MINISTERIO DE CIENCIA E INNOVACIÓN

Cofinanciado por la Unión Europea

AGENCIA ESTATAL DE INVESTIGACIÓN

CURRICULUM VITAE (CVA)

IMPORTANT – The Curriculum Vitae cannot exceed 4 pages. Instructions to fill this document are available in the website.

CV date	29/11/2021

Part A. PERSONAL INFORMATION

First name	Juan Ramón		
Family name	Pacha Andújar		
Gender (*)	Male	Birth date (dd/mm/yyyy)	22/08/1967
Social Security, Passport, ID number			46590657 V
e-mail	juan.ramon.pacha@upc.edu	URL Web	
Open Researcher and Contributor ID (ORCID) (*)		0000-0003-4599-3141	

(*) Mandatory

A.1. Current position

Position	Profesor agregado			
Initial date	24/10/2010			
Institution	Universidad Politécnica de Cataluña (UPC)			
Department/Center	Dept.of Mathematics	Escuela Técnica Superior de Ingeniería de Barcelona (ETSEIB)		
Country	Spain		Teleph. number	934054256
Key words	Dynamical Systems, Celestial Mechanics, Differential Equations			

A.2. Previous positions (research activity interuptions, art. 14.2.b))

Period	Position/Institution/Country/Interruption cause
01/02/2006-23/12/2010	Colaborador-Doctor/UPC/Spain
01/09/2000-31/01/2006	Prof. Asociado/UPC/Spain

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Licensed	Universidad de Barcelona/Spain	1990
PhD	Universidad Politécnica de Cataluña/Spain	2002

Part B. CV SUMMARY *(max. 5000 characters, including spaces)*

Position: Lecturer (“professor agregado”) at the Universidad Politécnica de Cataluña since 2010.

Key numbers: 11 research articles 10 of them indexed in 9 different JCR-indexed journals. 9 co-authors. Citations: 70 (Web of Science), 78 (Scopus), 141 (Research Gate), 150 (Google Scholar). H-Index: 5 (Elsevier), 5 (Scopus), 7 (Google Scholar).

Research field: Hamiltonian Dynamical Systems, Celestial Mechanics and Atomic Physics (from the point of view of classical dynamics).

Main scientific achievements: (in collaboration with other co-authors) description of the local dynamics in a neighbourhood of 1:-1 non semi-simple resonant periodic orbit, using

bifurcation theory and KAM methods. For Hamiltonian systems with hyperbolic equilibrium points, development of methods to detect transversal intersections of invariant manifolds along homoclinic loops. For Hamiltonian systems with a saddle-center equilibrium point and an homoclinic orbit, it is stated that, if n elliptic and 2 hyperbolic directions are assumed together with the existence of an homoclinic orbit; then, generically, the invariant manifolds of the KAM hyperbolic tori close to the equilibrium point intersect transversally when the system is perturbed. Furthermore, on particular examples, it is shown that such intersections can be detected by means of a Melnikov potential.

The theoretical studies related with periodic and quasiperiodic bifurcations carried out have been applied in Celestial Mechanics (in the Circular Restricted Three Body Problem) and in atomic physics (in a model of the Rydberg atom in a circular polarized microwave field).

Other research interests: Invariant subspaces, control theory, and piecewise and non-smooth dynamical systems.

Activities related with diffusion of research: Organizing cometee of the *2a. Jornada de Sistemes Dinàmics a Catalunya*. October, 4th, 2017 [2JSDC2017].

Teaching profile. Calculus in technical schools, and Differential Equations, and Numerical Methods both in technical schools and in the Mathematics Faculty.

