

PABLO FAJARDO, PH. D.

CONTACT INFORMATION Visiting Professor **Email: pfajardo@ing.uc3m.es**
Dept. Bioingeniería e Ing. Aeroespacial. **Phone: +34916248239**
Universidad Carlos III de Madrid
Av. de la Universidad, 30.
28911 Leganés, Spain. *Last update: October 2016*

RESEARCH INTERESTS CFD, Fluid-Structure Interaction, Aeroelasticity, Numerical methods, Plasma Propulsion.

EDUCATION **Ph.D. in Aeronautical Engineering, July 2012**

Universidad Politécnica de Valencia, Spain

PhD Thesis: *Methodology for the Numerical Characterization of a Radial Turbine under Steady and Pulsating Flow*

Diploma Course in Fluid Mechanics (Master in Research), July 2008

von Karman Institute for Fluid Dynamics, Belgium

Research Project: *Supersonic and High Pressure Plasma Testing*

MSc/Bc in Aeronautical Engineering, July 2007

5 years program; ETSIA, U. Politécnica de Madrid, Spain

Minor in Aerospace Vehicles

PROFESSIONAL EXPERIENCE **Universidad Carlos III de Madrid, Leganés, Spain**

Visiting Professor (Associate Professor Level) July 2013 to present

Director of the M.Sc. in Aeronautical Engineering April 2014 to present

Vice-Dean of the School of Engineering June 2014 to present

Universidad Politécnica de Valencia, Valencia, Spain

Researcher and Assistant Lecturer September 2008 to June 2013

REFEREED JOURNAL PUBLICATIONS

1. Juste, G.L., Fajardo, P., and Guijarro, A. "Assessment of secondary bubble formation on a backward-facing step geometry". *Physics of Fluids*, 28 (7), 074106, 2016.
2. Hoyas, S., Ianiro, A., and Pérez-Quiles, M. J., and Fajardo, P. "On the onset of instabilities in a Bénard-Marangoni problem in an annular domain with temperature gradient". *Thermal Science*, IN PRESS
3. Hoyas, S., Fajardo, P., and Pérez-Quiles, M. J. "Influence of geometrical parameters on the linear stability of a Bénard-Marangoni problem". *Physical Review E*, 93 (4), 043105, 2016.
4. Juste, G.L., and Fajardo, P. "Assessment of experimental optical techniques for characterizing heat transfer using numerical simulations". *Engineering Applications of Computational Fluid Mechanics*, 2015.
5. Hoyas, S., Fajardo, P., Gil, A., and Perez-Quiles, M. J. "Analysis of bifurcations in a Bénard-Marangoni problem: Gravitational effects". *International Journal of Heat and Mass Transfer*, 73, 33-41, 2014.

