Cristhian **Montoya**

PhD in Engineering Science · Mathematical Modelling

Universidad EAFIT, School of Applied Sciences and Engineering, Medellín. Colombia

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Personal Data

May 15, 2025

Name: Cristhian David Montoya Zambrano

Born: September 6, 1985, Bogotá, Colombia

Education

2012–2016 PhD in Engineering Science: Mathematical Modelling. Advisor: Axel Osses. Universidad de Chile, Chile.

2010–2012 Master in Mathematics. Advisor: Humberto Prado. Universidad de Santiago de Chile, Chile.

2003–2009 Mathematics. Advisor: Francisco Enriquez Saavedra. Universidad del Cauca, Colombia.

Academic positions

Currently Full Professor. Universidad EAFIT, Medellín, Colombia.

2/2021–7/2021 Postdoctoral researcher. Advisor: Martin Lazar. University of Dubrovnik, Croatia.

03/2018–02/2021 Postdoctoral researcher. Advisor: Eduardo Cerpa. Pontificia Universidad Católica de Chile (PUC) and Universidad Técnica Federico Santa Maria (UTFSM), Chile.

1/2018–4/2018 Professor. Universidad Yachay Tech, San Miguel de Urcuquí, Ecuador.

9/2016–12/2017 Postdoctoral researcher. Advisor: Luz de Teresa. Universidad Nacional Autónoma de México, Mexico.

Research Grants and Projects

5/2025–6/2025 Collaborations with Developing Countries, grant N° 52402. United Kingdom.

2024–2027 Proyecto de Investigación Interno de Alta Cuantía. EAFIT, Colombia.

2022–2024 Proyecto de Investigación Interno de Mediana Cuantía. EAFIT, Colombia.

2020–2021 Math–AmSud MATH190008: Analysis, Control and Inverse Problems for PDEs (Chile, France, Brazil).

3/2018–3/2021 Fondecyt Postdoctorado No. 3180100, Anid. PUC–UTFSM, Chile. (three years).

9/2016–12/2017 Fordecyt Postdoctorado No. 265667, Conacyt. UNAM, Mexico. (18 months).

Research lines

- Inverse problems for partial differential equations.
- Control theory.
- Mathematical modelling.
- Numerical analysis of partial differential equations.

Students

Since 2024 Advisor PhD student in Mathematical Engineering, Carlos Marín, EAFIT, Medellin, Colombia.

Since 2022 Advisor Master student in Applied Mathematics, David Bolivar, EAFIT, Medellin, Colombia.

2019–2023 Co–advisor PhD student, Louis Breton, PhD in Mathematics. UNAM, Mexico City, Mexico.

2018–2019 Co–advisor undergraduate student, Alex Imba. Universidad YachayTech, Ecuador.

12/2016 PhD committee member, Victor Hernandez Santamaria, PhD in Automatic Control. CINVESTAV. Advisor: Luz de Teresa and Alexander Poznyak. Mexico City, Mexico.

Teaching experience

7/24–12/24 Nonlinear optimization, numerical analysis (master students in Applied Mathematics). Universidad EAFIT, Medellin, Colombia. Lecturer.

1/24–6/24 Nonlinear optimization, partial differential equations (Doctorate program in Mathematical Engineering). Universidad EAFIT, Medellin, Colombia. Lecturer.

1/23–6/23 Linear and nonlinear optimization, numerical analysis (master students in Applied Mathematics). Universidad EAFIT, Medellin, Colombia. Lecturer.

7/21–6/22 Linear and nonlinear optimization, Differential calculus, partial differential equations. Universidad EAFIT, Medellin, Colombia. Lecturer.

8/19–1/20 Calculus in several variables. UTFSM. Campus San Joaquin, Chile. Lecturer.

3/19–7/19 Numerical Analysis of Partial Differential Equations. UTFSM. Campus San Joaquin, Chile. Lecturer.

1/18–5/18 Numerical Analysis of Partial Differential Equations. Universidad Yachay Tech, Ecuador. Lecturer in english.

3/16–7/16 Linear algebra – Calculus I. UTFSM. Santiago, Chile. Lecturer.

2010–2014 Linear algebra, Calculus I, Calculus II, Calculus in several variables, ODEs. UTFSM. Santiago, Chile.

