CURRICULUM VITAE ABREVIADO (CVA)

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

Part A. PERSONAL INFORMATION

First name	Rafael
Family name	Vázquez Valenzuela
Open Research and Contributor ID (ORCID)(*)	0000-0001-6904-2055

A.1. Current position

Position	Catedrático de Universidad
Initial date	2023
Institution	Universidad de Sevilla
Departament/Center	Dpto. de Ingeniería Aeroespacial y Mecánica de Fluidos / Escuela Técnica Superior de Ingeniería
Country	Spain
Key words	Aerospace Engineering, Control Theory

A.2. Previous positions (research activity interruptions, indicate total months)

Period	Position/Institution/Country/Interruption cause
2000-2001	Systems Engineer at Telvent Interactiva - Spain
2002-2006	Researcher at University of California, San Diego – USA
2007-2008	Profesor Ayudante Doctor – Univ. de Sevilla, España
2008-2010	Profesor Contratado Doctor – Univ. de Sevilla, España
2010-2023	Profesor Titular de Universidad – Univ. De Sevilla, España

A.3. Education

PhD, Licensed, Graduate	University/Country	Year
Ingeniero Industrial	Universidad de Sevilla	1999
Licenciado en Matemáticas	Universidad de Sevilla	2003
Master in Aerospace Engineering	University of California San Diego	2004
PhD in Aerospace Engineering	University of California San Diego	2006

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

3 Sexenios (2003-2008, 2009-2014, 2015-2020); 4 supervised PhD (2012, 2021, 2024, 2024), 3 ongoing PhDs and 1 MCSA Postdoc (2022-2023); Total citations: 2544 (WOS), 4994 (Google Scholar, see https://scholar.google.com/citations?user=0Zwv3iMAAAAJ); Citations per year (2019-2023): 456 (Google Scholar); Total Q1 journal papers: 39 (JCR); H index: 28 (WOS), 35 (Google Scholar).

Rafael Vazquez received the M.S. and Ph.D. degrees in aerospace engineering from the University of California, San Diego (USA) in the years 2004 and 2006, respectively, and BS degrees in electrical engineering (Ingeniero Industrial) and mathematics (Licenciado en Matematicas) from the University of Seville (Spain), in the years 1999 and 2003.

Since March 2023, he is a **Full Professor** (Catedrático) in the Aerospace Engineering and Fluid Mechanics Department at the University of Seville, where he started as Assistant

Professor in 2007. He has been **Chair of the Department** from 2016 to 2020. He has been **Academic Coordinator for the Master's Degree in Aeronautical Engineering and the Bs. Degree in Aerospace Engineering** from 2016 to 2019. He has taught courses in Orbital Mechanics and Space Vehicle Dynamics for more that 15 years. He belongs to the board of the PEGASUS network of European aerospace universities since 2023. Since February 2024 he is the director of the newly created **INDRA Endowed Chair (Cátedra de Empresa) on Space Surveillance**. The activities of this Chair include dissemination activities of space topics, organization of events and diverse prizes for students in the field of space.

Supervision of student's work

Finished PhDs (last 10 years):

1. Julio Cesar Sanchez Merino (Model Predictive Control Applications to Spacecraft Rendezvous and Small Bodies Exploration), December 2021 (co-supervised).
2. José Manuel Montilla García (Satellite maneuver detection with radar data: Leveraging improved orbital uncertainty characterization for reachability-based metrics), May 2024.
3. Guillermo Pacheco Ramos (Modeling and Control of Electric Solar Wind Sails: A High-Fidelity Multibody Dynamical Approach), November 2024.

Ongoing PhDs/expected defense date (all co-supervised):

1. Ana Sánchez Rivero (Diseño y Validación de Herramientas Avanzadas para Análisis de Conjunciones en Órbita Terrestre), exp. Jun 2025.
2. Jesús Fernando Ramírez Sánchez-- industrial PhD, Sener (Desarrollo de técnicas de optimización convexa para vehículos espaciales con alta autonomía), exp. 2028.
3. Manuel Sánchez Piedra--industrial PhD, Real Observatorio de la Armada (Determinación de órbita de objetos de basura espacial a partir de la fusión de la información obtenida por diferentes sensores), exp.2028.

Visiting PhD students: **3 visiting Chinese PhD students (Jing Zhang, Guangwei Chen, Xin Lin) with a 1-year CSC scholarship (1 ongoing).**

Postdocs: **one MCSA postdoc (**Julio Cesar Sanchez Merino, Jan 2022-Apr 2023).

