

Pablo Alexei Gazca Orozco

Curriculum Vitae

Academic History

- 2025-present **Faculty Member**, *Faculty of Mathematics and Physics*, Mathematical Institute, Charles University, Prague.
- 2022–2025 **Postdoctoral Researcher**, *Mathematical Institute*, Albert-Ludwigs-Universität Freiburg (in the group of Prof. Michael Růžička).
- 2022 **Postdoctoral Researcher**, *Faculty of Mathematics and Physics*, Mathematical Institute, Charles University, Prague (in the group of Prof. Josef Málek).
- 2020–2021 **Postdoctoral Researcher**, *Chair of Applied Analysis*, FAU Erlangen-Nürnberg, Germany (in the group of Prof. Enrique Zuazua).
- 2016–2020 **DPhil**, *Mathematical Institute*, University of Oxford, UK, Member of the Centre for Doctoral Training in Partial Differential Equations (PDE-CDT).
Thesis: Numerical Analysis of Implicitly Constituted Incompressible Fluids.
Supervisors: Endre Süli and Patrick Farrell.
- 2010–2015 **B.Sc. (Physics)**, *Facultad de Ciencias*, Universidad Nacional Autónoma de México.

Research Funding

- 2025–2028 **Principal Investigator**, *Numerical analysis for non-smooth partial differential equations*, PRIMUS/25/SCI/025, Charles University, 3 000 000 CZK
- 2024–2029 **Junior team member**, *University Centre for Mathematical Modelling, Applied Analysis and Computational Mathematics*, UNCE 24/SCI/005, Charles University, PI Josef Málek

Scientific Interests

- Analysis of finite element discretisations under minimal regularity assumptions.
- Non-smooth and/or constrained variational problems.
- Numerical and mathematical analysis of nonlinear partial differential equations arising from fluid and solid mechanics.
- Preconditioning and fast solvers for PDEs describing incompressible fluids.

Publications

Refereed Journal Papers

- *A Nitsche method for incompressible fluids with general dynamic boundary conditions*. (with F. Gmeineder, E. Maringová-Kokavcova and T. Tschierpel). arXiv:2502.09550, 2026. To appear in ESAIM: M2AN.
- *Quasi-optimal Discontinuous Galerkin discretisations of the p -Dirichlet problem*. (with J. Blechta,

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- A. Kaltenbach and M. Růžička). *Numer. Math.* 158, 587–626, 2026.
- *On the stability and convergence of Discontinuous Galerkin schemes for incompressible flows* (with A. Kaltenbach). *IMA J. Numer. Anal.*, drae004, 2024.
 - *Development of boundary layers in Euler fluids that on “activation” respond like Navier–Stokes fluids.* (with J. Málek and K. R. Rajagopal). *Math. Models Methods Appl. Sci.*, 34(04), 705–721 2024.
 - *Numerical approximation of a thermodynamically complete rate-type model for the elastic-perfectly plastic response* (with V. Průša and K. Tůma). *Z. Angew. Math. Mech.* 00, e202300030, 2023.
 - *A thermodynamic framework for non-isothermal phenomenological models of the Mullins effect* (with D. Cichra, V. Průša and K. Tůma). *Proc. Roy. Soc. A*, 472(2272), 2023.
 - *Nonlinear iterative approximation of steady incompressible chemically reacting flows.* (with P. Heid and E. Süli). *Comptes Rendus. Mécanique* 350.S2, 1–25, 2022.
 - *Weak-strong uniqueness for heat-conducting non-Newtonian incompressible fluids.* (with V. Patel). *Nonlinear Anal. Real World Appl.*, 68, 2022.
 - *Finite element approximation and augmented Lagrangian preconditioning for anisothermal implicitly-constituted non-Newtonian flow* (with P. E. Farrell and E. Süli). *Math. Comp.* 91, 659–697, 2022.
 - *A semismooth Newton method for implicitly constituted non-Newtonian fluids and its application to the numerical approximation of Bingham flow.* *ESAIM: M2AN*, 55(6), 2679–2703, 2021.
 - *An augmented Lagrangian preconditioner for implicitly constituted non-Newtonian incompressible flow.* (with P. E. Farrell). *SIAM J. Sci. Comput.*, 42(6), B1329–B1349, 2020.
 - *Numerical analysis of unsteady implicitly constituted incompressible fluids: 3-field formulation.* (with P. E. Farrell and E. Süli). *SIAM J. Numer. Anal.*, 58(1), 757–787, 2020.