2011 Abstract algebra. Universidad de Santiago. Santiago, Chile. Lecturer.

Publications

[1] G. García., C. Montoya., A.Osses. A source reconstruction algorithm for the Stokes system from incomplete velocity measurements, Inverse Problems, 33,10, pages 105003, 2017 http://stacks.iop.org/0266-5611/33/i=10/a=105003

[2] S. Guerrero., C. Montoya. Local null controllability of the N- dimensional Navier-Stokes system with nonlinear Navier–Slip boundary conditions and $N-1$ scalar controls. J. Math. Pures Appl. (9), 113:37-69, 2018 https://doi.org/10.1016/j.matpur.2018.03.004

[3] C. Montoya., L. de Teresa. Robust–Stackelberg controllability for the Navier–Stokes system. Nonlinear Differ. Equ. Appl. (2018) 25: 46 https://doi.org/10.1007/s00030-018-0537-3

[4] C. Montoya. Inverse source problems for a Korteweg–de Vries–Burgers equation with mixed boundary conditions. J. Inverse Ill-Posed Probl. Volume 27, Issue 6, Pages 777–794, 2019 https://doi.org/10.1515/jiip-2018-0108

[5] C. Montoya., J. Moreno., L. de Teresa. Observer Design For Multidimensional Parabolic Systems. International Federation on Automatic Control, IFAC–Papers OnLine. Volume 52, Issue 2, 2019, Pages 195-200 https://doi.org/10.1016/j.ifacol.2019.08.035

[6] E. Cerpa., C. Montoya., BY. Zhang. Local exact controllability to the trajectories of the Korteweg–de Vries–Burgers equation on a bounded domain with mixed boundary conditions. J. Differential Equations. Volume 268, Issue 9, 15 April 2020, Pages 4945-4972. https://doi.org/10.1016/j.jde.2019.10.043

[7] C. Montoya. Remarks on local controllability for the Boussinesq system with Navier boundary condition. Comptes Rendus. Mathématique. Volume 358 (2020) no. 2, pp. 169-175. https://comptes-rendus.academie-sciences.fr/mathematique/item/CRMATH_2020__358_2_169_0/

[8] C. Montoya., J–P. Romero–Leiton. Mathematical modelling for malaria under resistance and population movement. Rev. Integr. temas mat. 38 (2020), No. 2, 131-161. http://cmontoya.mat.utfsm.cl/paper/2020-Montoya-Romero.pdf

[9] L. Bretón., P.González–Casanova., C. Montoya. RBF collocation and hybrid–LHI methods for Stokes systems and its application to controllability problems. Comp. Appl. Math. 40, 15 (2021). https://doi.org/10.1007/s40314-020-01400-7

[10] C. Montoya., L. Bretón. Robust Stackelberg Controllability for the Kuramoto–Sivashinsky Equation. Mathematics of Control, Signals, and Systems, 1-44, 2022.
https://link.springer.com/article/10.1007/s00498-022-00316-3

[11] C. Montoya, C. Spa. A numerical study of third-order equation with time-dependent coefficients: KdVB equation. Preprint 2022. http://cmontoya.mat.utfsm.cl/paper/2020-CMontoya-ArXiV.pdf

[12] C. Montoya, Ignacio Brevis, David Bolivar. Inverse source problems for coupled parabolic systems from measurements of one internal component. Preprint 2024. https://arxiv.org/abs/2402.07593

[13] Louis Breton, Cristhian Montoya, Pedro González-Casanova, Jesús López Estrada. Identification of a boundary obstacle in a Stokes fluid with Dirichlet–Navier boundary conditions. J. Math. Anal. Appl. (2024), 127814.
https://www.sciencedirect.com/science/article/abs/pii/S0022247X2300817X?via

[14] Ledyz Cuesta-Herrera, Luis Pastenes, Ariel D. Arencibia, Fernando Córdova-Lepe, Cristhian Montoya. Dynamics of Activation and Regulation of the Immune Response to Attack by Viral Pathogens Using Mathematical Modeling. Mathematics 2024,12,2681. https://crismontoya.github.io/2024-CMontoyaetal.pdf

[15] Fredy Marin, Alejandro Pinilla, Cristhian Montoya, Santiago Medina. Valuation of European call options for the Scott's stochastic volatility model: An explicit finite difference scheme.
Mathematics and Computers in Simulation, Volume 236, October 2025, Pages 411-425.
https://doi.org/10.1016/j.matcom.2025.03.033

Awards and Fellowships

2014–2016 PhD fellowship. Conicyt, Santiago, Chile
9/2012 Best graduate student. Universidad de Santiago de Chile, Santiago, Chile.
4/2011 Outstanding Lecturer Prize. Universidad Técnica Federico Santa Maria, Santiago, Chile.
2010–2012 Master fellowship. Universidad de Santiago de Chile, Santiago, Chile.
6/2006 Merit prize in mathematical olympiads. Universidad Pontificia Javeriana de Colombia, Valle del Cauca, Colombia.
7/2005 Merit prize in mathematical olympiads. Universidad Pontificia Javeriana de Colombia, Valle del Cauca, Colombia.
2003–2009 Merit grant. Universidad del Cauca, Cauca,Colombia.

