

# Cristhian Montoya

PHD IN ENGINEERING SCIENCE · MATHEMATICAL MODELLING

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## Personal Data

March 15, 2021

NAME: CRISTHIAN DAVID MONTOYA ZAMBRANO

BORN: SEPTEMBER 6, 1985, BOGOTÁ, COLOMBIA

## Education

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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

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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 María (UTFSM), Chile.

1/2018–4/2018 Visiting professor. Universidad Yachay Tech, San Miguel de Urququí, Ecuador.

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

## Research Grants and Projects

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2020–2021 Math–AmSud MATH190008: Analysis, Control and Inverse Problems for PDEs.

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

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

## Students

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Since 2019 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

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

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

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- [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 non-linear 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/](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. Preprint 2020. <http://cmontoya.mat.utfsm.cl/paper/2020-Breton-Montoya-ArXiV.pdf>
- [11] C. Montoya. A numerical study of third-order equation with time-dependent coefficients: KdVB equation. Preprint 2020. <http://cmontoya.mat.utfsm.cl/paper/2020-CMontoya-ArXiV.pdf>
- [12] C. Montoya. Inverse source problems for coupled parabolic systems using measurements of one scalar state–Part I: Theoretical analysis. Preprint 2020. <http://cmontoya.mat.utfsm.cl/paper/InverseProblems-CMontoya.pdf>

## Awards and Fellowships

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- 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

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- 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

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- 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, Valparaíso. 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. Valparaíso. 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

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- 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.