

CV Date

08/05/2024

Part A. PERSONAL INFORMATION

First Name *	MARIA	
Family Name *	BARBERO LIÑÁN	
Researcher's identification number	Open Researcher and Contributor ID (ORCID) *	0000-0001-5151-9775
	Researcher ID	
	Scopus Author ID	22033559800

* Mandatory

A.1. Current position

Job Title	Profesora Titular de Universidad		
Starting date	2019		
Institution	Universidad Politécnica de Madrid		
Department / Centre	Matemática Aplicada / ETSAM		
Country		Phone Number	
Keywords	120404 - Differential geometry		

A.2. Previous positions

Period	Job Title / Name of Employer / Country
2015 - 2019	Profesora Contratada Doctora / Universidad Politécnica de Madrid
2011 - 2015	Ayudante Doctor / Universidad Carlos III de Madrid
2010 -	Juan de la Cierva (investigador postdoctoral) / INSTITUTO DE CIENCIAS MATEMATICAS
2010 -	Assistant Professor / Queen's University, Kingston, ON, Canada
2009 -	Investigador postdoctoral (Beatriu de Pinós) / Queen's University, Kingston, ON, Canadá
2009 -	Investigador postdoctoral / Centre de recherche INRIA Nancy-Grand Est, Francia
2005 -	Investigador predoctoral con beca de Formación de Profesorado Universitario (FPU) del Ministerio de Educación y Ciencia / Universitat Politècnica de Catalunya
2005 -	Investigador predoctoral con beca FI de Agencia de Gestio d'Ajuts Universitaris i de Recerca / Universitat Politècnica de Catalunya
2004 -	Becario introducción a la investigación / Centro Europeo para el Paralelismo de Barcelona (CEPBA) IBM Research Institute (CIRI)

A.3. Education

Degree/Master/PhD	University / Country	Year
Programa Oficial de Doctorado en Matemática Aplicada	Universitat Politècnica de Catalunya	2008
Diploma de Estudios Avanzados	Universitat Politècnica de Catalunya	2006

Degree/Master/PhD	University / Country	Year
Licenciado en Matemáticas	Universitat Politècnica de Catalunya	2004

A.4. General quality indicators of scientific production

22 JCR artículos (12 en el primer cuartil, 5 en el primer decil), 34 publicaciones en total, editora de 2 volúmenes de actas de congresos (uno de ellos publicados en Springer Proceedings in Mathematics & Statistics).

WoS 156 citas (133 no autocitas), h-índice 7 (actualizado el 22 de enero de 2023).

Google Scholar: 311 citas y h-índice 10 (actualizado el 22 de enero de 2023).

Codirección de 1 tesis doctoral y dirección de 6 Trabajos de Fin de Grado en Ingeniería y Arquitectura.

Certificado I3 concedido en enero de 2020.

3 sexenios de investigación(tramos 2005-2010, 2011-2016, 2017-2022).

Participación como conferenciante en **más de 40 conferencias internacionales**, entre ellas las prestigiosas del área de Matemática Aplicada e Ingeniería de Control como AIMS, IFAC, ICIAM, IEEE-CDC.

19 coautores de diferentes instituciones en Argentina, Canadá, Dinamarca, Francia, Polonia, Estados Unidos de América y España.

Part B. CV SUMMARY

I am currently a **Profesor Titular de Universidad** at the Department of Applied Mathematics at **U. Politécnica de Madrid**. Graduated in Mathematics (Licenciada) in 2004, obtained a **Ph D in Applied Mathematics in 2008** (awarded as **Best PhD Dissertation in 2011**) both at **U. Politécnica de Cataluña**.

My research focuses, generally speaking, on how different aspects of differential geometry intertwine with more applied sciences like mechanics, control theory, architecture and material engineering, in a continuous and discrete framework. The use of typical tools in differential geometry, topology and Lie algebra theory has been deepening and, still does, the understanding of geometric control theory and geometric mechanics, both in the continuous and the discrete setting.

The geometric techniques on optimal control theory mastered during the Ph.D made me the most suitable candidate to enroll the project at **INRIA in France as a postdoctoral fellow** to develop tracking algorithms for mechanical control systems such as submarines, planar rigid bodies. I not only developed the algorithms theoretically, but also implemented them in SciLab, a free simulation software.

