

Daniel Castañón-Quiroz

Assistant Professor

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Personal Information

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Research Interests

- Numerical analysis of PDEs, scientific computing, finite element methods, non-conforming approximation.
- Navier–Stokes equations, Maxwell equations, the coupling of free flow and flow in porous media.

Education

- **Texas A&M.** College Station, Texas, USA.
PhD in Applied Mathematics. Aug. 2010 - May 2016.
 - Advisor : Prof. Jean-Luc Guermond.
 - Thesis title: ‘*Solving the MHD equations in the presence of non-axisymmetric conductors using the Fourier-finite element method*’.
<https://oaktrust.library.tamu.edu/handle/1969.1/156971>
- **IPN-Mexico.** Mexico City, Mexico.
Bachelor in Applied Mathematics. Aug. 2000 - Aug. 2005.

Publications

- 1.- A. Armandine Les Landes, D. Castanon Quiroz, L. Jeannin, S. Lopez, and R. Masson, **Two-phase geothermal model with fracture network and multi-branch wells**. SMAI Journal of Computational Mathematics. Volume 9, 2023.
<https://doi.org/10.5802/smai-jcm.97>,
<https://hal.archives-ouvertes.fr/hal-03273589>
- 2.- D. Castanon Quiroz and D. A. Di Pietro, **A pressure-robust HHO method for the solution of the incompressible Navier–Stokes equations on general meshes**. *IMA Journal of Numerical Analysis*, published online in April, 2023.
<https://doi.org/10.1093/imanum/drad007>,
<https://hal.archives-ouvertes.fr/hal-03608248>
- 3.- D. A. Di Pietro, D. Castanon Quiroz and A. Harnist, **A Hybrid High-Order method for incompressible flows of non-Newtonian fluids with power-like convective behaviour**. *IMA Journal of Numerical Analysis*, December, 2021.
<https://doi.org/10.1093/imanum/drab087>,
<https://hal.archives-ouvertes.fr/hal-03273118>
- 4.- M. Botti, D. Castanon Quiroz, D. A. Di Pietro, and A. Harnist, **A Hybrid High-Order method for creeping flows of non-Newtonian fluids**. *ESAIM: Math. Model Numer. Anal.*, Volume 55, Number 5, September-October 202, 2021. <https://hal.archives-ouvertes.fr/hal-02519233>

- 5.- D. Castanon Quiroz and D. A. Di Pietro, **A Hybrid High-Order method for the incompressible Navier–Stokes problem robust for large irrotational body forces**. *Comput. Math. Appl.*, 2020. Vol 79, Issue 9. <https://doi.org/10.1016/j.camwa.2019.12.005>, <https://hal.archives-ouvertes.fr/hal-02151236>
- 6.- C. Nore, D. Castanon Quiroz, L. Cappanera and J.-L. Guermond, **Numerical simulation of the Von-Kármán-Sodium experiment**. *J. Fluid Mech.*, 854 (2018) 10 November 2018, 164–195. <https://doi.org/10.1017/jfm.2018.582>
- 7.- C.E. Janson, A. Shiri, J. Jansson, M. Moragues, D. Castanon, L. Saavedra, C. Degirmenci and M. Leoni, **Nonlinear Computations of Heave Motions for a Generic Wave Energy Converter**. *Proceedings of NAV 2018: 19th International Conference on Ship and Maritime Research*, 2018, 283–290. <http://ebooks.iospress.nl/publication/49237>, <https://bird.bcmath.org/handle/20.500.11824/901>
- 8.- C. Nore, D. Castanon Quiroz, L. Cappanera and J.-L. Guermond, **Direct numerical simulation of the axial dipolar dynamo in the Von Kármán Sodium experiment**. *EPL (Europhysics Letters)*, Volume 114, Number 6, July 2016. <https://doi.org/10.1209/0295-5075/114/65002>
- 9.- C. Nore, D. Castanon Quiroz, J.-L. Guermond, J. Léorat and F. Luddens, **Numerical Dynamo Action in Cylindrical Containers**, *The European Physical Journal Applied Physics* (2015) 70:31101. <http://dx.doi.org/9.1051/epjap/2015150049>