Part C. RELEVANT MERITS *(sorted by typology)*

C.1. Publications *(see instructions)*

1. Ollé, M; Pacha, J.R. (2019): How does the Hopf bifurcation appear in the hydrogen atom in a circularly polarized (CP) microwave field? *Extended abstracts Spring 2018. Singularly Perturbed Systems, Multiscale Phenomena and Hysteresis: Theory and Applications,* 237–244, In Trens. Math. Res. Perspect. CRM. Barc. 11. Birkhauser/Springer, Cham, [2019]. ISBN: 978-3-030-25261-8 **MR4094368.**

2. Ollé, M; Pacha, J.R. (2018) Hopf bifurcation for the hydrogen atom in a circularlypolarized microwave field. Commun Nonlinear Sci. Numer Simul. 62, 27–60. Review (from MathSciNet MR): Using analytic tools, the authors state that, for a threshold of the polarization parameter, a sub-critical Hamiltonian Hopf bifurcation takes place at one of the equilibrium points of the system. The analytic results are completed with numerical simulations. **MR4094368.**

3. Mingueza, D.; Montoro, M.E.; Pacha, J.R. (2013) Description of characteristic non-hyperinvariant subspaces over the field GF(2). Linear Algebra and its Applications. 439:12, 3734—3745. Review (from MathSciNet MR): the authors give an explicit construction to obtain the characteristic non-hyperinvariant subspaces for a nilpotent matrix in GF(2). **MR3133453.**

4. Ferrer, J.; Pacha, J.R.; Peña, M. (2013) Controllability of continuous bimodalpiecewise linear systems. Math. Probl. Eng. 2013, Art. ID 342548, 14 pp. Review (from MathSciNet MR): the authors show that, for these systems, the study of their controllability can be reduced to the unobservable case, and for these ones they obtain a simple explicit characterization of controllability for dimensions 2 and 3, as well as some partial criteria for higher dimensions. **MR3062686.**

5. Delshams, A.; Gutiérrez, P.; Pacha, J.R. (2013) Transversality of homoclinic orbits to hyperbolic equilibria in a Hamiltonian system, via the Hamilton-Jacobi equation. Physica D, Nonlinear Phenomena. 243:1, 64—85. Review (from MastSciNet MR): For two degree of freedom Hamiltonian systems with an equilibrium point having a

loop or homoclinic orbit, the authors provide a constructive approach to study whether the unstable and stable invariant manifolds of the hyperbolic point intersect transversely along the loop inside their common energy level, and they establish a necessary and sufficient condition for the transversality. **MR3002431.**

6. Mingueza, D.; Montoro, E.; Pacha, J.R. (2013) Description of characteristic non-hyperinvariant subspaces over the field GF(2). Liner Algebra Appl. 439:12, 3734-3745. Review (from MathSciNet MR): In this paper, the authors present an explicit construction to obtain the characteristic non-hyperinvariant subspaces for a nilpotent matrix in GF(2); conditions for the existence of such subspaces are known and given in Shoda's theorem. Given a square matrix A, a subspace V is A-hyperinvariant if for every matrix T that commutes with A, V is T-invariant. If we impose the condition that T must be non-singular, then V is said to be A-characteristic. The main result of the paper decomposes the characteristic subspaces that are not hyperinvariant for nilpotent A as $Y \otimes Z$ where Y is a hyperinvariant subspace and Z is a so-called minext subspace, both associated to a char-tuple associated to the Segre partition of the Jordan matrix of A. Examples are used throughout the discussion to illustrate the definitions and the use of notation. **MR3133453**

7. Ferrer, J; Pacha, J.R.; Peña, M. (2013) Controllability of continuous bimodal linear systems. Math. Probl. Eng. Art. ID 342548, 14 pp. Review (from MathSciNet MR): This paper gives simple explicit criteria for the controllability of a continuous bimodal linear control system, based on the implicit conditions from [M. K. Çamlĭbel, W. P. M. H. Heemels and J. M. Schumacher, in Hybrid systems: computation and control, 250–264, Lect. Notes Comput. Sci., 2993, 2004, doi:10.1007/978-3-540-24743-2_17]. The results obtained completely cover dimensions $n=2$ and $n=3$, and partially cover higher dimensions. In particular, the authors prove that one need only consider the nongeneric case of unobservable systems. Some interesting problems for further research could be the characterization of controllability for systems with multiple inputs and an extension of the present results to systems with delays in the state variables, or even to general switched systems. **MR3062686**

