

Maria Teresa Chiri

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Academic Position

Queen's University

Assistant Professor (Tenure-track)

Kingston, ON (Canada)

July 2022-to date

Penn State University

Postdoctoral Scholar

University Park, Pa. (USA)

Jan 2020-June 2022

Advisor: Prof. Alberto Bressan

Education

University of Padova

PhD in Mathematics, Committee rating: Excellent

Structural properties of solutions, approximation and control for conservation laws with discontinuous flux and bio-inspired PDE models. Advisor: Prof. Fabio Ancona

Padova (Italy)

2016-2019

University of Pisa

Master Degree in Mathematics, with honors

Thesis: The Ohta-Kawasaki functional and related nonlocal problems. Supervisor: Prof. Matteo Novaga

Pisa (Italy)

2013-2016

University of Salento

Bachelor Degree in Mathematics, with honors

Thesis: From Lagrangian Mechanics to Hamiltonian Mechanics with an introduction to Classical Perturbation Theory. Supervisor: Dr. Anna Maria Cherubini

Lecce (Italy)

2010-2013

Research Interests

My research focuses on methods coming from nonlinear partial differential equations, calculus of variations, and control theory, to study problems in applied sciences. In particular I work on problems motivated by the control of invasive biological species, the confinement of forest fires, and the improvement of traffic flow through autonomous vehicles. A further research deals with scalar conservation laws with discontinuous flux and error estimates for approximate solutions to hyperbolic system of conservation laws.

Publications

Published or accepted.....

- 1 F. Ancona and M.T.Chiri, Attainable profiles for conservation laws with flux function spatially discontinuous at a single point, *ESAIM: COCV*, 26, (2020)
- 2 A. Bressan, M.T.Chiri and W. Shen, A posteriori Error Estimates for Numerical Solutions to Hyperbolic Conservation Laws. *Arch. Rat. Mech. Anal.*, 241 (2021), 357–402
- 3 A. Bressan and M.T.Chiri, On the regularity of optimal dynamic blocking strategies, *Calculus of Variations and Partial Differential Equations*, 61 (2022)
- 4 S. Albeaik, A. Bayen, M.T.Chiri, X. Gong, A. Hayat, N. Kardous, A. Keimer, S. T. McQuade,

B. Piccoli, Y. You, *Limitations and improvements of the intelligent driver model (IDM)*, *SIAM J. on Applied Dynamical Systems* 21, (2022)

5 F. Ancona, A. Bressan, and M.T.Chiri, Soil searching by an artificial root, *SIAM Journal on Applied Mathematics* 82 (2022), 1423-1445

6 A. Bressan, M.T.Chiri, and N. Salehi, On the optimal control of propagation fronts, *Mathematical Models and Methods in the Applied Sciences.* 32 (2022), 1109-1140

7 M.T.Chiri, X. Gong, and B. Piccoli, Mean-field limit of a hybrid system for multi-lane car-truck traffic, *Network and Heterogeneous Media* 18 (2023), 723-752

8 A. Bressan, M.T.Chiri, Najmeh Salehi, Boundary Control of Moving Sets, *Journal of Differential Equations* 361 (2023), 97-137

Preprints, submitted.....

9 M.T.Chiri, X. Gong, and B. Piccoli, Hybrid multi-population traffic flow model: Optimal control for a mean-field limit, preprint 2021.

10 M.T.Chiri, M. Zhang, On backward Euler approximations for systems of conservation laws, submitted, 2021.

11 S. Bianchini, A. Bressan, M.T. Chiri, Optimal Solutions for a Class of Set-Valued Evolution Problems, preprint 2023.

Reports and Proceedings.....

