

Ioannis P. A. Papadopoulos

Weierstrass Institute

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EMPLOYMENT

BMS Dirichlet Fellow, *Weierstrass Institute Berlin* Nov. 2023 – date

- Research interests: nonlinear partial differential equations, quasi-variational inequalities, topology optimization, numerical analysis, scientific computing, finite element methods.

Research Associate, *Imperial College London* Jul. 2021 – Nov. 2023

- EPSRC Grant: *Spectral element methods for fractional differential equations, with applications in applied analysis and medical imaging*, PI: Dr Sheehan Olver.
- Leverhulme Trust Research Project Grant: *Constructive approximation theory on and inside algebraic curves and surfaces*.

The MathWorks, Inc., *Cambridge* 2019 – 2020

- Two summer placements, with the GPU & deep learning group and the parallel toolbox group.

EDUCATION

PhD in Mathematics, *University of Oxford*, viva date: 24 Sep. 2021 2017 – 2021

- Title: *Computing multiple solutions of topology optimization problems*.
- Supervisors: Prof. Patrick Farrell and Prof. Endre Süli.
- EPSRC Centre for Doctoral Training in Partial Differential Equations.

MSc in Mathematical Modelling and Scientific Computing, 2016 – 2017
University of Oxford (Distinction)

- Dissertation: *Computing and controlling transitions in multi-stable partial differential equations* supervised by Prof. Patrick Farrell.

BSc in Mathematics, *Imperial College London* (First Class Honours) 2013 – 2016

NOTABLE PRIZES

- **IMA Leslie Fox Prize in Numerical Analysis**, second place, for the numerical analysis of divergence-free finite element methods for the topology optimization of fluids. 2023
- **MathWorks PhD scholarship** 2017–2021
- **Oxford three-minute thesis competition** (first place) 2019
- **Durham Prize**, awarded by Keble College for performance during an MSc. 2017
- **Gerald Whitrow Prize**, awarded for excellence during the final undergraduate examinations. 2016
- **Dean's List**, awarded to the top 10% of the cohort. 2016
- **London Mathematical Society** undergraduate research bursary. 2015
- Imperial College London Undergraduate Research Bursary. 2014

SUPERVISING & TEACHING

Guest Lecturer, *Department of Mathematics, Imperial College London* 2023

- “Finite elements: numerical analysis” (Part 1, MATH60022).

Co-supervisor, *Department of Mathematics, Imperial College London* 2021– 2022

- Co-supervised two 4th year undergraduate dissertations.
- Co-supervised a 2nd year group project on deflation who won the **Winton Capital Second Year Project Prize**.

Teaching Assistant/Tutor, *Mathematical Institute, University of Oxford* 2018 – 2021

- Courses: continuous optimization (year 3/4 course), numerical linear algebra (year 3/4 course), functional analysis I (year 3 course), numerical solution of differential equations I (year 3 course), numerical solution of differential equations II (year 3 course), scientific computing and numerical analysis of PDEs (PhD course), further PDEs (MSc course).
- Marking and presenting solutions of problems to students.

Tutor, *Oxford Study Abroad Programme, University of Oxford* 2020 – 2021

- Continuous Optimization - one-on-one tutoring covering the UCLA syllabus in 8 weeks.

MATHEMATICAL ENGAGEMENT

- Organizer of the Research Group 8 seminars at WIAS 2024–date
- Assistant in the Imperial-UCL Numerical Analysis Seminars 2022–2023
- Organizer of minisymposiums at CSE23 and Biannual NA conferences 2023
- President of the University of Oxford SIAM Student Chapter 2020–2021
- Founder of the Oxford numerical analysis reading group 2019–date
- Peer reviewer for Foundations of Computational Mathematics, SIAM Journal on Scientific Computing, SIAM Journal on Numerical Analysis, Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales, Optimization Methods and Software, Structural and Multidisciplinary Optimization, Computer Methods in Applied Mechanics and Engineering, and Journal of Scientific Computing

TALKS

Highlighted talks (selected from over 40 presentations):

A semismooth Newton method for obstacle-type quasivariational inequalities

- Firedrake’24 workshop September 2024

Numerical analysis of a topology optimization problem for Stokes flow/linear elasticity

- IMA Leslie Fox Prize Competition (second place) June 2023
- Joint UCL-Imperial College London Numerical Analysis Seminar November 2022

A sparse hp -finite element method for rectangles, disks, annuli, and cylinders

- Bath Numerical Analysis Seminar October 2023
- Flatiron Institute (New York) July 2023

Sparse spectral methods for fractional PDEs

- ICOSAHOM 2023 August 2023
- CSE23 in Amsterdam March 2023
- University of Leicester CSE Mathematics Seminar October 2022

Computing multiple solutions of topology optimization problems

- USNCCM17 in Albuquerque, New Mexico July 2023
- GAMM 2022 Conference - Young Researcher’s minisymposium August 2022
- Oxbridge Applied Mathematics “Woolly Owl” Meeting September 2021

