Alberto Cuadra Lara

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Research Experience

Jul 2025 - current	**Assistant Professor in Fluid Mechanics**, Fluid Mechanics Group, Universidad Carlos III de Madrid, Spain.
Jul 2023 - Jul 2025	**Post-doctoral researcher in Fluid Mechanics**, Fluid Mechanics Group, Universidad Carlos III de Madrid, Spain.
Jun 2024 - Jul 2024	**Visiting Postdoctoral Scholar**, Center for Turbulence Research, Stanford University, USA.
Jul 2019 - Jul 2023	**Pre-doctoral researcher in Fluid Mechanics**, Fluid Mechanics Group, Universidad Carlos III de Madrid, Spain. Advisors: Prof. Marcos Vera & Prof. César Huete
Nov 2022 - Feb 2023	**Research-stay**: Department of Engineering for Innovation, University of Salento, Italy. Advisor: Prof. Mario Di Renzo
Mar 2019 - Jun 2019	**Research Technician in Fluid Mechanics**, Fluid Mechanics Group, Universidad Carlos III de Madrid, Spain. Advisor: Prof. Marcos Vera
Oct 2018 - Jan 2019	**M.Sc. research assistant**, Fluid Mechanics Group, Universidad Carlos III de Madrid, Spain. Advisor: Prof. Marcos Vera

Education

Jul 2019 - Jul 2023	**Ph.D. in Fluid Mechanics, Universidad Carlos III de Madrid** Thesis title: Development of a wide-spectrum thermochemical code with application to planar reacting and non-reacting shocks. Advisors: Prof. Marcos Vera and Prof. César Huete. Cum Laude, International Ph.D.
Sept 2017 - Feb 2019	**M.Sc. Applied Mathematics, Universidad Carlos III de Madrid** Thesis title: Development of a thermochemical code with teaching and research applications. GPA: 3.68/4.0
Oct 2011 - Jul 2017	**B.Sc. Industrial Technologies Engineering, Universidad de Málaga** Thesis title: Numerical study of a diffusion flame with axial co-flow using ANSYS Fluent. GPA: 3.08/4.0

Awards & Fellowships

2024	**2024 Center for Turbulence Research Summer Program**, Stanford University, USA
Oct 2018 - Jan 2019	**M.Sc. Research Assistant Fellowship**, Universidad Carlos III de Madrid, Spain
Sep 2016 - Dec 2016	**Study-stay under Convocatoria Iberoamérica**, Ministerio de Educación, Spain. Destination: Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico.
Oct 2014 - Jul 2015	**Study-stay under ERASMUS +**, Ministerio de Educación, Spain. Destination: Universitatea Politehnica din București, Romania.

Publications

Journal Articles

1. **Cuadra, A.**, Di Renzo, M., Hoste, J., Williams, C. T., Vera, M., & Huete, C. (2025). Review of Shock-Turbulence Interaction with a Focus on Hypersonic Flow. Physics of Fluids 37, 045129. DOI: 10.1063/5.0255816
2. **Cuadra, A.**, Williams, C. T., Di Renzo, M., & Huete, C. (2024). The role of compressibility and vibrational-excitation in hypersonic shock-turbulence interactions (**under review**).
3. **Cuadra, A.**, Huete, C., & Vera, M. (2024). Combustion Toolbox: An open-source thermochemical code for gas- and condensed-phase problems involving chemical equilibrium (**under review**).
4. Sánchez, J., **Cuadra, A.**, Huete, C., & Vera, M. (2022). SimEx: A tool for rapid evaluation of the effects of explosions. Applied Sciences, 12(18), 9101. DOI: 10.3390/app12189101.
5. Huete, C., **Cuadra, A.**, Vera, M., & Urzay, J. (2021). Thermochemical effects on hypersonic shock waves interacting with weak turbulence. Physics of Fluids 33, 086111 (**featured article**). DOI: 10.1063/5.0059948.
6. **Cuadra, A.**, Huete, C., & Vera, M. (2020). Effect of equivalence ratio fluctuations on planar detonation discontinuities. Journal of Fluid Mechanics, 903, A30. DOI: 10.1017/jfm.2020.651

Technical Reports

1. Huete, C., **Cuadra, A.**, Di Renzo, M., Williams, C. T., & Hoste, J. (2024). Hypersonic Shock-Turbulence Interactions: state-of-the-art and future prospects. Technical report. RTO-EN-AVT-352.
2. **Cuadra, A.**, Williams, C. T., Di Renzo, M., & Huete, C. (2024). Compressibility and vibrational-excitation effects in hypersonic shock-turbulence interaction. Summer Program Proceedings, Center for Turbulence Research, Stanford University.