Submitted Articles

- 1.- A. Armandine Les Landes, L. Beaudé, D. Castanon Quiroz, L. Jeannin, S. Lopez, F. Smai, T. Guillon, and R. Masson, **Geothermal Modeling in Complex Geological Systems with COMPASS**. *Submitted*, 2023. HAL-Preprint: <https://brgm.hal.science/hal-04246471>
- 2.- D. Castanon Quiroz, L. Jeannin, S. Lopez, and R. Masson, **Multi-segmented non-isothermal compositional liquid gas well model for geothermal processes**. *Submitted*, 2024. HAL-Preprint: <https://hal.science/hal-04362558>

Work as Referee for Journals

- Electronic Research Archive (ERA), *IMA Journal of Numerical Analysis (IMAJNA)*, *Computers and Mathematics with Applications (CAMWA)*, *Computer Methods in Applied Mechanics and Engineering (CMAME)*, *Numerical Algorithms*, *Mathematics in Engineering (MinE)*, *Boletín de la Sociedad Matemática Mexicana*.

Professional Experience

- **Assistant Professor.** Mexico City, Mexico.
May 2022 - Present
 - Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (IIMAS).
 - Universidad Autónoma de México (UNAM).
- **INRIA Postdoc-Fellow.** Nice, France.
Nov. 2019 - April 2022
 - Member of the INRIA Team Coffee.
Laboratoire de Mathématiques J. A. Dieudonné. Université Côte d’Azur.
 - Supervisor: Prof. Roland Masson.
 - Research on advanced thermal well modelling for the high performance simulation of geothermal systems.
 - Industrial Partners: BRGM and Storengy.

- **CNRS Postdoc-Fellow.**

Montpellier, France.
Nov. 2017 - Oct. 2019

- Institut Montpelliérain Alexander Grothendieck (IMAG),
Université de Montpellier.
- Supervisor: Prof. Daniele A. Di Pietro.
- Research on Hybrid-High Order methods (HHO) for the Navier-Stokes eqs.
- Industrial Partners: EDF-R&D.

- **Postdoc-Fellow.**

Bilbao, Spain.
Aug. 2016 - Aug. 2017

- Basque Center for Applied Mathematics (BCAM).
- Supervisor: Johan Jansson.
- Research on multiphase flow and finite element adaptivity.

- **Software Developer.**

Mexico City, Mexico.
Aug. 2007 - Aug. 2010

- Insys IT, Incorporated.
- Developed software tools for computer security such as TCP/IP servers,
and clients using C++ and Java.

- **Engineer and Research Assistant.**

Mexico City, Mexico.
Aug. 2005 - Aug. 2007

- ICAT-UNAM.
- Developed tool for the simulation of chemical systems using finite elements.

Teaching Experience

- Numerical Analysis of Ordinary Differential Equations (in Spanish). Graduate level course. Spring 2024. IIMAS-UNAM, Mexico City, Mexico.
- Introduction to Finite Elements: Practice and Applications (in Spanish). Bachelor level course. Fall 2024. Facultad de Ciencias, UNAM, Mexico City, Mexico.
- Theory, Practice and Applications of Finite Elements (in Spanish). Graduate course. Spring 2023. Posgrado en Matemáticas, IIMAS-UNAM, Mexico City, Mexico.
- Numerical Methods for Ordinary Differential Equations (in Spanish). Undergraduate course at the 3rd year. Fall 2022. UNAM, Facultad de Ciencias, Mexico City, Mexico.
- Differential Calculus and Dynamical Systems (in French). Python Labs. Undergraduate level 2nd year. Fall 2021. University Côte d'Azur, Nice, France.
- Math 610: (Master-graduate class) Numerical Methods for PDEs. Recitation and Labs (Matlab). Fall 2013. Texas A&M, USA.
- Math 151: Engineering Mathematics I. Recitation and Labs (Matlab). Fall 2011. Texas A&M, USA.
- Math 141/142: Business Mathematics I & II. Help Sessions. Summer 2011. Texas A&M, USA.
- Math 442: Mathematical Modeling. Grader. Spring 2011. Texas A&M, USA.
- Math 411: Mathematical Probability. Grader. Fall 2010. Texas A&M, USA.

Funding

- From 2023-01 to 2024-12, Grant DGAPA-UNAM (Mexico City, Mexico, MX). Grant Number: DGAPA-IA101723. Total of funding: \$ 182,000.00 MXN.