- [14] Jørgen S. Dokken, Patrick E. Farrell, Brendan Keith, **I. P. A. Papadopoulos**, Thomas M. Surowiec, *The latent variable proximal point algorithm for variational problems with inequality constraints*, (2025), <https://arxiv.org/abs/2503.05672>.
- [13] **I. P. A. Papadopoulos**, *Hierarchical proximal Galerkin: a fast hp-FEM solver for variational problems with pointwise inequality constraints*, (2024), <https://arxiv.org/abs/2412.13733>.
- [12] A. Alphonse, C. Christof, M. Hintermüller, **I. P. A. Papadopoulos**, *A globalized inexact semismooth Newton method for nonsmooth fixed-point equations involving variational inequalities*, (2024), <https://arxiv.org/abs/2409.19637>.
- [11] **I. P. A. Papadopoulos**, S. Olver, *A sparse hierarchical hp-finite element method on disks and annuli*, (2024), <https://arxiv.org/abs/2402.12831>.
- [10] K. Knook, S. Olver, **I. P. A. Papadopoulos**, *Quasi-optimal complexity hp-FEM for Poisson on a rectangle*, (2024), <https://arxiv.org/abs/2402.11299>.
- [9] T. S. Gutleb, **I. P. A. Papadopoulos**, *Explicit fractional Laplacians and Riesz potentials of classical functions*, (2023), <https://arxiv.org/abs/2311.10896>.
- [8] **I. P. A. Papadopoulos**, T. S. Gutleb, J. A. Carrillo, S. Olver, *A frame approach for equations involving the fractional Laplacian*, (2023), <https://arxiv.org/abs/2311.12451>.

PUBLICATIONS

- [7] **I. P. A. Papadopoulos**, *Numerical analysis of the SIMP model for the topology optimization problem of minimizing compliance in linear elasticity*, *Numerische Mathematik*, 1–36 (2024), <https://doi.org/10.1007/s00211-024-01438-3>.
- [6] **I. P. A. Papadopoulos**, T. S. Gutleb, R. M. Slevinsky, S. Olver, *Building hierarchies of semiclassical Jacobi polynomials for spectral methods in annuli*, *SIAM Journal on Scientific Computing*, 46(6), pp. A3448–A3476 (2024), <https://doi.org/10.1137/23M160846X>.
- [5] **I. P. A. Papadopoulos**, S. Olver, *A sparse spectral method for fractional differential equations in one-spatial dimension*, *Advances in Computational Mathematics*, 50, 69 (2024), <https://doi.org/10.1007/s10444-024-10164-1>.
- [4] **I. P. A. Papadopoulos**, P. E. Farrell, *Preconditioners for computing multiple solutions in three-dimensional fluid topology optimization*, *SIAM Journal on Scientific Computing*, 45 (2023), pp. B853–B883, <https://doi.org/10.1137/22M1478598>.
- [3] **I. P. A. Papadopoulos**, *Numerical analysis of a discontinuous Galerkin method for the Borrvall–Pettersson topology optimization problem*, *SIAM Journal on Numerical Analysis*, 60 (2022), pp. 2538–2564, <https://doi.org/10.1137/21M1438943>.
- [2] **I. P. A. Papadopoulos**, E. Süli, *Numerical analysis of the topology optimization of Stokes flow*, *Journal of Computational and Applied Mathematics*, 12 (2022), p. 114295, <https://doi.org/10.1016/j.cam.2022.114295>.
- [1] **I. P. A. Papadopoulos**, P. E. Farrell, T. M. Surowiec, *Computing multiple solutions of topology optimization problems*, *SIAM Journal on Scientific Computing*, 43 (2021), pp. A1555–A1582, <https://doi.org/10.1137/20M1326209>.

SOFTWARE

- I. P. A. Papadopoulos, *HierarchicalProximalGalerkin.jl: a hp-FEM solver for the variational problems with inequality constraints*, (2024), [HierarchicalProximalGalerkin.jl](https://github.com/I-P-A-Papadopoulos/HierarchicalProximalGalerkin.jl).

- I. P. A. Papadopoulos, *SemismoothQVIs.jl: a semismooth Newton method for obstacle-type quasivariational inequalities*, (2024), [SemismoothQVIs.jl](#).
- I. P. A. Papadopoulos, *RadialPiecewisePolynomials.jl: an hp-finite element method for disks and annuli*, (2024), [RadialPiecewisePolynomials.jl](#).
- I. P. A. Papadopoulos, S. Olver, *AnnuliOrthogonalPolynomials.jl: multivariate orthogonal polynomials on the annulus*, (2023), [AnnuliOrthogonalPolynomials.jl](#).
- I. P. A. Papadopoulos, *FractionalFrames.jl: a spectral method for solving fractional differential equations*, (2023), [FractionalFrames.jl](#).
- I. P. A. Papadopoulos, P. E. Farrell, *fir3dab: software for the computation of multiple solutions in three dimensions of topology optimization problems*, (2022), [fir3dab](#).
- I. P. A. Papadopoulos, P. E. Farrell, *deflatedbarrier: software for the computation of multiple solutions of topology optimization problems*, (2021), [deflatedbarrier](#).