Editorial Services

Since 2021 Reviewer for Mathematics of Control, Signals and Systems.
Since 2021 Reviewer for Annales de l'Institut Henri Poincaré C, Analyse Non Linéaire.
Since 2020 Reviewer for ESAIM: Control, Optimisation and Calculus of Variations.
Since 2019 Reviewer for Inverse Problems in Science & Engineering.
Since 2017 Reviewer for Boletín de la Sociedad Matemática Mexicana.
Since 2017 Reviewer for Mathematical Reviews of the American Mathematical Society.

Talks

11/2024 Identification of arterial stenosis: inverse problems from external measurements
Universidad Técnica Federico Santa María, Chile.
12/2023 An inverse problem in Stokes fluid for the stenosis detection
Universidad Industrial de Santander, Colombia.
04/2022 Inverse source problems in fluid mechanics. Webinar. Universidad del Cauca, Colombia.
11/2021 Some Inverse source problems using partial differential equations.
Universidad EAFIT. Colombia.
2/2021 Inverse source problems for coupled heat systems using measurements of one scalar state.
University of Dubrovnik. Croatia.
2/2020 Inverse source problems and controllability in a dispersive model: Korteweg-de Vries-Burgers equation. Université Paul Sabatier. Institut de Mathématiques de Toulouse. France.

11/2019 On robust and hierarchic control in some PDEs. Center for Mathematical Modeling (CMM). Chile.
12/2018 Stackelberg strategy for robust control systems in PDEs. UTFSM, Valparaiso. Chile.
05/2018 Robust Stackelberg controllability for the Navier–Stokes system. Universidad del Norte. Barranquilla. Colombia.
8/2017 Local null controllability for the Boussinesq system with nonlinear Navier–slip conditions and few controls. 3rd PRIMA Congress, Oaxaca. Mexico.
7/2017 Robust–Stackelberg controllability for the Navier–Stokes system. Mathematical Congress of the Americas. Montreal. Canada.
3/2017 Some inverse source problems in PDE's. IIMAS–UNAM. Mexico.
12/2016 Some inverse problems in PDEs. Universidad Autónoma del Estado de Hidalgo. Mexico.
12/2016 An introduction to the fractional calculus. Universidad Autónoma del Estado de Hidalgo. Mexico.
12/2016 On inverse source problems and controllability for the Stokes and Navier–Stokes equations. Huatulco. Oaxaca. Mexico.
4/2016 Local null controllability of the N–dimensional Navier–Stokes system with Navier– slip boundary conditions and N-1 scalar controls. Universidad de Chile. Chile.
1/2016 Local null controllability of the N–dimensional Navier–Stokes system with Navier– slip boundary conditions and N-1 scalar controls. Valparaiso. Chile.
11/2015 Poster. Local null controllability of the N–dimensional Navier–Stokes system with Navier–slip boundary conditions and N-1 scalar controls. Centre International de Rencontres Mathématiques. Marseille. France.

Visits

- Imperial College London. June 2025. United Kingdom.
- University of Nottingham. May 2025. United Kingdom.
- Universidad Técnica Federico Santa María. November 2024. Chile.
- Universidad Técnica Federico Santa María. January 2022. Chile.
- Université Paul Sabatier. Institut de Mathématiques de Toulouse. February 2020. France.
- Centro de Investigación en Matemáticas (CIMAT) & UNAM. September 2019. Mexico.
- Universidad de La Serena. La Serena. July 2019. Chile.
- Instituto de Alta Investigación. Universidad de Tarapacá. Arica. May 2019. Chile.
- Instituto de Matemáticas. UNAM. May– July 2018. Mexico.
- Universidad Técnica Federico Santa María. April 2017. Chile.
- Université Pierre et Marie Curie. Laboratoire Jacques–Louis Lions. Paris. 10 months, 2015. France.