Gabriele Todeschi – Résumé

Nationality:	Italian
Date of birth:	9^{th} February 1993
Email:	gabriele.todeschi@enpc.fr
Website:	https://gptod.github.io
Github:	gptod
Spoken languages:	Italian, English, French

Current and previous positions

02/2025 - Postdoctoral researcher at CERMICS, École Nationale des Ponts et Chaussées, Paris (France). Supervisor: Virginie Ehrlacher.

02/2023 - - 12/2024 Postdoctoral researcher at LIGM, Université Gustave Eiffel, Paris (France), in the working group *New challenging Monge problems and their applications* of the Labex Bézout. Supervisor: François-Xavier Vialard

02/2022 - - 01/2023 Postdoctoral researcher at ISTerre, Université Grenoble Alpes, Grenoble (France). Supervisors: Jean-Marie Mirebeau and Ludovic Métivier

07/2020 - - 08/2020 Visiting PhD student at the Departement of Mathematics of Università degli Studi di Padova, Padova (Italy).

2018-2021 PhD student in the MOKAPLAN team, Inria-Ceremade, Paris (France).
Fellow of the Marie Sklodowska-Curie Cofund MathInParis Doctoral Program of the Fondation Sciences Mathématiques de Paris (FSMP).

Education

2018-2021 PhD in Applied Mathematics, Université Paris-Dauphine - PSL, Paris (France).
Thesis: *Finite volume approximation of optimal transport and Wasserstein gradient flows.* HAL: tel-03500566. Advisors: *Jean-David Benamou (Inria, Paris), Thomas Gallouët (Inria, Paris), Clément Cancès (Inria, Lille).*

2017-2018 Master M2 in Optimization - Université Paris-Saclay, Orsay (France). Average: 15.533/20.
Thesis: *A new approach to compute Wasserstein gradient flows using an H^{-1} linearization of the Wasserstein W_2 distance and its application to the numerical approximation of the solutions of a nonlinear drift diffusion equation using finite volumes.* Advisors: *Thomas Gallouët (Inria, Paris), Clément Cancès (Inria, Lille).*

2015-2018 Master's Degree in Mathematical Engineering - Università degli Studi di Padova, Padova (Italy).
Curriculum: Mathematical Modelling for Engineering and Science. Score: 110/110 cum laude.
Thesis: *The non-conforming Virtual Element Method (VEM) for the solution of the Navier-Stokes equations.* Advisors: *Mario Putti (Università degli Studi di Padova), Marco Manzini (Los Alamos National Laboratory).*

2012-2015 Bachelor's Degree in Energy Engineering - Università degli Studi di Padova, Padova (Italy). Curriculum: Electrical Engineering. Score: 110/110 cum laude.
Thesis: *Discrete geometric formulation for bidimensional magnetostatic problems.* Advisor: *Paolo Bettini (Università degli studi di Padova).*

2007-2012 High School Diploma (scientific studies) - Liceo Scientifico "A. Rosmini", Rovereto (Italy). Score: 100/100.

Teaching

2020-2021 Teaching assistant, Université Paris-Dauphine, Paris (France). Course: *Numerical methods for linear algebra and real univariate functions.*

2019-2020 Teaching assistant, Université Paris-Dauphine, Paris (France). Courses: *Analysis 3; Introduction to probability.*

2018-2019 Teaching assistant, Université Paris-Dauphine, Paris (France). Courses: *Analysis 3; Numerical methods for linear algebra and real univariate functions; Optimization.*

2016-2017 Teaching assistant, Università degli Studi di Padova, Padova (Italy). Courses: *Numerical methods for continuous systems, ordinary differential equations and partial differential equations; Programming (MATLAB/Fortran).*

Students supervision

2021-2022 Internship supervisor, 3rd year Mathematics, ENS Paris-Saclay, Paris (France).

Other responsabilities

2023-2024 Organization of the seminar of the working group *New challenging Monge problems and their applications* of the Labex Bézout.

2023-2024 Organization of the conference *New Monge Problems and Applications*, on computational optimal transport and its applications, held at the Université Gustave Eiffel on September 2023.

