

# Alberto Cuadra Lara



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## Research Experience

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

## Education

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| Jul 2019 - Jul 2023  | <b>Ph.D. in Fluid Mechanics, Universidad Carlos III de Madrid</b><br>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 | <b>M.Sc. Applied Mathematics, Universidad Carlos III de Madrid</b><br>Thesis title: Development of a thermochemical code with teaching and research applications. GPA: 3.68/4.0  |
| Oct 2011 - Jul 2017  | <b>B.Sc. Industrial Technologies Engineering, Universidad de Málaga</b><br>Thesis title: Numerical study of a diffusion flame with axial co-flow using ANSYS Fluent. GPA: 3.08/4.0   |

## Awards & Fellowships

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|---------------------|--|
| 2025                | <b>Grants for young doctors</b> , Universidad Carlos III de Madrid, Spain  |
| 2024                | <b>2024 Center for Turbulence Research Summer Program</b> , Stanford University, USA   |
| Oct 2018 - Jan 2019 | <b>M.Sc. Research Assistant Fellowship</b> , Universidad Carlos III de Madrid, Spain   |
| Sep 2016 - Dec 2016 | <b>Study-stay under Convocatoria Iberoamérica</b> , Ministerio de Educación, Spain.<br>Destination: Instituto Tecnológico y de Estudios Superiores de Monterrey, Mexico. |
| Oct 2014 - Jul 2015 | <b>Study-stay under ERASMUS +</b> , Ministerio de Educación, Spain.<br>Destination: Universitatea Politehnica din București, Romania.                                    |

## Publications

### Journal Articles

- Cuadra, A.**, Huete, C., & Vera, M. (2025). Combustion Toolbox: An open-source thermochemical code for gas- and condensed-phase problems involving chemical equilibrium. *Computer Physics Communications* 320, 110004. DOI: 10.1016/j.cpc.2025.110004.
- 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.
- 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.
- 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.
- 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.

## Manuscripts Under Review / In Preparation

1. **Cuadra, A.**, Williams, C. T., Di Renzo, M., & Huete, C. The role of compressibility and vibrational-excitation in hypersonic shock-turbulence interactions (**under review**).
2. **Cuadra, A.**, & Huete, C. Combustion Toolbox v1.3: A modular framework for linear shock-turbulence interaction and turbulence analysis (**in preparation**).
3. **Cuadra, A.**, D. Martínez-Ruiz, & Huete, C. Optimization of scramjet inlet geometry based on Lagrange multipliers for calorically imperfect gases (**in preparation**).

## 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. (2022-2025). 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](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, Acta Mechanica, Computer applications in engineering education**

## Teaching

### M.Sc. level

|             |   |   |                                  |
|-------------|---|---|----------------------------------|
| 2025 - 2026 |  | <b>Combustion</b> (12466)               | Universidad Carlos III de Madrid |
| 2023 - 2024 |  | <b>Combustion</b> (12466)               | Universidad Carlos III de Madrid |
| 2020 - 2025 |  | <b>Combustion</b> (Lab session) (12466) | Universidad Carlos III de Madrid |



### B.Sc. level

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



## Student Advising

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### M.Sc. level

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|-------------|---|-------------------------|----------------------------------|
| 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

|             |   |                         |   |
|-------------|---|-------------------------|---|
| 2021 - 2026 |  | 4-end-of-degree project | Universidad Carlos III de Madrid                                    |
| 2019 - 2020 |  | 1-internship project    | Universidad Carlos III de Madrid<br>Sending: ENSTA Bretagne, France |