Submitted (in review)

- *Pressure-robust and quasioptimal Discontinuous Galerkin discretisations of the p -Stokes problem.* (with M. Růžička). arXiv:2606.09586, 2026.
- *Bregman divergences and error control via convex duality.* arXiv:2606.05088, 2026.
- *A Priori and A Posteriori Error Identities for Vectorial Problems via Convex Duality* (with A. Kaltenbach). arXiv:2602.04368, 2026.

Experience

Teaching (selected)

2025- **Lecturer/Tutor, Charles University.**

I was the main lecturer for:

- **WS 2026/27** Applied Mathematics (BSc of Science).
- **SS 2026** Numerical Analysis for Nonlinear PDE (MSc).

I delivered tutorials and developed exercise sheets for:

- **WS 2025/26** Advanced Analysis (MSc), Applied Mathematics (BSc of Science).

2022-2025 **Lecturer/Tutor, Albert-Ludwigs-Universität Freiburg.**

I was the main lecturer for:

- **2023-24** Introductory Numerical Analysis (Numerik I & II).

I organised and delivered tutorials and/or developed exercise sheets for:

- **WS 2024/25** Analysis I.
- **SS 2023** Functional analysis, Seminar on Theory and Numerics for Fluids.
- **WS 2022/23** Practical course on the implementation of finite elements.

- 2021 **Class Tutor**, *FAU Erlangen-Nürnberg*.
I helped in the development of exercise sheets for the first year course *Mathematik für Ingenieure*.
- 2019-2020 **Stipendiary Lecturer in Mathematics**, *Wadham College, University of Oxford*
In addition to organising and delivering tutorials for several undergraduate courses, I was in charge of setting and marking termly examinations, writing and authorising reports on the students and providing pastoral care and advice. I was also a member of the College's Tutorial Board and was involved in the undergraduate admissions process.
- **TT 2020**. Analysis III, Calculus of Variations.
 - **HT 2020**. Multivariable Calculus, Numerical Analysis, Integral Transforms.
 - **MT 2019**. Differential Equations 1, Introductory Calculus.
- 2017-2020 **Class Tutor/Teaching Assistant**, *University of Oxford*.
The task of the Tutor is to organise the problem classes and perform most of the teaching, as opposed to a Teaching Assistant, who does limited teaching and mostly focuses on marking the problem sheets.
- **HT 2020**
 - *Mathematical Institute*: Fixed Point Methods for Nonlinear PDEs (Tutor/Graduate Level)
 - **MT 2019**
 - *Mathematical Institute*: Functional Analytic Methods for PDEs (Tutor/Graduate Level)
 - **TT 2019**
 - *Mathematical Institute*: Fixed Point Methods for Nonlinear PDEs (Revision Classes)
 - *Magdalen College and St. Edmund Hall*: Linear Algebra for Computer Science & Differential Equations 1 (Revision Classes)
 - **HT 2019**
 - *Mathematical Institute*: Fixed Point Methods for Nonlinear PDEs (Tutor/Graduate Level), Numerical Analysis and Scientific Computing (Tutor/PDE-CDT course)
 - **MT 2018**
 - *Mathematical Institute*: Viscous Flow (TA)
 - *Magdalen College*: Linear Algebra for Computer Science & Introduction to Complex Numbers (Tutor)
 - **TT 2018**
 - *Magdalen College and St Hilda's College*: Differential Equations 1, Integral Transforms, Differential Equations 2, Linear Algebra (Revision Classes)
 - **HT 2018**
 - *Mathematical Institute*: Further Mathematical Methods (TA)
 - **MT 2017**
 - *Mathematical Institute*: Applied Partial Differential Equations (TA), Introduction to Functional Analysis (TA/PDE-CDT course).
 - *Magdalen College*: Linear Algebra for Computer Science & Introduction to Complex Numbers (Tutor).