Journal publications

1. G. Todeschi, L. Métivier, J.M. Mirebeau. *Unbalanced L1 optimal transport for vector valued measures and application to Full Waveform Inversion.* Journal of Computational Physics, 523:113657, 2025.
2. T. Gallouët, A. Natale, G. Todeschi. *From geodesic extrapolation to a variational BDF2 scheme for Wasserstein gradient flows.* Mathematics of Computation, 2024.
3. E. Facca, G. Todeschi, A. Natale, M. Benzi. *Efficient preconditioners for solving dynamical optimal transport via interior point methods.* SIAM Journal on Scientific Computing, 46(3), A1397-A1422, 2024.
4. A. Natale, G. Todeschi. *A mixed finite element discretization of dynamical optimal transport.* Journal of Scientific Computing, 91(2), 1-26, 2022

5. A. Natale, G. Todeschi. *Computation of optimal transport with finite volumes.* ESAIM: Mathematical Modelling and Numerical Analysis, 55(5):1847-1871, 2021.

6. C. Cancès, T. O. Gallouët, G. Todeschi. *A variational finite volume scheme for Wasserstein gradient flows.* Numerische Mathematik, 146(3), pp. 437-480, 2020.

Conference proceedings

1. A. Natale, G. Todeschi. *TPFA finite volume approximation of Wasserstein gradient flows.* FVCA9 - International Conference on Finite Volumes for Complex Applications IX, 2020, Bergen, Norway.

Preprints

1. F. Léger, G. Todeschi, F.X. Vialard. *Nonnegative cross-curvature in infinite dimensions: synthetic definition and spaces of measures.* arXiv preprint arXiv:2409.18112, 2024.

2. T. O. Gallouët, A. Natale, G. Todeschi. *Metric extrapolation in the Wasserstein space.* arXiv preprint arXiv:2407.10516, 2024.

Talks

1. *Metric extrapolation in the Wasserstein space.* Seminar of the Analyse Appliquée team of the Institut de Mathématiques de Marseille, 2024, Marseille, France.

2. *EVI flows via Nonnegative cross-curvature.* Finite Volumes and Optimal Transport, Laboratoire de Mathématiques d'Orsay, 2024, Orsay, France.

3. *Metric extrapolation in the Wasserstein space.* Seminar of the EDP team of the Laboratoire Jean Kuntzmann, 2024, Grenoble, France.

4. *L1 optimal transport for vector valued measures and application to Full Waveform Inversion.* Seminar of the ANEDP team of the Laboratoire Paul Painlevé, 2024, Lille, France.

5. *L1 optimal transport for vector valued measures and application to Full Waveform Inversion.* 6th Dolomites Workshop on Constructive Approximation and Applications, 2024, Val di Fassa, Italy

6. *Extrapolation in the Wasserstein space.* Journées SMAI-MODE, 2024, Lyon, France.

7. *L1 optimal transport for vector valued measures and application to Full Waveform Inversion.* Seminar GT Transport Optimal - EDP - Machine Learning, 2023, Orsay, France.

8. *Optimal transport for SPD valued measures: a relaxed Beckmann's problem and application to Full Waveform Inversion.* SEISCOPE annual meeting, 2023, Grenoble, France.

9. *A relaxed Beckmann's problem for SPD valued measures and application to Full Waveform Inversion.* Optimal Transport Theory and Applications to Physics, École de Physique des Houches, 2023, Les Houches, France.

10. *Application of Optimal Transport to the computation of Wasserstein gradient flows and an inverse problem in seismic imaging.* Seminar of the EDP team of the Laboratoire Jean Kuntzmann, 2023, Grenoble, France.

11. *From geodesic extrapolation to a variational BDF2 scheme for Wasserstein gradient flows.* Seminar GTCalVa (Groupe de Travail de Calcul des Variations), Université Paris-Dauphine, 2022, Paris, France.

12. *Computation of optimal transport with finite volumes.* Journées MAGA (annual meeting of the ANR project MAGA), 2022, Autrans, France.

13. *TPFA finite volume approximation of Wasserstein gradient flows.* FVCA9 - International Conference on Finite Volumes for Complex Applications IX, 2020, Bergen, Norway.

Softwares

1. Contribution to the Fortran software TOY2DAC developed by the SEISCOPE team for seismic imaging via Full Waveform Inversion in the acoustic regime. Specifically, design of new misfit functions based on optimal transport.

2. OT-FV (Matlab): computation of dynamical quadratic optimal transport with finite volumes, owing to an interior point method for the solution of the discrete optimization problem and efficient iterative linear solvers for the saddle point problems that arise from it.

3. dynamic-ot (Python): solution of dynamical quadratic optimal transport with mixed finite element discretizations and the implementation of proximal-splitting type optimization solvers.

4. LJKO, LJKO_IPM (Matlab): reliable and efficient computation of Wasserstein gradient flows via variational finite volume schemes.