13 Conservation laws with transition phase for supply chains, M.T. Chiri, Seminario Dottorato (2019)

14 A posteriori Error Estimates for Numerical Solutions to Hyperbolic Conservation Laws, M.T.Chiri, Oberwolfach Report (2021)

Awards

- NSERC Discovery Launch Supplement, 12.500 CA\$
- NSERC Discovery Grant, 150.000 CA\$
- Research Initiation Grant, Queen’s University, 30,000 CA\$

Mentoring

- o (2020-2022) Co-mentor of the Ph.D. student Minyan Zhang at Penn State University (main advisor Prof. Alberto Bressan)

Teaching Experience

Queen’s University, Department of Mathematics and Statistics <i>Instructor for Math 338: Fourier Methods for Boundary value Problems</i>	Ontario, Canada 01/2023-04/2023
Queen’s University, Department of Mathematics and Statistics <i>Instructor for Math120: Differential and Integral Calculus</i>	Ontario, Canada 09/2022-10/2022
Penn State University, Department of Mathematics <i>Instructor for Math140: Functions and Derivatives</i>	Pennsylvania (USA) 01/2022-04/2022
Penn State University, Department of Mathematics <i>Instructor for Math141H: Integration and ODEs, Honor Course</i>	Pennsylvania (USA) 08/2021-12/2021
Penn State University, Department of Mathematics <i>Instructor for two sections of Numerical Computation</i>	Pennsylvania (USA) 01/2021-04/2021

Penn State University, Department of Mathematics <i>Teaching Assistant for the course of Numerical Computation</i>	Pennsylvania (USA) 05/2020-08/2020
University of Padova, Department of Mathematics and Computer Science <i>Teaching Assistant for the course of Mathematical Analysis I</i>	Padova (Italy) 10/2017-01/2018
University of Pisa, Department of Energy Engineering <i>Teaching Assistant for the course of Mathematical Analysis I</i>	Pisa (Italy) 10/2015-12/2015

Talks

Upcoming:

- Minisymposium "Recent Advances in Numerical Methods and Scientific Computing " The VI AMMCS International Conference, August 14-18, 2023, Waterloo ON, Canada
- Minisymposium " Optimal Control, Differential Games, and Applications" The VI AMMCS International Conference, August 14-18, 2023, Waterloo ON, Canada

Past:

- May 28th 2023, Meeting on Nonlinear Evolution PDEs, Fluid Dynamics and Transport Equations, Erice, Italy
- February 10th 2023, Department of Mathematics and Statistics, Queen's University, Canada
- November 24th 2022, Department of Data Science, Friedrich-Alexander-Universität Erlangen-Nürnberg , Germany
- October 28th 2022, Mathematics Department, University of Houston, USA
- September 23rd 2022, Mathematics Department, Louisiana State University, USA
- September 14th 2022, Department of Mathematics - NC State University, USA
- June 23th 2022, International Conferences on Hyperbolic Problems (HYP 2022), Spain
- May 27th 2022, UMI100-Unipd, Padua, Italy
- May 16th 2022, Workshop 'Living Active Matter: Theory and Experiment', USA
- April 11th 2022, Department of Mathematics, Tufts University, USA
- February 1st 2022, School of Science & Engineering, Tulane University, USA
- January 28th 2022, Department of Mathematical Sciences, Rutgers University–Camden, USA
- January 26th 2022, Department of Mathematics and Statistics, Queen's University, Canada
- January 18th 2022, Department of Mathematical Sciences, New Jersey Institute of Technology, USA
- January 12th 2022, Department of Mathematics, Penn State University, USA
- January 11th 2022, School of Mathematical and Data Sciences, West Virginia University, USA
- April 15th 2021, Department of Mathematics, Princeton, USA
- March 10th 2021, Virtual seminar series on Control Methods in Hyperbolic Differential Equations
- March 2nd 2021, Oberwolfach meeting "Hyperbolic Balance Laws: modeling, analysis, and numerics" , Germany
- October 21st 2020, Department of Mathematics, Basel, Switzerland
- October 4th 2020, AMS Sectional Meeting, Penn State University, USA
- June 5th 2020, Department of Mathematics, Padova, Italy
- February 12th 2020, Department of Mathematics, Penn State University, USA
- October 17th 2019, Department of Mathematics, RWTH Aachen, Germany
- October 3rd 2019, Department of Mathematics, Padova, Italy
- May 22nd 2019, International Conference on Elliptic and Parabolic Problems, Gaeta, Italy
- May 16th 2019, IperPA2019 - XVIII Italian Meeting on Hyperbolic Equations, Palermo, Italy

- January 30th 2019, Department of Mathematics, Padova, Italy
- September 27th 2018, Analysis, Control and Inverse Problems for PDEs, Napoli, Italy
- September 10th 2018, Interactive workshop on hyperbolic equations, Ferrara, Italy
- HYP 2018, University Park, Pennsylvania, USA
- September 24th 2017, Centro de Ciencias de Benasque Pedro Pascual, Spain
- July 28th 2016, Department of Mechanical Engineering, EPFL, Lausanne, Switzerland
- July 4th 2016, Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany

Academic Experience

Events/Meeting organization.....