Other supervision: **13 Diploma thesis (PFC), 11 Master thesis (TFM), 25 Degree thesis (TFG), and 8 scholarships (4 "beca de colaboración" and 4 "beca de iniciación a la investigación" from Univ. Sevilla)**

Research Experience

His research interests include control theory, distributed parameter systems, and optimization, with applications to flow control, ATM, UAVs, and orbital mechanics. He is coauthor of the book Control of Turbulent and Magnetohydrodynamic Channel Flows (Birkhauser, 2007). He currently serves as **Associate Editor** for the journals Automatica (Q1 in the JCR category Automation and Control Systems) and IEEE Control and Systems Letter (Q1, SJR Control and Optimization). Among other merits, he has published **55 journal papers** (JCR-indexed journals), **102 conference proceedings** (most of them peer reviewed), and **7 book chapters**.

His main research work has been on control of distributed parameter systems; besides he has worked as a researcher in numerous research projects and contracts with companies in topics related to Astrodynamics, Air Traffic Control, Applied Mathematics, Guidance and Control of Spacecraft and Autonomous Air Vehicles, Control Theory, and Scheduling of Ground Station Antennas. In particular, he has been very active and has considerable expertise on the **rendezvous problem** and in **Model Predictive Control** techniques as demonstrated by the published body of work and recent conference presentations and submissions. He currently is or has been IP of **three national projects** on advanced rendezvous algorithms and other astrodynamics topics, and **has been the IP of a project for ESA under a contract with INDRA** which dealt with uncertainty modelling and quantification to detect maneuvers in LEO. He also belongs to international committees on both Control theory and Aerospace

applications (IFAC and IEEE), being a regular attendee in conferences on both topics. His research career is markedly international, with several stays in United States, France, Germany and Brazil (**more than 6 months of postdoctoral stays, plus his full doctoral career in United States with long predoctoral stays in France and Germany**). He has published numerous papers with co-authors from U.S.A., France, Brazil, China, Germany, Italy and Greece.

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

C.1. Publications – *(aerospace focus)*

1. J Urrios, G Pacheco-Ramos, R Vazquez, “Optimal planning and guidance for Solar System exploration using Electric Solar Wind Sails,” Acta Astronautica, vol. 217, pp.116-129, 2024.
2. L. Linares, R. Vazquez, F. Perea, J. Galan-Vioque, "The Shaving Algorithm: A Mixed Integer Linear Programming-based Model for Resolution of the Antenna-Satellite Scheduling Problem", IEEE Transactions on Aerospace and Electronic Systems, vol. 60, pp. 463-473, 2024.
3. G. Pacheco-Ramos, D. Garcia-Vallejo, and R. Vazquez, "Formulation of a high-fidelity multi-body dynamic model for an electric solar wind sail," International Journal of Mechanical Sciences, Vol. 256, pp. 108466, 2023.
4. J.M. Montilla, J.C. Sanchez, R. Vazquez, J. Galan-Vioque, J. Rey Benayas, J. Siminski, "Manoeuvre detection in Low Earth Orbit with Radar Data," Advances in Space Research, Vol. 72, pp. 2689-2709, 2023.
5. J. C. Sanchez, J.D. Biggs, F. Bernelli-Zazzera, R. Vazquez, "Asteroid station-keeping predictive control with autonomous navigation and in-situ gravity estimation," vol. 45, pp. 262-279, Journal of Guidance, Control and Dynamics, 2022.
6. J. C. Sanchez, C. Louembet, F. Gavilan, R. Vazquez, "Event-based Impulsive Control for Spacecraft Rendezvous Hovering Phases," vol. 44 (10), pp. 1794-1810, Journal of Guidance, Control and Dynamics, 2021.
7. J. C. Sanchez, F. Gavilan, R. Vazquez, “Chance-constrained Model Predictive Control for Near Rectilinear Halo Orbit spacecraft rendezvous,” Aerospace Science and Technology Vol. 100, 105827, 2020.
8. J. C. Sanchez, F. Gavilan, R. Vazquez, C. Louembet, "A Flatness-Based Predictive Controller for Six-Degrees of Freedom Spacecraft Rendezvous," Acta Astronautica, vol. 167, 391-403, 2020.
9. F. Gavilan, R. Vazquez, E. F. Camacho, "Pulse-Width Predictive Control for LTV Systems with Application to Spacecraft Rendezvous," Control Engineering Practice, Vol. 60, pp. 199-210, 2017.
10. R. Vazquez, F. Perea, J. Galan-Vioque, "Resolution of an Antenna-Satellite assignment problem by means of Integer Linear Programming," Aerospace Science and Technology, vol. 39, pp. 567-574, 2014.

C.2. Congress – (recent, aerospace focus)

1. J. Galan-Vioque, J.M. Montilla, R. Vazquez and C. Bombardelli, "Continuation and Bifurcations of Quasi Satellite Orbits in the Mars Phobos RTBP problem," CELMEC VIII, 2022.
2. J.M. Montilla, R. Vazquez and P. Di Lizia, "Mixture-Based Cost Metrics for Maneuver Detection Using Radar Track Data," 33rd AIAA/AAS Space Flight Mechanics Meeting, 2023.
3. A.S. Rivero, C. Bombardelli, and R. Vazquez "Space-Occupancy Conjunction Filter," 33rd AIAA/AAS Space Flight Mechanics Meeting, 2023.
4. J.A. Rebollo, R. Vazquez, F. Gavilan, J. Cordero, J. Jimenez, "A Simmetry-Based Unscented Particle Filter for State Estimation of a Ballistic Vehicle," IFAC WC 2023.
5. R. Vazquez, M. Krstic, "Gain-Only Neural Operator Approximators of PDE Backstepping Controllers," ECC 2024.

