated to mechanical systems with magnetic terms. Advisors: Leonardo Colombo and Marcela Zuccalli. Date of defense: Thesis defended on December 18, 2019.
- **Víctor Jiménez Morales**. Ph.D in Mathematics at Department of Mathematics, Science Faculty, Universidad Autónoma de Madrid. Title: Material Geometry. Advisor: Manuel de León Rodríguez. Date of defense: November 2019.
- **Rodrigo Takuro Sato Martín de Almagro**. Ph.D in Mathematics at Department of Mathematics, Science Faculty, Universidad Complutense de Madrid. Title: Discrete Mechanics for Forced and Constrained Systems. Advisor: David Martín de Diego. Date of defense: June, 2019.
- **Marta Farré Puiggali**. Ph.D in Mathematics at Department of Mathematics, Science Faculty, Universidad Complutense de Madrid. Title: New developments and applications of the Inverse Problem of the Calculus of Variations. Advisors: David Martín de Diego and María Barbero Liñán. Date of defense: 2017.
- **Miguel Vaquero.** PhD in Mathematics at Department of Mathematics, Science Faculty, Universidad Autónoma de Madrid. Title: On the Geometry of the Hamilton-Jacobi equation. Advisor: Manuel de León Rodríguez. Date of defense November 27th, 2015.
- **Leonardo Colombo.** PhD in Mathematics at Department of Mathematics, Science Faculty, Universidad Autónoma de Madrid. Title: Geometric and Numerical Methods for Optimal Control of Mechanical Systems. Advisor: David Martín de Diego. July 2014

Scientific or professional development of graduate doctors.

We detail the professional development of the PhDs supervised by a member of the project research team (from 2000 to present)

- **Manuel Lainz.** Postdoctoral fellow at ICMAT (2023).
- **Alexandre Anahory Simoes.** Postdoctoral fellow associated with FBBVA Project (December 2021- August 2022). Assistant Professor IE University (from September 2022).
- **María Emma Eyrea Irazú**. Postdoctoral fellow from CONICET (Argentinian National Council of Scientific and Technical Research) at Centre for Mathematics of La Plata, CMaLP (April 2020 - March 2023). Assistant Professor (Tenure Track) at CMaLP form 2023.
- **Víctor Jiménez Morales.** Description of the scientific and professional development: Assistant Professor at Universidad de Alcalá (2020 - 2022), Assistant Professor Universidad Nacional de Educación a Distancia (2022-present).
- **Rodrigo Takuro Sato Martín de Almagro**. Description of the scientific and professional development: Postdoctoral fellow at Department of Mechanical Engineering, Institute of Applied Dynamics, Friedrich-Alexander-Universität Erlangen-Nürnberg (Aug 2019 - present).
- **Marta Farré Puiggali.** Description of the scientific and professional development: Post-doctoral fellow at University of Michigan, USA from 2017-2020. Senior Postdoc at University of Antwerp from 2020-2023.
- **Miguel Vaquero.** Description of the scientific and professional development: postdoctoral position at ICMAT 2015-2017, postdoctoral scholar at University of California San Diego from 2017-2020, Assistant Professor at IE University from 2021 to present.
- **Leonardo Colombo.** Prize Vicent Caselles of RSME and FBBVA in 2016. He has held postdoctoral positions at Universidad de Michigan (USA), KTH Royal Institute of Technology (Sweden) and Juan de la Cierva Incorporación (ranked 1st in Mathematics). Postdoctoral Junior Leader Fellowship from la Caixa Foundation. Becario Leonardo FBBVA 2020. Since 2021 he is Científico Titular (Tenured Researcher) at CSIC.
- **Fernando Jiménez.** Postdoctoral researcher at Waseda University (Japan), Technische Universität München (Germany), the University of Munich, Oxford (UK) and University of Waterloo (Canada). Currently, Assistant Professor at UPM.
- **Cédric Martínez Campos.** Marie Curie fellow at Technische Universität München and Université Pierre et Marie Curie, 2011-2013. Postdoctoral fellow at Universidad de Valladolid, 2013-2015. Associate Professor at Yachay Tech University, 2016-2019. Assistant Profesor at Universidad Rey Juan Carlos, 2020-present.
- **Aitor Santamaría**. SM and SRE chapter lead, and Automation chapter lead for DevSecOps, VIEWNEXT

- **Sonia Martínez**, Full Professor, Department of Mechanical and Aerospace Engineering at the University of California, San Diego and a Jacobs Faculty Scholar. NSF CAREER Award in 2007. She is a Senior Editor of Automatica and an IEEE Fellow. Editor in Chief of IEEE Open Journal of Control Systems
- **Jorge Cortés,** Full Professor, Department of Mechanical and Aerospace Engineering, University of California, San Diego. NSF CAREER award in 2006 and was the recipient of the 2006 Spanish Society of Applied Mathematics Young Researcher Prize. At the IEEE Control Systems Society, he has been a Distinguished Lecturer (2010-2014) and an elected member (2018-2020) of its Board of Governors, and is currently its Director of Operations. He is a Fellow of IEEE and SIAM.