8. Delshams, A.; Gutiérrez, P.; Pacha, J.R. (2013) Transverslity orbits to hyperbolic equilibria in a Hamiltonian system, via the Hamilton-Jacobi equation. Phys. D 243, 64–85. **MR300431**

C.2. Congress

1. Delshams, Amadeu; Ollé, Mercè; Pacha, Juan R: Celestial Mechanics tools for studying the hydrogen atom. In *Recent Developments in Dynamical Systems and their Applications*, Kyoto, June 21-- 25, 2021. Invited conference.

2. Delshams, Amadeu; Ollé, Mercè; Pacha, Juan R: Scattering maps for the htdrogen atom in a circularly polarized microwave field. In *Hamiltonian Dynamical Systems in Honor of Jean-Pierre Marco.* Paris, June 7–10, 2021. Invited conference.

3. Babb, Thomas; Benedito, Ernest; Bond, Oliver; Kumar; Solà Morales, Joan; Pacha, Juan R; Sosa, Wilfredo: Safe trajectory of piece moved by a robot. In *European Study Group with Industry, ESGI 158.* Centre de Recerca Matemàtica (CRM), Bellaterra, January 27–31, 2020. Oral presentation.

4. Ollé, Mercè; Pacha, Juan R.: The hydrogen atom in a circularly polarized (CP) microwave field: Hopf bifurcation and Chaos. In *Multi-Rate Process and HYSteresis*

(MURPHYS). Centre de Recerca Matemàtica (CRM), Bellaterra, May 28 – June 1, 2018. Oral presentation.

5. Ollé, Mercè; Pacha, J.R.: The hydrogen atom in a circularly polarized (CP) microwave field: Hopf bifurcation and Chaos. In *Global Summit on Physics.* Madrid, September 27–28, 2018. Oral presentation.

C.3. Research projects

1. Researcher in the project *Mecánica Celeste: Métodos Analíticos y Numéricos y Aplicaciones (MECMANA18).* PGC2018-100928-B-100. Funded by the Ministerio de Ciencia, Innovación y Universidades. Principal researcher: María Mercedes Ollé Torner, Universidad Poltécnica de Cataluña. Period: 2018-2021. Funded amount: 35 695€.

2. Researcher in the network *Dinámica, Atractores y Nolinealidad: Caos y Estabilidad* MTM2016-81902-REDT. Funded by the MECC. A network of 18 Spanish Universities. Principal researcher: María Teresa Martínez-Seara Alonso. Universidad Poltécnica de Cataluña. Period: 2017-2018. Funded amount: 11 000€.

3. Researcher in the project 2017SGR-1049, funded by the AGAUR. Principal researcher: María Teresa Martínez-Seara Alonso. Universidad Politécnica de Cataluña. Period: 2017-2019. Funded amount: 44 480€.

4. Researcher the project *Dinámica Asociada a Conexionesentre Objetos Invariantes, Aplicaciones a Astrodinámica, Neurociencia y Otras Aplicaciones (DACOBIANA).* MTM2015-65715-P. Funded by the MINECO-FEDER. Principal researcher: Teresa Martínez-Seara Alonso, Universidad Politécnica de Cataluña. Period: 2016-2018. Funded amount: 167 200€.

5. Researcher in the project 2014SGR-504, funded by the AGAUR. Principal researcher: María Teresa Martínez-Seara Alonso, Universidad Politécnica de Cataluña. Period: 2014-2016. Principal investigator. Funded amount: 63 000€.

6. Researcher in the project *Dinámica Asociada a Conexiones entre Objetos Invarian-antes, Aplicaciones a Astrodinámica, Neurociencia y Otros Campos (DACOBIANO)*. MTM2012-31714, funded by the MECC-FEDER. Principal researcher: Amadeo Delshams Valdés, Universidad Politécnica de Cataluña. Period: 2013-2015. Funded amount: 282 672€.

C.4. Contracts, technological or transfer merits