6. A. Seuret, R. Vazquez, L. Zaccarian, "A hybrid dynamical system approach to the impulsive control of spacecraft rendezvous," ECC 2024.
7. G. Napoletano. A. Seuret, R. Vazquez, "A hybrid model for robust impulsive control applied to spacecraft rendezvous," EuroGNC 2024.
8. F. P. Salzo. G. Bucchioni, R. Vazquez, "Model Predictive Control for Formation Flying around Halo Orbits," EuroGNC 2024.
9. J. G. Lopez-Cepero, J. Galan-Vioque, R. Vazquez, "Control design for rendezvous operation near Halo Orbits using Lyapunov-Floquet theory and AUTO," EuroGNC 2024.

C.3. Research projects

1. "Algoritmos avanzados de determinación de trayectorias y sistemas robustos de guiado, navegación y control en órbita" Funding from: Ministerio de Ciencia, Innovación y Universidades (Proyectos Investigación Orientada, PID2023-147623OB-I00), IP: **Rafael Vazquez**, 2024-2027. Amount: 60.000€.
2. "Estrategias Seguras De Rendezvous Para Eliminacion Activa De Basura Espacial Mediante Control Predictivo Basado En Modelo Con Cuantificacion De Incertidumbre." Funding from: Ministerio de Ciencia e Innovación (Proyecto de Transición Ecológica y Digital TED2021-132099B-C33), IP: **Rafael Vazquez** and Daniel Limón, 2022-2024. Amount: 96.200€.
3. "Towards Higher Levels of Autonomy and Robustness in Space Operations through Uncertainty Management and Quantification—THOR." Funding from: European Comission (Horizonte 2020). IP: **Rafael Vazquez** 2021-2024. Amount: 204.415,68€.
4. "Diseño de Algoritmos de Guiado y Control Innovadores para Aplicaciones Avanzadas de Rendezvous: Órbitas Halo y Exploración de Asteroides." Funding from: Ministerio de Ciencia. IP: **Rafael Vazquez**. 2019-2021. Amount: 39.930€.
5. "AIRPORTS MPC". Funding from: CDTI - Boeing Research and Technology Institute Europe S.L. (Proyecto CIEN). IP: Eduardo Fernández Camacho (Univ. de Sevilla). 2015-2017. Amount: 200.000€. Role: researcher.
6. "Análisis de Bifurcaciones en Sistemas Dinámicos: Aplicación". Funding from: Ministerio de Economía y Competitividad. IP: Jorge Galán Vioque (Univ. de Sevilla). 2016-2018. Amount: 51.300€. Role: researcher (50%).
7. "Analisis Y Optimizacion De Trayectorias De Avion Bajo Los Efectos De Incertidumbre Meteorologica". Funding from: Ministerio de Economía y Competitividad. IP: Damián Rivas Rivas (Univ. de Sevilla). 2015-2017. Amount: 80.000 €. Role: researcher (50%).

C.4. Contracts, technological or transfer merits

1. "Design of Celestial Navigation Algorithms for UAVs". Funding: Technology Innovation Institute (TII). IP: Rafael Vázquez. 2023. Amount: 21.000€. **Role: IP**
2. "Desarrollo de un CubeSat con Tecnología Andaluza, MISION ALPHA". Funding: Ministerio de Industria, Comercio y Turismo. 2023. IP: Fernando Muñoz Chavero. Amount: 98.609,06€. Role: researcher.
3. "Manoeuvre detection for near-orbiting objects". Funding: **Indra** (subcontrato para la Agencia Espacial Europea). IP: Rafael Vázquez. 2020. Amount: 40.000€. **Role:IP**
4. "BASGE: diseño de Bomba Aire-Superficie Guiada para Entrenamiento". Funding: Aertec Solutions S.L. (programa COINCIDENTE del Ministerio de Defensa). IP: Francisco Gavilán Jiménez. 2020. Amount: 27.500€. Role:researcher
5. "CEFIRO-3". Funding: Aertec Ingeniería y Desarrollos S.L.. IP: Damián Rivas Rivas. 2014-2015. Amount: 100.000 €. Role: researcher.
6. "SESAR WP-E ComplexWorld Network - Mastering Complex Systems Safely". Funding: Eurocontrol - SESAR WP-E (red europea). IP: Damián Rivas Rivas. 2010-2014. Amount: 198.000 €. Role: researcher.