Synergistic Activities

- Co-mentoring the student Hind Bouyri in her master thesis at IMAG (University of Montpellier) titled: *Implementation of Hybrid High-Order methods for convective terms in Code-Saturne*. Thesis supervisor: Daniele Di Pietro.

Participation in Conferences and Invited Seminars

- The ERC NEMESIS kick-off workshop, invited keynote speaker. Montpellier, France. June 19th-21st, 2024.
- Seventh Chilean Workshop on Numerical Analysis of Partial Differential Equations (WONAPDE) 2024, invited speaker in the minisymposium named *Recent Advances in Polytopic Methods*, Concepción, Chile. January 18th, 2024.
- Seventh Chilean Workshop on Numerical Analysis of Partial Differential Equations (WONAPDE) 2024, invited speaker in the minisymposium named *Recent Advances in (Hybridizable) Discontinuous Galerkin Methods and Applications*, Concepción, Chile. January 16th, 2024.
- SIAM Mexico Annual Meeting, invited speaker in the minisymposium named *Ecuaciones Diferenciales Parciales no Lineales: Análisis, Numérico y Aplicaciones*, Mexico City, Mexico. June 7th- June 9th, 2023.
- 22nd Conference in Computational Fluid Dynamics, invited speaker in the minisymposium named *Recent advancements in Polytopal Methods for Fluid Mechanics*, Cannes, France. April 25th-28th, 2023.
- 10° Congreso Metropolitano de Modelado y Simulación Numérica, invited speaker, Mexico City, Mexico. April 19, 2023.
- Workshop on Polytopal Element Methods in Mathematics and Engineering (POEMS), Politecnico de Milano, Milan, Italy. December 12nd-14th, 2022.
- Coloquio de Matemáticas y Mecánica del IIMAS, UNAM, Mexico City, Mexico. March 9th, 2022.
- MexSIAM Annual Meeting, mini-symposium “Modelación matemática de flujo y transporte en medios porosos”, Mexico City, Mexico. June 21st-23rd, 2021.
- Séminaire de l'équipe EDP Analyse Numérique, Laboratoire J. A. Dieudonné, Nice, France, May 20th, 2021.
- Séminaire Approx, EDP et Modèles aléatoires, LMPA, Université de Littoral, France. April 22nd, 2021.
- ALGORITMY 2020, mini-session “Pressure-robust discretisations for flow problems and their applications”, 10th-15th September, Podbanské, Slovakia, 2020.
- MAFELAP 2019, mini-symposium “Theoretical and computational advances in polygonal and polyhedral methods”, 18th–21st June 2019, London, England.
- POEMs 2019, session d'affichage, 29th April–3rd May 2019, Marseille, France.
- Colloquium, CIMAT, 13th December 2019, Guanajuato, Mexico.
- Colloquium, Instituto de Matemáticas, 11th December 2019, Querétaro, Mexico.
- CEDYA 2017, mini-symposium “Tecnología matemática como herramienta clave para la Industria 4.0: algunos casos de éxito”, 26th–30th June 2017, Cartagena, Spain.
- COUPLED PROBLEMS 2017, 12th–14th June, 2017, Rhodes, Greece.
- 5to Congreso Metropolitano de Modelado y Simulación Numérica 2017, Mexico City, Mexico.
- Colloquium, Instituto de Matemáticas, 13th May 2019, Querétaro, Mexico.
- Colloquium, CIMAT, 12th May 2017, Guanajuato, Mexico.
- Finite Element Rodeo 2016, 4th–5th May 2016, Texas A&M, Texas, USA.

- Finite Element Rodeo 2015, 27th–28th February 2015, Southern Methodist University, Texas, USA.
- Finite Element Rodeo 2014, 28th February–1st March 2014, UT Austin, Texas, USA.

Research Visits

- Visit to IMAG at the University of Montpellier, Montpellier, France. May 16th–June 22nd 2024.
- Visit to LJAD at the Université Côte d’Azur, Nice, France. May 2nd–May 5th 2023.
- Visit to LIMSI at the University of Orsay-Paris, France. Under grant NSF-500401-00001. Summer 2012.

Skills

Spoken Languages: Spanish (native), English (fluent), French (level B1).

Programming Languages: C/C++, Fortran90, Python3, MPI, Unix-Bash.