6. Galindo, J., Tiseira, A., Fajardo, P., and García-Cuevas, L. M. "Development and validation of a radial variable geometry turbine model for transient pulsating flow applications". *Energy Conversion and Management*, 85, 190-203, 2014.
7. Benajes, J. and Galindo, J. and Fajardo, P. and Navarro, R. "Development of a segregated compressible flow solver for turbomachinery simulations"- *Journal of Applied Fluid Mechanics*, 7 (4), 673-682, 2014.
8. Galindo, J., Hoyas, S., Fajardo, P., and Navarro, R. "Set-up analysis and optimization of CFD simulations for radial turbines". *Engineering Applications of Computational Fluid Mechanics*, 7 (4), 441-460, 2013.
9. Hoyas, S., Gil, A., Fajardo, P., and Pérez-Quiles, M. J. "Codimension-three bifurcations in a Bénard-Marangoni problem". *Physical Review E*, 88(1), 015001, 2013.
10. Galindo, J., Tiseira, A., Fajardo, P., and Navarro, R. "Analysis of the influence of different real flow effects on computational fluid dynamics boundary conditions based on the method of characteristics". *Mathematical and Computer Modelling*, 57(7-8), 1957-1964, 2013.
11. Galindo, J., Fajardo, P., Navarro, R., and García-Cuevas, L. M. "Characterization of a radial turbocharger turbine in pulsating flow by means of CFD and its application to engine modeling". *Applied Energy*, 103, 116-127, 2013.
12. Torregrosa, A.J., Fajardo, P., Gil, A., and Navarro, R. "Development of non-reflecting boundary condition for application in 3D computational fluid dynamics codes". *Engineering Applications of Computational Fluid Mechanics*, 6 (3), 447-460, 2012.
13. Serrano, J. R., Arnau, F. J., Fajardo, P., Belmonte, M. R., and Vidal, F. "Contribution to the modeling and understanding of cold pulsating flow influence in the efficiency of small radial turbines for turbochargers". *Journal of Engineering for Gas Turbines and Power*, 134(10), 102701, 2012.
14. Payri, F., Serrano, J. R., Fajardo, P., Reyes-Belmonte, M. A., and Gozalbo-Belles, R. "A physically based methodology to extrapolate performance maps of radial turbines". *Energy Conversion and Management*, 55, 149-163, 2012.
15. Galindo, J., Tiseira, A., Fajardo, P., and Navarro, R. "Coupling methodology of 1D finite difference and 3D finite volume CFD codes based on the Method of Characteristics". *Mathematical and Computer Modelling*, 54(7), 1738-1746, 2011.
16. Margot, X., Hoyas, S., Fajardo, P., and Patouna, S. "CFD study of needle motion influence on the spray conditions of single-hole injectors". *Atomization and Sprays*, 21(1), 2011.
17. Tancrez, M., Galindo, J., Guardiola, C., Fajardo, P., and Varnier, O. "Turbine adapted maps for turbocharger engine matching". *Experimental thermal and fluid science*, 35(1), 146-153, 2011.
18. Margot, X., Hoyas, S., Fajardo, P., and Patouna, S. "A moving mesh generation strategy for solving an injector internal flow problem". *Mathematical and Computer Modelling*, 52(7), 1143-1150, 2010.
19. Fajardo, P., Barahona, S., and Sanz-Andres, A. "Some Results of the Educational Experiment APIS (Cervantes Mission on Board ISS)". *Microgravity Science and Technology*, 21(3), 247-255, 2009.

RESEARCH
PROJECTS

- *Electromagnetic Thrusters for Space Exploration (PE3)*. Funded by Spanish Ministry of Economy and Competitiveness. PI: P. Fajardo, E. Ahedo (2017-2019). 228.400 €
- *MagnetIc NOzzle thruster with elecTron cyclOtron Resonance (MINOTOR)*. H2020 Programme - European Commission. PI: M. Merino (Jan. 2017- Dec. 2019). 310.000 €
- *Consortium for Hall Effect Orbital Propulsion System (CHEOPS)*. H2020 Programme - European Commission. PI: E. Ahedo (Jan. 2017- Jun. 2020). 360.000 €
- *Model and experimental validation of spacecraft thruster interactions for electric propulsion thrusters plume*. Funded by ESA (Contract number: 4000116180/15/NL/PS). PI: E. Ahedo (03/2016-02/2018). 80.000 €
- *Plasma Space Propulsion: Simulations and Experiments*. Funded by Spanish Ministry of Economy and Competitiveness. PI: E. Ahedo, P. Fajardo (2014-2016). 242.000 €
- *Cámara de Ensayo de Propulsión Eléctrica*. Funded by Spanish Ministry of Economy and Competitiveness. PI: E. Ahedo, P. Fajardo (2013-2015). 547.000 €
- *Low Earth Orbit Security With Enhanced Electric Propulsion (LEOSWEEP)*. 7th Framework Programme of the European Union, 2013-2016. PI: E. Ahedo. 164.724 €
- *Design Of Compressor Air Inlet Protection For Electrical ECS*. CLEAN SKY JOINT UNDERTAKING (UE). Oct. 2012 -April 2014. PI: V. Macian.
- *LES methods for multiphase flow simulations (Metodos LES para la simulacion de chorros multifasicos)*. Funded by Spanish Ministry of Science and Innovation. (Jan. 2011-Dic. 2014). PI: J.M. Desantes.
- *CleanSky CROR FEM-CFD Model for static aeroelastic analysis investigation*. Funded by Airbus Military (from UE programm). 2012.
- *PROYECTO MIURA: Analisis del desarrollo e implementacion de un sistema de guiado para proyectiles no guiados*. Funded by EVERIS AEROESPACIAL Y DEFENSA, S.L.U. (Spanish Government project). May 2013 - Feb. 2014.

