

# Carlos González Hernández

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## EDUCATION

<b>Ph.D. in Mathematics</b> Imperial College London, London, United Kingdom	2021
<b>M.S. in Physics</b> Ecole Polytechnique, Palaiseau, France	2015

## APPOINTMENTS

<b>Stanford University</b> Research Fellow, Department of Aeronautics & Astronautics Institute for Computational & Mathematical Engineering	01/2023 – Present
<b>Imperial College London</b> Honorary Research Fellow	01/2023 – Present
<b>Imperial College London</b> Research Associate	03/2020 – 12/2022
<b>University of Leeds</b> Visiting Fellow, School of Mathematics	03/2022 – 06/2022
<b>Imperial College London</b> Research Assistant, Department of Mathematics	10/2016 – 02/2020
<b>French Atomic Energy Commission</b> Research Scientist, Inertial Confinement Fusion Team, CEA/CELIA	01/2016 – 09/2016

## RESEARCH AREAS

Petrov-Galerkin model order reduction, hyperreduction methods, nonlinear manifold approximation via artificial neural networks and Gaussian processes, and uncertainty quantification.

Classification and regression algorithms, multi-agent reinforcement learning, deep learning (CNNs, RNNs, GNNs), generative models (GANs, VAEs, diffusion models) and computer vision.

NLP/LLMs: transformer-based architectures (GPT, BERT), pre-training methodologies, model compression, pruning and distillation, fine-tuning, application in healthcare and science.

Computational physics, including solid and fluid mechanics, high-performance computing and parallel algorithms for large-scale simulations, stochastic methods, and Monte Carlo simulations.

## PUBLICATIONS

### Journal Articles

- 2025 [8] Hernández, C. G., Tezaur, R. and Farhat, C. “Gaussian-process-augmented projection-based model order reduction for mitigating the Kolmogorov barrier to reducibility.”, In preparation.
- 2025 [7] Hernández, C. G. and Hwang, Y. “Wall turbulence without self-sustaining process.”, In preparation.
- 2024 [6] Hernández, C. G., Cao, K., Herrmann, B., Brunton, S. and McKeon, B. J. “Toward data-driven resolvent analysis of nonlinear flows.” *CTR Ann. Res. Briefs*. <https://ctr.stanford.edu/publications/annual-research-briefs/>
- 2023 [5] Luo, Z., Hernández, C. G. and Hwang, Y. “Generalized quasilinear approximations in homogeneous shear turbulence.” *Phys. Rev. Fluids* 8, 064604. doi:10.1103/PhysRevFluids.8.064604
- 2022 [4] Hernández, C. G., Yang, Q. and Hwang, Y. “Generalised quasilinear approximations of turbulent channel flow: Part 2. Spanwise triadic scale interactions”.” *J. Fluid Mech.* 944, A34. doi:10.1017/jfm.2022.499
- 2022 [3] Hernández, C. G., Yang, Q. and Hwang, Y. “Generalised quasilinear approximations of turbulent channel flow: Part 1. Streamwise nonlinear energy transfer.” *J. Fluid Mech.* 936, A33. doi:10.1017/jfm.2022.59
- 2020 [2] Hernández, C. G. and Hwang, Y. “Spectral energetics of a quasilinear approximation in uniform shear turbulence.” *J. Fluid Mech.* 904, A11. doi:10.1017/jfm.2020.678
- 2019 [1] Hernández, C. G. and Wu, X. “Receptivity of supersonic boundary layers over smooth and wavy surfaces to impinging slow acoustic waves.” *J. Fluid Mech.* 872, 849-888. doi:10.1017/jfm.2019.388

### Conference Proceedings

- 2021 [1] Hernández, C. G. and Hwang, Y. “Spectral Energetics of a Quasilinear Approximation in Uniform Shear Turbulence.” *Turbulence IX. iTi 2021. Springer Proc. in Phys.* vol 267. doi:10.1007/978-3-030-80716-033

### Thesis

- 2021 Hernández, C. G. “New Receptivity Mechanisms of Supersonic Boundary Layers.” Department of Mathematics, Imperial College London. Ph.D. Thesis.