In order to pursue some open problems left behind during my Ph.D thesis I started a postdoctoral stay, financially supported by **Beatriu de Pinós postdoctoral fellowship, at Queen's University, Canada**, to continue to work with Prof. Lewis. **I provided a partial answer to an open problem since the nineties:** the intrinsic characterization of the accessibility algebra for affine connection mechanical control systems at some points with nonzero velocity. After obtaining a **Juan de la Cierva fellowship at ICMAT and becoming Profesor Ayudante Doctor at UC3M** I started to work on exploiting different geometric structures to describe mechanic, engineering problems and control systems.

I have been a visiting scientific researcher at prestigious institutions such as The Fields Institute for the Research in Mathematical Sciences and University of Waterloo in Canada; University of California, San Diego (USA); Institute of Mathematics of the Polish Academy of Sciences, Poland; École Nationale Supérieure de Techniques Avancées and Institut Henri Poincaré, France; Universidade de Coimbra, Portugal; University of Bergen, Norway; University of Southern Denmark.

In 2018-2019 I was **the main researcher of an individual research project** (GEOmetric structures to enhance Control and engineering problems (GEO-Coep)) within the program Ayuda dirigida a Jóvenes Investigadores para Fortalecer sus Planes de Investigación en el marco del Programa Propio de I+D+i 2018 de la UPM (10000 €). In 2014-2015 I was the **main researcher (IP) of an international research project between Norway and Spain**

supported by EEA Financial Mechanism. I have participated in 1 international IRSES network project supported by European Community and in 13 research and network projects supported by Spanish Institutions with international participants, including **Severo Ochoa Excellence Programme**.

I am also the **chair of the scientific committee of the International Young Researcher Workshop on Geometry, Mechanics and Control** and have organized more than 20 international conferences. I am also involved in the dissemination math program in high schools and to the general public.

The current research lines focus on describing geometrically complex control systems such as port-Hamiltonian and multiagent systems, to construct geometric integrators.

Part C. RELEVANT ACCOMPLISHMENTS

C.1. Publications

AC: corresponding author. (n° x / n° y): position / total authors. If applicable, indicate the number of citations

- 1 **Scientific paper**. María; David. 2022. Retraction maps: a seed of geometric integrators. Found Comput Math.
- 2 **Scientific paper**. Alexandre Anahory Simoes; María Barbero Liñán; Leonardo Colombo; David Martín de Diego. 2023. Higher-order retraction maps and construction of numerical methods for optimal control of mechanical systems. Proc. 62th. IEEE Conference on Decision and Control.
- 3 **Scientific paper**. María; David. 2022. Presymplectic integrators for optimal control problems via retraction maps. Controlo 2022. Springer.
- 4 **Scientific paper**. María Barbero Liñán; Jorge Cortés Monforte; Sonia Martínez; David Martín de Diego; Miguel C. Muñoz Lecanda. 2020. Global controllability tests for geometric hybrid control systems. Nonlinear Analysis: Hybrid Systems. 38, pp.100935. <https://doi.org/10.1016/j.nahs.2020.100935>
- 5 **Scientific paper**. María Barbero Liñán; Hernan Cendra; Eduardo García-Toraño; David Martín de Diego. 2019. Morse families and Dirac systems. Journal of Geometric Mechanics. 11-4. GoogleScholar (3)
- 6 **Scientific paper**. Leonardo Colombo; Héctor García de Marina; María Barbero Liñán; David Martín de Diego. 2019. On the observability of relative positions in left-invariant multi-agent control systems and its application to formation control. Proc. 58th. IEEE Conference on Decision and Control.
- 7 **Scientific paper**. María Barbero Liñán; Hernan Cendra; Eduardo García-Toraño; David Martín de Diego. 2018. New insights in the geometry and interconnection of port-Hamiltonian systems. Journal of Physics A: Mathematical and Theoretical. 51-37. GoogleScholar (2)
- 8 **Scientific paper**. María Barbero Liñán; Marta Farré Puiggalí; Sebastián Ferraro; David Martín de Diego. 2018. The inverse problem of the calculus of variations for discrete systems. Journal of Physics A: Mathematical and Theoretical. 51-18. SCOPUS (2), GoogleScholar (4) <https://doi.org/10.1088/1751-8121/aab546>
- 9 **Scientific paper**. María Barbero Liñán; David Martín de Diego. 2018. Bäcklund transformations in discrete variational principles for Lie-Poisson equations. Springer Proceedings in Mathematics and Statistics. 276, pp.315-332.
- 10 **Scientific edition**. Kurusch Ebrahimi Fard; María Barbero Liñán. 2018. Discrete Mechanics, Geometric Integration and Lie-Butcher Series. Springer Proceedings in Mathematics & Statistics. Springer. 267.

