Patrick E. Farrell

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Research statement

My research interests centre on the numerical solution of partial differential equations arising in physics and chemistry. The goals of my research are to extend humanity's numerical simulation capabilities, to develop new numerical algorithms that are useful to science and important to society, and to collaborate with scientists and engineers to translate numerical solutions into scientific advances.

I particularly focus on the development of structure-preserving finite element discretisations in space and time, adjoint techniques and their applications, bifurcation analysis of nonlinear problems, and preconditioners and fast solvers.

I have applied the numerical techniques I develop to applications in the areas of renewable energy, cardiac electrophysiology, glaciology, magnetohydrodynamics, quantum mechanics, liquid crystals, and multicomponent flows.

Employment history

2025–2029	**Associate Head of Department**, Mathematical Institute, University of Oxford.
2022–date	**Full Professor**, Mathematical Institute, University of Oxford.
2016–2022	**Associate Professor**, Mathematical Institute, University of Oxford.
2016–date	**Tutorial Fellow**, Oriel College, University of Oxford.
2013–2018	**EPSRC Early Career Research Fellow**, Mathematical Institute, University of Oxford.
2013–2016	**Postdoctoral Research Fellow**, Christ Church College, University of Oxford.
2010–2013	**Postdoctoral Research Associate**, Earth Science & Engineering, Imperial College London.

Visiting positions

2025–2026	**Visiting Chair**, *Donatio Universitatis Carolinæ*, Charles University, Prague.
2021–date	**Specialist Consultant**, UK Atomic Energy Authority, Culham.
2012–2017	**Adjunct Research Scientist**, Simula Research Laboratory, Oslo.

Notable prizes

2026	**Invited ICM lecture**, in Section 15: *Numerical Analysis and Scientific Computing*.
2025	**Germund Dahlquist Prize**, awarded by the Society for Industrial and Applied Mathematics 'for broad, creative, and groundbreaking contributions to numerical solutions of partial differential equations, and the design and analysis of algorithms and software for scientific computing'.
2021	**Whitehead Prize**, awarded by the London Mathematical Society 'in recognition of his broad, creative and impactful work as a computational mathematical scientist'.
2021	**Broyden Prize in Optimization**, awarded by the editorial board of Optimization Methods and Software for the development of algorithms for computing multiple solutions of variational inequalities, with M. Croci and T. M. Surowiec.

2015	**Wilkinson Prize for Numerical Software**, awarded by the Society for Industrial and Applied Mathematics for the development of algorithms for the automated derivation of adjoint models, with D. A. Ham, S. W. Funke and M. E. Rognes.
2015	**Leslie Fox Prize in Numerical Analysis**, second place, awarded by the Institute of Mathematics and its Applications for the development of algorithms for computing multiple solutions of partial differential equations.

Academic history

2006–2009	**PhD in Computational Physics**, Imperial College London.
Thesis	*Galerkin projection of discrete fields via supermesh construction.* Viva: 27 Nov 2009.
Prizes	UK Association of Computational Mechanics Roger Owen thesis prize, 2010; Finalist, European Community on Computational Methods in Applied Sciences award, 2010; Imperial College Research Excellence Award, 2010; Janet Watson award, Imperial College London.
2002–2006	**BSc (Hons) in Mathematics**, University of Galway.
Thesis	*Cryptographic applications of polycyclic groups.*
Prizes	Hamilton Prize, Royal Irish Academy, 2005; Blayney Exhibition, University of Galway, 2006.

Research funding

2025–2027	**Towards a CCP in Data-driven Computational Mechanics**, STFC UKRI495, £250k, Oxford PI.
2021–2025	**SysGenX: Composable software generation for system-level simulation at Exascale**, EPSRC EP/W026163/1, £3.3m, Oxford PI.
2020–2021	**Gen X: ExCALIBUR working group on exascale continuum mechanics through code generation**, EPSRC EP/V001493/1, £174k, Oxford PI.
2019–2020	**Leverhulme Trust Visiting Professorship for Prof. Panayotis Kevrekidis**, VP2-2018-007, £85k, PI.
2018–2023	**PRISM: Platform for Research In Simulation Methods**, EPSRC EP/R029423/1, £1.6m, Oxford PI, Platform grant.
2015–2018	**A new simulation and optimisation platform for marine technology**, EPSRC EP/M011151/1, £558k, Oxford PI, Software for the Future II.
2014–2015	**Scalable automated parallel PDE-constrained optimisation for dolfin-adjoint**, EPSRC eCSE02-03, £60k, PI.
2013–2018	**Automating optimisation subject to partial differential equations on high-performance computers**, EPSRC EP/K030930/1, £487k, PI.
2012–2013	**Optimising the layout of tidal turbines for marine renewable energy**, EPSRC, £36k, Researcher Co-I.