## CONFERENCE ACTIVITY

### Conference Papers Presented

- 2024 NASA Advanced Modeling and Simulation Seminar series, NASA Ames (USA).
- 2024 77<sup>th</sup> APS Fluid Dynamics, Salt Lake City (USA).
- 2023 76<sup>th</sup> APS Fluid Dynamics, Washington DC (USA).
- 2023 Theoretical Division, Los Alamos National Laboratory (USA).
- 2023 76<sup>th</sup> APS Fluid Dynamics, Washington DC (USA).

- 2023 TFSA Conference, Stanford (USA).
- 2022 75<sup>rd</sup> APS Fluid Dynamics, Indianapolis, Indiana (USA).
- 2022 Causality in Turbulence and Transition, Madrid (Spain).
- 2021 74<sup>th</sup> APS Fluid Dynamics, Phoenix, Arizona (USA).
- 2021 ICTAM 2020+1, Milano (Italy).
- 2021 iTi – interdisciplinary Turbulence initiative, Darmstadt (Germany).
- 2020 73<sup>rd</sup> APS Fluid Dynamics, Chicago, Illinois (USA).
- 2018 71<sup>st</sup> APS Fluid Dynamics, Atlanta, Georgia (USA).
- 2018 12<sup>th</sup> European Fluid Mechanics Conference, Vienna (Austria).
- 2018 UK Fluids Conference 2018, Manchester (UK).
- 2018 18<sup>th</sup> USNC Theoretical and Applied Mechanics, Chicago, Illinois (USA).
- 2017 EUROMECH 591, Bari (Italy).

## GRANTS AND AWARDS

### Awards and Fellowships

- 2022 CTR Fellowship (\$74,000). Stanford University (USA).
- 2022 Visiting Fellowship (£3,000). School of Mathematics, University of Leeds (UK).
- 2018 Travel Grant (\$1,000). APS (Atlanta, Georgia, USA).
- 2016–20 Roth Doctoral Fellowship (£100,000). Department of Mathematics, Imperial College London. Awarded to the most promising candidate for a Ph.D. in Mathematics (4-year funding).
- 2016 Ph.D. Fellowship (€70,000, declined). LadHyx, Ecole Polytechnique. Awarded through the Ecole Doctorale of Ecole Polytechnique (3-year funding).
- 2014 Fee waiver for M.S. at Ecole Polytechnique (€4,000). French Ministry of Defence (DGA).
- 2008 Fee waiver for first year of university studies (€2,000). Baccalaureate Special Distinction: 9.94/10.00. Andalusian Government.

## STUDENT SUPERVISION

- 2023 Katherine Cao, Center for Turbulence Research (co-supervised with B. McKeon, Stanford University) ‘ResDMD for turbulent flows’. M.S. Project.
- 2020–24 Zhenghao Luo, Department of Aeronautics (co-supervised with Y. Hwang, Imperial College) ‘Generalized quasi-linear approximation in uniform shear turbulence’. Ph.D. Thesis.
- 2020 Jonathan de Sousa, Department of Aeronautics (co-supervised with Y. Hwang, Imperial College) ‘Non-modal analysis of tilted stratified shear flows’. UROP.
- 2018 Ziheng Yu, Department of Aeronautics (co-supervised with Y. Hwang, Imperial College) ‘Minimal quasi-linear approximation in uniform shear turbulence’. M.S. Thesis.

## **COURSES TAUGHT**

### **Stanford University**

2023      Low-Order Modeling for Turbulent Flows

### **Imperial College London**

2017–21    Complex Analysis

2017–21    Infinitesimal Calculus

2021      Reinforcement Learning

## **MEMBERSHIPS**

2018–      Isaac Newton Institute for Mathematical Sciences, University of Cambridge

2018–      American Physical Society

## **CODING**

Languages: FORTRAN, C/C++, MATLAB, Mathematica, Python (PyTorch, Scikit).

## **LANGUAGES**

Spanish (Mother tongue), French (Fluent), English (Fluent), Italian (Fluent).