Relevant Code contribution

1. **Cuadra, A.**, Huete, C., & Vera, M. (2024). Combustion Toolbox: A MATLAB-GUI based open-source tool for solving gaseous combustion problems. Zenodo. DOI: 10.5281/zenodo.5554911.
   Website: https://combustion-toolbox-website.readthedocs.io
2. Sánchez, J., **Cuadra, A.**, Huete, C., & Vera, M. (2022). SimEx: A tool for rapid evaluation of the effects of explosions. Applied Sciences 2022, 12(18), 9101. DOI: 10.3390/app12189101.
3. **Cuadra, A.** (2022). ATWS: Algorithmic Trading Weighted Strategy developed in Pine Script for TradingView. Available in: https://github.com/AlbertoCuadra/algo_trading_weighted_strategy.

Conference contribution

1. **Cuadra, A.**, Romero, M. A., Vera, M., & Huete, C. (2025). Impact of vibrational-excitation on scramjet inlet design. In 3rd Spanish Fluid Mechanics Conference (SFMC), Málaga, Spain.
2. **Cuadra, A.**, Huete, C., & Vera, M. (2025). Combustion Toolbox: An Open-Source Computational Tool for Aerothermochemical Research and Education. In 3rd Spanish Fluid Mechanics Conference (SFMC), Málaga, Spain.
3. **Cuadra, A.**, Williams, C. T., Di Renzo, M., & Huete, C. (2024). Compressibility and vibrational-excitation effects in hypersonic shock-turbulence interaction. In 77th Annual Meeting of the Division of Fluid Dynamics (APS DFD), Salt Lake City, USA.
4. Romero, M., Huete, C., Jenaro, G., & **Cuadra, A.** (2024). Optimización del diseño y operación de un motor scramjet para propulsión hipersónica mediante métodos numéricos. In 11th Congreso Nacional de I+D en Defensa y Seguridad, Jaén, Spain.
5. **Cuadra, A.**, Williams, C. T., Di Renzo, M., & Huete, C. (2024). The influence of turbulence compressibility on hypersonic shock turbulence interaction. In 2024 Meeting of the Spanish Section of The Combustion Institute (SEIC), Madrid, Spain.
6. Di Renzo, M., **Cuadra, A.**, Williams, C. T., & Huete, C. (2024). Impact of density fluctuations on hypersonic shock-wave/turbulence interactions. In 1st European Fluid Dynamics Conference (EFDC1), Aachen, Germany.
7. **Cuadra, A.**, Williams, C. T., Di Renzo, M., Vera, M., & Huete, C. (2023). Direct numerical simulations of hypersonic shock-turbulence interactions. In 76th Annual Meeting of the Division of Fluid Dynamics (APS DFD), Washington DC, USA.
8. **Cuadra, A.**, Vera, M., Di Renzo, M., & Huete, C. (2023). Linear Theory of Hypersonic Shocks Interacting with Turbulence in Air. In 2023 AIAA SciTech Forum, National Harbor, USA. DOI: 10.2514/6.2023-0075.
9. **Cuadra, A.**, Huete, C., & Vera, M. (2022). Desarrollo de un código termoquímico para la evaluación de las propiedades teóricas de explosivos (CT-EXPLO) y la estimación del rendimiento de motores cohete (CT-ROCKET). In 9th Congreso Nacional de I+D en Defensa y Seguridad, Pontevedra, Spain.
10. **Cuadra, A.**, Huete, C., & Vera, M. (2022). Amplificación de la turbulencia a través de una onda de choque en régimen hipersónico. In 9th Congreso Nacional de I+D en Defensa y Seguridad, Pontevedra, Spain.
11. **Cuadra, A.**, Huete, C., & Vera, M. (2022). Combustion Toolbox: a MATLAB-GUI based open-source tool for solving combustion problems. In 12th National and 3rd International Conference on Engineering Thermodynamics (CNIT), Madrid, Spain.
12. **Cuadra, A.**, Huete, C., & Vera, M. (2022). Theory of turbulence augmentation across hypersonic shock waves in air. In 1st Spanish Fluid Mechanics Conference (SFMC), Cádiz, Spain.
13. **Cuadra, A.**, Huete, C., Vera, M., & Urzay, J. (2021). Theory of turbulence augmentation across hypersonic shock waves. In 74th Annual Meeting of the Division of Fluid Dynamics (APS DFD), Phoenix, USA.
14. **Cuadra, A.**, Huete, C., & Vera, M. (2021). Effect of fuel mass fraction heterogeneity on the detonation propagation speed. In 25th International Congress of Theoretical and Applied Mechanics (ICTAM), Milano, Italy.