SELECTED
RESEARCH
CONTRACTS

- *DEGASS-Desarrollo de sistemas embarcados de generación de gas inerte para aviones de tamaño medio y medio recorrido*. Funded by COMPAÑIA ESPAÑOLA DE SISTEMAS AERONAUTICOS S.A. Sep. 2016 - Mar. 2017. PI: P. Fajardo.
- *Convenio específico entre Ingeniería de Sistemas para la Defensa de España y la Universidad Carlos III de Madrid para el desarrollo de Trabajos de Prospectiva Tecnológica en el área Aeroespacial*. Funded by INGENIERÍA DE SISTEMAS PARA LA DEFENSA DE ESPAÑA, S.A. (ISDEFE). Mar. 2016 - Mar. 2018. PI: P. Fajardo.
- *Campaña experimental de caracterización y optimización del prototipo HPT-05 (Experimental Campaign of HPT-05 prototype)*. Funded by SENER, INGENIERIA Y SISTEMAS, S.A. Jun. 2016 - Aug. 2016. PI: P. Fajardo.
- *Design and Manufacturing of a Langmuir Probe for the use in RF Generated Plasmas*. Funded by SENER, INGENIERIA Y SISTEMAS, S.A. (project with ESA). Dec. 2015 - April 2016. PI: M. Merino.
- *10kW Hall-Effect Thruster Optimized for Space Transportation*. Funded by SNECMA (project with ESA). March 2014 - July 2014. PI: E. Ahedo.

- *Advisor in CFD projects.* Funded by COMET Ingeniería. Jun. 2014-May. 2017. PI: P.Fajardo.
- *Apoyo en la obtención de las características aerodinámicas de un seguidor solar.* Several projects on this topic both numerical and experimental. Funded by ATOS SPAIN, S.A.U. Jul. 2013-Jul. 2014. PI: P.Fajardo.
- *Development Of A Methodology For Centrifugal Compressor Modelling By Means Of STARCCM+.* Funded by POWERTECH ENGINEERING S.R.L. Nov 2012 - July 2013. PI: F. Payri.
- *Aerodynamic characterization of a guided bomb (análisis de las características aerodinámicas y de estabilidad de un nuevo modelo de bomba guiada).* Funded by Embention s.l., 2010-2011. PI: F. Payri.
- *Proyecto de viabilidad para la fabricación de vehículos aéreos híbridos para el transporte de mercancías.* Funded by NEW TRANSPORT CONCEPT PROYECT, S.L., 2009. PI: F. Payri.
- *Projet De Recherche Sur Le Pompage Du Compresseur (Essais Metier).* Funded by PEUGEOT CITROEN AUTOMOBILES, S.A., Sep 2009-Jan 2010. PI: F. Payri.
- *Pulsating Flow in Turbochargers.* Funded by Peugeot Citroen Automobiles (PSA), 2009. PI: F. Payri.