- Organizer of the Minisymposium "Control and stabilization of PDEs: recent advances and applications", 10th International Congress on Industrial and Applied Mathematics, Waseda University Tokyo, August 20-25, 2023
- Organizer of the CIRCLES workshop "Traffic and Autonomy", Maiori IT, June 21-23 2023
- Organizer Special Session "Mathematical models for traffic monitoring and control", The AIMS Conference on Dynamical Systems, Differential Equations and Applications, Wilmington NC, May 31-June 4 2023
- Organizer of the Workshop "Living Active Matter: Theory and Experiment", Penn State University, May 15-17 2022
- Organizers of the Special Session "New Trends in Mathematical Models for Traffic Flow" at AWM Research Symposium, Minneapolis, June 16-19 2022
- Organizer of 1st CIRCLES Workshop on Traffic and Autonomy Sept. 23-24 2021

Editorial activities and reviewer.....

- Referee for *Discrete and Continuous Dynamical Systems*, *Journal of Mathematical Analysis and Applications*, *Nonlinear Differential Equations and Applications NoDEA*, *Proceeding of European Control Conference*, *Journal of Hyperbolic Differential Equations*, *The American Naturalist*, *IMA Journal of Numerical Analysis* and *Mathematical Biosciences*.

Experiments on the field.....

- Vanderbilt Test 2021: Using deep reinforcement learning and self-driving cars to improve traffic flow and reduce energy consumption in Nashville. Experiments conducted with the CIRCLES team led by UC Berkeley and the Institute of Transportation Studies (ITS) Berkeley, in coordination with Vanderbilt University, University of Arizona, Temple University, Rutgers University-Camden, the Tennessee Department of Transportation, Toyota North America, and General Motors
- MegaVandertest 2022: Over the course of five days, the CIRCLES team conducted one of the largest traffic experiments the world, deploying a fleet of 100 Nissan Rogue, Toyota RAV4 and Cadillac XT5 vehicles onto a busy stretch of Nashville's I-24 during the morning commute. Each vehicle was equipped with an AI-powered cruise control system designed to automatically adjust the speed of the vehicle to improve the overall flow of traffic.

Research Visits

- University of Padova, Italy, May 2022 and June 2023
- RWTH Aachen, Germany, October 2019
- Penn State University, USA, September-November 2018, April-May 2019 and October-December 2019

Academic Service

M.Sc. Thesis Examining Committee.....

2022: Mher Marc Karakouzian (M.Sc. Applied Mathematics, Queen's University)

PhD Supervisory Committee.....

2022-to date : Anirban Dutta (Ph.D. Analysis, Geometry & Topology, Queen's University)

2022-to date : Chongming Li (Ph.D. Applied Mathematics, Queen's University)

Thesis Defence Chair.....

2022: Andres Chavez Ramos (Ph.D. Electrical & Computer Engineering, Queen's University)

Department Committees.....

2022-23 Graduate Committee (Queen's University)

Outreach

- Leader TaMIS (Toward a More Inclusive Science) for the Math Department, Penn State University
- Member of Committee Climate and Diversity, Penn State University
- Member of Committee for equal opportunities, enhancement of the welfare and against discrimination (CUG), University of Padua

Scholarships

- MIUR (Italian Ministry for University and Research) scholarship for members of "Albo Nazionale di eccellenza"
- ADISU scholarships 2010-2011 and 2011-2012 (Regional competitive scholarships)
- DSU scholarship 2013-2015 (Regional competitive scholarships)
- HYP2018 conference at Penn State, fellowship for Junior Participants.

Programming and Computer Skills

Excellent expertise in:

- Mathematica, Matlab
- C,C++ language (I wrote a program for cryptographic attack by implementing the Kasiski's algorithm)
- Latex

Good knowledge of:

- Python
- Computer-aided drafting

Languages

Italian: Mother tongue

English: Fluent