Academic Service

- 2018-present **Reviewer**, *Contributed as anonymous referee for several journals, including IMA J. Numer. Anal., Numer. Math., J. Differential Equations, Math. Models Methods Appl. Sci., Math. Comput. Simulation, Internat. J. Numer. Methods Engrg.*
- 2018-2020 **Seminar Series**, *Co-organiser of the PDE CDT Lunchtime Seminar at the Mathematical Institute, University of Oxford.*

Conferences and Summer Schools

Invited Talks (selected):

- Mar 2027 “*Title TBA*”, Minisymposium “Non-Newtonian Flows in Geodynamics, Biomedicine, and Industrial Applications: Modeling, Analysis, and Scalable Solvers”, 24th IACM Computational Fluids Conference, Yokohama, Japan.
- Jan 2027 “*Title TBA*”, Minisymposium “Numerical PDE-constrained optimization”, Eighth Chilean Workshop on Numerical Analysis of Partial Differential Equations, University of Concepción, Chile.
- Jul 2026 “*Bregman divergences and error control via convex duality*”, Minisymposium “Energy reduction methods and adaptivity for nonlinear PDEs”, CMAM 2026, TU Wien, Austria.
- Dec 2025 “*A Nitsche method for fluid flow with dynamic and set-valued BCs*”, XV Symposium “Mathematics and Applications” (plenary talk), University of Belgrade, Serbia.
- Sep 2025 “*A Nitsche method for fluid flow with dynamic and set-valued BCs*”, Minisymposium “Recent Developments in the Numerical Analysis of Nonlinear PDE”, ENUMATH 25, University of Heidelberg, Germany.
- Jun 2025 “*A Nitsche method for fluid flow with set-valued BCs*”, Minisymposium “Advancements and applications of solvers for PDE with nonsmooth structures”, The 30th Biennial Numerical Analysis Conference, University of Strathclyde, UK.
- Sep 2024 “*A priori and a posteriori estimates for vectorial problems via convex duality*”, Modelling, PDE analysis and computational mathematics in materials science, Prague, Czech Republic.
- Dec 2023 “*Numerical computations and thermodynamically complete models for inelastic behaviour in solids*”, MathLab seminar, SISSA, Italy.
- Sep 2023 “*Quasioptimal nonconforming discretisations of the p -Laplace equation*”, Minisymposium “Nonlinear problems in fluid mechanics and related problems”, ENUMATH 2023, Lisbon, Portugal.
- Jul 2023 “*Numerical computations and thermodynamically complete models for inelastic behaviour in solids*”, MATHPHYS Analysis Seminar, ISTA, Austria.
- Jun 2023 “*A posteriori analysis for Bingham via equilibrated fluxes*”, Minisymposium “Recent advances in the approximation of variational inequalities”, The 29th Biennial Numerical Analysis Conference, University of Strathclyde, United Kingdom.
- Mar 2023 “*On the finite element approximation of incompressible implicitly constituted fluids*”, Minisymposium “Modelling and computation for Implicitly Constituted Materials: Fluids, Solids, Plasmas and Mixtures”, SIAM CSE23, Amsterdam, Netherlands.
- Aug 2022 “*FE approximation and weak-strong uniqueness for incompressible heat-conducting fluids*”. Bi.discrete22 Workshop, Universität Bielefeld, Germany.
- Jul 2022 “*Numerical computations for a novel description of rate-type inelastic responses in solids*”, Minisymposium “Mathematical Models and Numerical Methods in Solid Mechanics”, Equadiff 15, Brno, Czech Republic.
- May 2022 “*Heat-conducting incompressible fluids and weak-strong uniqueness*”. Weekly seminar “PDE & Geometric Analysis”, University of Wisconsin–Madison, USA (virtual).