REFEREED
PROCEEDINGS

1. Merino, M., Proux, A., Fajardo, P., and Ahedo, E., “Collisionless electron cooling in unmagnetized plasma thruster plumes”, 52th AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, No. AIAA 2016-5037, AIAA, Salt Lake City, UT, 2016.
2. D. Pérez-Grande, P. Fajardo, E. Ahedo. “Benchmarks for Magnetically Aligned Meshes in Electromagnetic Plasma Thruster Simulations”. IEPC, Kobe, Japan, 2015.
3. D. Pérez-Grande, P. Fajardo, E. Ahedo. “Evaluation of Erosion Reduction Mechanisms in Hall Effect Thrusters”. IEPC, Kobe, Japan, 2015.
4. P. Fajardo. “Research Activities in Aerospace at UC3M”. Congreso de Ingeniería Aeronáutica Invited Lecture. Madrid, 2014.
5. M. Lázaro, C.F. Casanova, P. Fajardo and P. Martín. “Recursive Computation of Complex Frequencies of Vibrating Non-Viscous Damped Systems”. Proceedings of the Ninth International Conference on Engineering Computational Technology. Civil-Comp Press, Stirlingshire, United Kingdom, Vol. 105, paper 35 (16pp), 2014.
6. S. Hoyas, A. Gil, P. Fajardo, Dung Khuong-Anh, and Frederic Ravet. “Evaluation and Validation of ELSA Model in Diesel Sprays: 3D Cavitating Nozzles Case” *ICLASS 2012, 12th Triennial International Conference on Liquid Atomization and Spray Systems.* 2012.
7. Roibas-Millan, E., Chimeno-Manguan, M., Martínez-Calvo, B., López-Díez, J., Fajardo, P., Fernandez, M.J., Simon, F. Criteria for mathematical model selection for satellite vibro-acoustic analysis depending on frequency range. European Space Agency, (Special Publication) *ESA SP, 691*, 2012. ISBN 978-92-9092-255-1
8. Martínez-Calvo, B., Roibas-Millán, E., Chimeno Manguan, M., Fajardo, P., Riobóo, J. L., Simon, F., and López Díez, J. (2012). “Development of FEM/BEM and SEA models from experimental results for structural elements with attached equipment”. European Space Agency, (Special Publication) *ESA SP, 691*, 2012. ISBN 978-92-9092-255-1

9. Chimeno Manguan, M., Martínez-Calvo, B., Roibás-Millán, E., Fajardo, P., Simon, F., and López Díez, J. "Comparison of numerical models for vibroacoustic analysis of structural panels in low modal density range engaging air layers". European Space Agency, (Special Publication) *ESA SP, 691*, 2012. ISBN 978-92-9092-255-1
10. Serrano, J. R., Climent, H., Fajardo, P., Reyes-Belmonte, M. A., and Vidal, F. "Contribution to the Understanding of Cold Pulsating Flow Influence in the Efficiency of Small Radial Turbines for Turbochargers". In *ASME Turbo Expo 2012: Turbine Technical Conference and Exposition*, 571-580. June 2012. American Society of Mechanical Engineers.
11. Margot, X., García, A., Fajardo, P., Patouna, S. "Analysis Of The Cavitating Flow In Real Size Diesel Injectors With Fixed And Moving Needle Lift Simulations". *V European Conference on Computational Fluid Dynamics (ECCOMAS)*. 2010. ISBN 978-989-96778-1-4.
12. Tiseira, A., Valencia, O., Fajardo, P., Chimeno, M., Hernández, L., Cid, E., López-Díez, J. "The use of new configuration airship for the desaturaton of the sky". *8th International Airship Convention*. Bedford, England. 29 September to 3 October 2010. ISBN 0-9528578-7-1.

OTHER
CONFERENCES

1. Merino, M., Ahedo, E., and Fajardo, P., "Development of physical models of electron cooling in collisionless plasma thruster plumes", *22nd SPINE Meeting and Workshop*, SPIS/SPINE Community, ESA, 2016.
2. Domínguez, A., Cichocki, F., Pérez, D., Merino, M., Fajardo, P., and Ahedo, E., "Hybrid PIC-fluid simulation of plasma thrusters and their plumes", VKI Lecture Series: Electric Propulsion Systems: from recent research developments to industrial space applications, No. STO-AVT-263, Von Karman Institute, Von Karman Institute, Belgium, 2016.
3. Cichocki, F., Domínguez, A., Pérez, D., Merino, M., Ahedo, E., and Fajardo, P., "Hybrid particle codes for electric propulsion", *14th Spacecraft Charging Technology Conference*, 2016.
4. Merino, M., Fajardo, P., Navarro, J., Chen, X., Babou, Y., and Ahedo, E., "Characteristics and capabilities of the new EP2 plasma propulsion laboratory", *Space Propulsion Conference 2016* , 2016.
5. Dominguez, A., Pérez, D., Fajardo, P., and Ahedo, E., "DEVELOPMENT UPDATE ON NOMADS: A VERSATILE, MULTI-THRUSTER PLASMA DISCHARGE SIMULATION CODE", *Space Propulsion Conference 2016* , 2016.
6. P. Fajardo. "Research Activities in Aerospace at UC3M". Invited. Madrid, 2014