C.2. Conferences and meetings

- 1 María. Symplectic integration of constrained mechanical systems via discretization maps. II Encuentro RSME-UMA. RSME-UMA. 2022. Spain.

- 2 María. Presymplectic integrators for optimal control problems via retraction maps. 15th APCA International Conference on Automatic Control and Soft Computing. PORTUGUESE ASSOCIATION OF AUTOMATIC CONTROL.. 2022. Portugal.
- 3 María. Retraction maps: a seed of geometric integrators for optimal control problems. French German Portuguese 2022 Conference on Optimization. Institute of Systems and Computer Engineering, Technology and Science. 2022. Portugal.
- 4 María. From retraction maps to geometric integrators for optimal control problems. VI Congreso Latinoamericano de Matemáticos. Unión Matemática de América Latina y el Caribe. 2021. Uruguay.
- 5 María. Retraction maps: a new seed for geometric integrators. SIAM Conference on Control and Its Applications (CT21). SIAM. 2021. United States of America.
- 6 María Barbero Liñán. Superficies minimales regladas y control óptimo.. XX Encuentro de invierno. Geometría, Mecánica y Control. 2019. Spain.
- 7 María Barbero Liñán. The geometry and interconnection of port-Hamiltonian systems. II Joint Meeting Spain-Brazil in Mathematics. Universidad de Cádiz. 2018. Spain.
- 8 María Barbero Liñán. Geometric (discrete) controllability for control-affine systems. Dynamics, Control and Geometry, in honor of Bronislaw Jakubczyk's 70th birthday.. Institute of Mathematics of the Polish Academy of Sciences. 2018. Poland.
- 9 María Barbero Liñán. New insights in the geometry and interconnection of port-Hamiltonian systems. 12th AIMS International Conference on Dynamical Systems, Differential Equations and Applications. National Center for Theoretical Sciences. 2018. Taiwan.
- 10 María Barbero Liñán. La geometría de la interconexión de sistemas hamiltonianos con puertos. XIX Encuentro de invierno. Geometría, Mecánica y Control. 2018. Spain.

C.3. Research projects and contracts

- 1 **Project.** PID2022-136585NB-C21, Geometry of dynamical systems: from theory to application. MINISTERIO DE EDUCACION Y CIENCIA. David Martín de Diego. (INSTITUTO DE CIENCIAS MATEMATICAS). 01/09/2023-31/08/2028. 178.750 €.
- 2 **Project.** PID2019-106715GB-C21, Geometric structures in dynamical systems, mechanics and hydrodynamics. MINISTERIO DE EDUCACION Y CIENCIA. Daniel Peralta Salas. (INSTITUTO DE CIENCIAS MATEMATICAS). 01/06/2020-31/05/2023. 78.287 €.
- 3 **Project.** EIN2019-103037, NEW APPLICATIONS OF GEOMETRIC INTEGRATION IN ENGINEERING. Ministerio de Ciencia e Innovación. Universidades. David Martín de Diego. 2019-2021. 15.500 €.
- 4 **Project.** VJIDOCUPM18MBL, GEOmetric structures to enhance Control and engineering problems (GEO-Coep). Ayuda dirigida a Jóvenes Investigadores para Fortalecer sus Planes de Investigación en el marco del Programa Propio de I+D+i de la Universidad Politécnica de Madrid. María Barbero Liñán. (Universidad Politécnica de Madrid). 10/2018-31/12/2019. 10.000 €. Investigadora principal de este proyecto dentro de "Ayuda dirigida a Jóvenes Investigadores para Fortalecer sus Planes de Investigación en el marco del Programa Propio de I+D+i" evaluado dentro del á...
- 5 **Project.** MTM2016-76072-P., Geometric and numerical analysis of dynamical systems and applications to mathematical physics. MINISTERIO DE EDUCACION Y CIENCIA. Daniel Peralta Salas. (INSTITUTO DE CIENCIAS MATEMATICAS). 2016-31/12/2019. 31.921 €.

C.5. Stays in public or private R&D centres

- 1 KTH. Sweden. Estocolmo. 27/10/2019-01/11/2019. Guest.
- 2 University of Southern Denmark. Denmark. Odense. 07/04/2019-11/04/2019. Guest.