Ioannis P. A. Papadopoulos

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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 4^{th} year undergraduate dissertations.
· Co-supervised a 2^{nd} 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 minisymposia at CSE23 and Biennial 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, SIAM Journal on Optimization, 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

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

PREPRINTS IN REVIEW

[14] **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.

[13] 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.

[12] 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.

[11] T. S. Gutleb, **I. P. A. Papadopoulos**, *Explicit fractional Laplacians and Riesz potentials of classical functions*, (2023), https://arxiv.org/abs/2311.10896.

[10] **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

[9] 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*, Computer Methods in Applied Mechanics and Engineering (2025), https://doi.org/10.1016/j.cma.2025.118181.

[8] **I. P. A. Papadopoulos**, S. Olver, *A sparse hierarchical hp-finite element method on disks and annuli*, Journal of Scientific Computing (2025), https://doi.org/10.1007/s10915-025-02964-4.

[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–Petersson 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.

- 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.