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- Jun 2021 “*A semismooth Newton method for implicitly constituted flow*”, Minisymposium “PDEs describing far-from-equilibrium open systems”, 8th European Congress of Mathematics, Portorož, Slovenia (virtual conference).
- Jun 2021 “*A semismooth Newton method for Bingham flow*”, XX International Workshop on Numerical Methods for Non-Newtonian Flows, Oaxaca, Mexico (virtual conference).
- May 2021 *A semismooth method for implicitly constituted flow*. Weekly seminar “Modelling of materials”, Charles University Prague.
- May 2021 Title TBC. BIRS Workshop “Efficient Simulation Algorithms for Viscoelastic and Viscous non-Newtonian Fluids”, Banff, Canada (Cancelled due to Covid-19).
- Mar 2021 “*Discretizations and preconditioners for implicitly constituted non-Newtonian anisothermal flows*”, Minisymposium “Advanced solvers for advanced discretizations”, SIAM CSE21, Fort Worth, Texas, USA (virtual).

Contributed Talks (selected):

- Jun 2026 “*A priori and a posteriori estimates for vectorial problems via convex duality*”, Equadiff 16, Prague, Czech Republic.
- Mar 2026 “*Bregman divergences and error control via convex duality*”, Weekly seminar “Modelling of Materials”, Charles University, Czech Republic.
- Jun 2025 “*A priori and a posteriori estimates for vectorial problems via convex duality*”, EMS School in Applied Mathematics: Mathematical Modelling, Numerical Analysis and Scientific Computing, Kácov, Czech Republic.
- Sep 2024 “*A Nitsche method for fluid flow with set-valued and dynamic BCs*”, Firedrake '24, Oxford, UK.
- Jun 2023 “*Numerical computations and thermodynamically complete models for inelastic behaviour in solids*”, Internal Seminar, Department of Applied Mathematics, University of Freiburg, Germany.
- May 2023 “*On certain stability properties of DG schemes for incompressible flow*”, EMS School in Applied Mathematics: Mathematical Modelling, Numerical Analysis and Scientific Computing, Kácov, Czech Republic.
- Oct 2022 “*Weak-strong uniqueness and heat conducting fluids (In Spanish)*”, 55th Congress of the Mexican Mathematical Society (virtual).
- Aug 2022 “*Numerical approximation of fluids with semismooth implicitly constituted laws*”. Regularity Theory for Elliptic and Parabolic Systems and Problems in Continuum Mechanics, Telč, Czech Republic.
- Jul 2022 “*Nonlinear iterative approximation of steady incompressible chemically reacting flows*”. Workshop on Numerical Methods and Analysis in CFD, WIAS, Berlin, Germany.
- May 2022 “*Nonlinear iterative approximation of steady incompressible chemically reacting fluids*”. Weekly seminar “Modelling of materials”, Charles University Prague, Czech Republic.
- Mar 2022 “*Weak-strong Uniqueness for heat-conducting incompressible flow*”. Weekly seminar “Modelling of materials”, Charles University Prague, Czech Republic.
- Aug 2021 “*A robust preconditioner for non-Newtonian flow*”, ENOAN XXIX, Mexico (virtual conference).

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- Jun 2021 “*A semismooth Newton method for Bingham flow*”, MexSIAM Annual Meeting (virtual conference).
- Mar 2021 “*Semismooth Newton method for Bingham flow*”, FEniCS 2021 (virtual conference).
- Oct 2020 “*Numerical Analysis for Implicitly Constituted Incompressible Fluids*”, Chair in Applied Analysis Internal Seminar, FAU Erlangen-Nürnberg.
- Oct 2019 “*A Robust Solver for non-Newtonian Incompressible Flow*”, Oxford Fluids Network Workshop, University of Oxford.
- May 2019 “*Numerical Analysis of Implicitly Constituted Fluids: 3-Field Formulation*”, EMS School in Applied Mathematics: Mathematical Modelling, Numerical Analysis and Scientific Computing, Kácov, Czech Republic.

Languages

Spanish **Native**
English **Fluent**
German **Advanced (C1)**