REFEREE SERVICE **International journals**

- Applied Energy
- International Journal of Heat and Fluid Flow
- International Journal of Heat and Mass Transfer
- Engineering Applications of Computational Fluid Mechanics
- Applied Thermal Engineering
- Journal of Aerospace Engineering
- Aerospace Science & Technology

- Journal of Mechanical Engineering Science

Research projects

- Spanish National Evaluation and Foresight Agency (ANEP)

STUDENT
ADVISING - PHD
LEVEL

- **Daniel Perez.** Universidad Carlos III de Madrid. *Modelling and simulation of plasma discharges under complex magnetic topologies.* Co-supervised with E. Ahedo. Expected graduation Sep. 2017.

STUDENT
ADVISING - BSc &
MSC LEVEL

- 14 Final Year Projects in the Aeronautical Engineering (5 years degree) at Universidad Politécnica de Valencia. 2008-2013.
- 3 Bachelor thesis at UC3M. 2013-2016.
- 2 Master thesis at UC3M. 2013-2016.

TEACHING
EXPERIENCE

Universidad Carlos III de Madrid, Leganés, Spain

- Aerospace Propulsion. BSc Aerospace Eng. (3rd year). Winter semester 2013-2014.
- Helicopters and other aircrafts. BSc Aerospace Eng. (4th year). Fall semester 2013-2014.
- Introduction to Flight Mechanics. BSc Aerospace Eng. (2nd year). Winter semester 2014-2015.
- Advanced Aircraft Design and Certification I (Finite Element Modeling). MSc Aeronautical Eng. (1st year). Fall semester 2014-2015, 2015-2016, 2016-2017.
- Advanced Aeroelasticity. MSc Aeronautical Eng. (1st year). Fall semester 2015-2016, 2016-2017.
- Aeroelasticity. BSc Aeronautical Eng. (4th year). Fall semester 2014-2015, 2015-2016, 2016-2017.
- Stability and Integrity of Aerospace Structures. BSc Aeronautical Eng. (3rd year). Fall semester 2014-2015.
- Aerospace Engineering Design - Structural Dynamics & Helicopter Design. BSc Aeronautical Eng. (4th year). Winter semester 2015-2016, 2016-2017.

Universidad Politécnica de Valencia, Valencia, Spain

- Aeroelasticity. Aeronautical Engineering - 5 years degree. (5th year). 2010-2011, 2011-2012, 2012-2013.
- Aerodynamics and Aeroelasticity. Aeronautical Engineering - 5 years degree. (5th year). 2010-2011, 2011-2012, 2012-2013.
- Aircrafts, Astronautics and Space Engineering. Aeronautical Engineering - 5 years degree. (4th year). 2008-2009, 2009-2010, 2012-2013.
- Space vehicles and missiles. Aeronautical Engineering - 5 years degree. (5th year). 2009-2010.
- Aerodynamics. Aeronautical Engineering - 5 years degree. (3th year). 2008-2009.

UNAQ - Universidad Aeronáutica en Queretaro, Queretaro, Mexico

- Procesos de diseño, desarrollo y certificación. MSc. Aerospace Eng. (3rd four-moth period). 2011-2012, 2012-2013, 2013-2014, 2014-2015, 2015-2016.
- Turbomachinery. MSc. Aerospace Eng. (4th four-moth period). 2011-2012, 2012-2013, 2013-2014.
- Structural Analysis. MSc. Aerospace Eng. (4th four-moth period). 2011-2012, 2013-2014.

COMPLEMENTARY **Universidad Politécnica de Madrid**, Madrid, Spain.

TEACHING

EXPERIENCE

Vibro Acoustics Simulations in Aerospace. ATHENS Programme. March 2011.

TEACHING

MATERIALS

- *Aerospace Technology*. Aerospace Engineering Degree. Editorial Universitat Politècnica de València, 2013.
- *Transferencia de masa y energía: Ejercicios resueltos*. Aerospace Engineering Degree. Editorial Universitat Politècnica de València, 2014. ISBN: 978-84-9048-207-0.

MANAGEMENT

- *Framework agreement ISDEFE-UC3M*. Coordinator. Activities in fields of: Prospective Technology Studies (Aerospace), Teaching, and Research. Signed on 2015.