15. Huete, C., **Cuadra, A.**, & Vera, M. (2019). Stability of non-adiabatic shock waves. Proceedings of the 27th International Colloquium on the Dynamics of Explosions and Reactive Systems (ICDERS), Paper 077, Beijing, China.
16. **Cuadra, A.**, & Vera, M. (2019). Development and validation of a new MATLAB®/GUI based thermochemical code. In 11th International Mediterranean Combustion Symposium (MSC), Tenerife, Spain.
17. **Cuadra, A.**, & Vera, M. (2019). Development of a GUI-based thermochemical code with teaching and research applications. In 1st Colloquium of the Spanish Theoretical and Applied Mechanics Society (STAMS), Madrid, Spain.
18. Huete, C., Melendez, A., **Cuadra, A.**, Sánchez, J., & Vera, M. (2018). Simulación del efecto de ondas expansivas sobre estructuras porticadas. In 6th Congreso Nacional de I+D en Defensa y Seguridad, Valladolid, Spain.

Seminars & Workshops

1. **Cuadra, A.**, Williams, C. T., Di Renzo, M., & Huete, C. (2024). Exploring hypersonic shock-turbulence interaction and advances in the Combustion Toolbox code. UC3M Fluid Mechanics Seminars - Fall 2024, Madrid, Spain.
2. **Cuadra, A.**, Williams, C. T., Di Renzo, M., Vera, M., & Huete, C. (2023). Direct numerical simulations and linear analysis for hypersonic shock-turbulence interaction in air. In 4th Spanish HPC Combustion Workshop, Barcelona, Spain.
3. **Cuadra, A.**, Huete, C. & Vera, M. (2023). Linear analysis on shock-turbulence interaction implemented with the Combustion Toolbox. Seminar presented during the research-stay with Prof. M. Di Renzo, Lecce, Italy.
4. **Cuadra, A.**, Huete, C. & Vera, M. (2021). Development of an open-source thermochemical code: Fundamentals and application to shock turbulence interaction problems in the hypersonic regime. Seminar presented as part of the PhD Programme in Mechatronics Engineering, Málaga, Spain.
5. **Cuadra, A.**, Huete, C. & Vera, M. (2019). Turbulence generation by planar detonations in heterogeneous mixtures. In Spanish Workshop on Fluid Mechanics, Granada, Spain.

Reviewer for International Journals

- **Journal of Fluid Mechanics**, **Physics of Fluids**, **European Journal of Mechanics / B Fluids**, **Computer applications in engineering education**

Teaching

M.Sc. level

2025 - 2026	**Combustion** (12466)	Universidad Carlos III de Madrid
2023 - 2024	**Combustion** (12466)	Universidad Carlos III de Madrid
2020 - 2025	**Combustion** (Lab session) (12466)	Universidad Carlos III de Madrid

B.Sc. level

2024 - 2026	**Aero-thermochemical Systems** (15061)	Universidad Carlos III de Madrid
2019 - 2026	**Aero-thermochemical Systems** (Lab session) (15061)	Universidad Carlos III de Madrid
2023 - 2024	**Fluid Mechanics I - Directed studies** (17909)	Universidad Carlos III de Madrid
2023 - 2026	**Fluid Mechanics** (14023)	Universidad Carlos III de Madrid
2019 - 2024	**Fluid Mechanics** (Lab sessions) (15499)	Universidad Carlos III de Madrid
2019 - 2024	**Explosion Dynamics** (Lab sessions) (16350)	Centro Universitario de la Guardia Civil

Student Advising

M.Sc. level

2024 - 2025	2-end-of-degree project	Universidad Carlos III de Madrid
2023 - 2024	1-end-of-degree project	Universidad Carlos III de Madrid

B.Sc. level

2024 - 2025	1-end-of-degree project	Universidad Carlos III de Madrid
2023 - 2024	1-end-of-degree project	Universidad Carlos III de Madrid
2021 - 2022	1-end-of-degree project	Universidad Carlos III de Madrid
2019 - 2020	1-internship project	Universidad Carlos III de Madrid Sending: ENSTA Bretagne, France

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