Carlos González Hernández

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EDUCATION

Ph.D. in Mathematics 2021
Imperial College London, London, United Kingdom

M.S. in Physics 2015
Ecole Polytechnique, Paris, France

B.S.+M.S. in Engineering 2014
Universidad de Sevilla, Seville, Spain

APPOINTMENTS

Stanford University 01/2023 – Present
Research Fellow, Department of Aeronautics & Astronautics
Institute for Computational & Mathematical Engineering

Imperial College London 01/2023 – Present
Honorary Research Fellow

Imperial College London 03/2020 – 12/2022
Research Associate

University of Leeds 03/2022 – 06/2022
Visiting Fellow, School of Mathematics

Imperial College London 10/2016 – 02/2020
Research Assistant, Department of Mathematics

French Atomic Energy Commission 01/2016 – 09/2016
Research Scientist, Inertial Confinement Fusion Team, CEA/CELIA

RESEARCH AREAS

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

ML: 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:10.1007/978-3-030-80716-03 3

Thesis

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

CONFERENCE ACTIVITY AND TALKS

Conference Papers presented and Invited Talks

2024   NASA Advanced Modeling and Simulation Seminar series, NASA Ames (USA).

2024   77th APS Fluid Dynamics, Salt Lake City (USA).

2023   76th APS Fluid Dynamics, Washington DC (USA).

2023   Theoretical Division, Los Alamos National Laboratory (USA).

2023   76th APS Fluid Dynamics, Washington DC (USA).

2023   TFSA Conference, Stanford (USA).

2022 75rd APS Fluid Dynamics, Indianapolis, Indiana (USA).

2022   Causality in Turbulence and Transition, Madrid (Spain).

2021 74th APS Fluid Dynamics, Phoenix, Arizona (USA).

2021   ICTAM 2020+1, Milano (Italy).

2021   iTi – interdisciplinary Turbulence initiative, Darmstadt (Germany).

2020 73rd APS Fluid Dynamics, Chicago, Illinois (USA).

2018 71st APS Fluid Dynamics, Atlanta, Georgia (USA).

2018 12th European Fluid Mechanics Conference, Vienna (Austria).

2018   UK Fluids Conference 2018, Manchester (UK).

2018 18th USNC Theoretical and Applied Mechanics, Chicago, Illinois (USA).

2017   EUROMECH 591, Bari (Italy).

GRANTS AND AWARDS

Awards and Fellowships

2022   CTR Fellowship ($74,000). Center for Turbulence Research, Stanford University (USA).

2022   Visiting Fellowship (£3,000). Leeds Institute for Fluid Dynamics, University of Leeds (UK).

2018   Travel Grant ($1,000). APS Fluid Dynamics (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 (3.5-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. in Fluid Mechanics 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).