Departmental Teaching

2019	**Departmental Teaching Award**, Mathematical Institute, University of Oxford.
2023–2027	**Prelims Computational Mathematics**, Mathematical Institute, University of Oxford.
2021–2024	**Prelims Constructive Mathematics**, Mathematical Institute, University of Oxford.
2017–2022	**C6.4 Finite Element Methods for PDEs**, Mathematical Institute, University of Oxford.
2017–2025	**MMSC Python in Scientific Computing**, Mathematical Institute, University of Oxford.

Teaching on summer schools

2024	**Solving PDEs with Firedrake**, University of Edinburgh, Edinburgh, UK.
2024	**Solving PDEs with Firedrake**, Peking University, Beijing, China.
2024	**Solving PDEs with Firedrake**, ICERM, Brown University, USA.

2023	**EMS School on Mathematical Modelling, Numerical Analysis and Scientific Computing**, Kácov, Czechia.
2018	**SSeMID Adjoints for Sensitivity, Optimisation and Control**, Montestigliano, Italy.
2018	**PMR5426 Adjoints for Sensitivity, Optimisation and Control**, Universidade de São Paulo, São Paulo, Brazil.
2018	**PMR5412 Modelling and Numerical Simulation via Variational Calculus**, Universidade de São Paulo, São Paulo, Brazil.
2017	**PMR5412 Modelling and Numerical Simulation via Variational Calculus**, Universidade de São Paulo, São Paulo, Brazil.
2016	**Frontiers in PDE-constrained Optimization**, Institute for Mathematics and its Applications, University of Minnesota, Minnesota, USA.
2014	**ANADE Summer School on Receptivity, Sensitivity Analysis and Uncertainty Quantification**, University of Cambridge, Cambridge, UK.

Research supervision

PDRA	Alberto Paganini, Thomas Roy, Duygu Sap, Pablo Brubeck.
PhD	Florian Wechsung, Matteo Croci, Pablo Alexei Gazca Orozco, Hamza Alawiye, Ioannis Papadopoulos, Jingmin Xia, Fabian Laakmann, Francis Aznaran, Alexander van Brunt, Nicolas Boullé, Gonzalo Gonzalez de Diego, Pablo Brubeck, Boris Andrews, Aaron Baier-Reinio, India Marsden, Umberto Zerbinati, Kars Knook, Mingdong He, Lenka Košárková, Chenghao Dong, Thomas Higham.
MSc	19 students on the Mathematical Modelling and Scientific Computing MSc.

Prizes won under my supervision

2022	**International Glaciological Society student paper prize**, Gonzalo Gonzalez de Diego won a prize for the best student presentation at the 2022 IGS meeting in Bilbao.
2022	**Copper Mountain student paper prize**, Pablo Brubeck won the Student Paper Competition of the 2022 Copper Mountain Conference on Iterative Methods.
2021	**STEM for Britain**, Nicolas Boullé was a finalist and presented his work in Parliament.
2021	**Broyden Prize in Optimization**, awarded to Matteo Croci for our joint work on deflation for semismooth equations.
2021	**IMA Leslie Fox Prize in Numerical Analysis**, Nicolas Boullé was shortlisted for his work on learning theory.
2021	**G-Research DPhil Prize**, £5K awarded to Nicolas Boullé for his work on rational neural networks.
2020	**Mathematical Institute DPhil Thesis Prize**, awarded to Florian Wechsung for his outstanding thesis.
2018	**G-Research DPhil Prize**, £10K awarded to Florian Wechsung for our joint work on robust preconditioners for the Navier–Stokes equations.

External administrative & editorial activities

2024–date	Chair of the prize committee for the EMS/ECMI Lanczos Prize for Mathematical Software.
2024–date	Chair of the prize committee for the Langtangen Prize on the foundations of numerical simulation technology.
2025–date	Associate Editor for AMS Mathematics of Computation.
2022–date	Associate Editor for the SIAM Journal on Scientific Computing.
2023–date	Editor for the Numerical Mathematics and Scientific Computing book series, published by the Oxford University Press.

2017–2020	Editor of the SIAM Fundamentals of Algorithms book series.
2022–2025	Member of the Committee on Applications and Interdisciplinary Relations of the European Mathematical Society.
2025–date	Member of the Program Committee for the European Conference on Numerical Mathematics and Advanced Applications (ENUMATH).
2019–date	Member of the Program Committee for the Copper Mountain Conference on Iterative Methods.
2026	Organiser of *European Mathematical Society Topical Activity Group on Mixtures*, Centre International de Rencontres Mathématiques.
2026	Organiser of *Smectics and Complex Layered Fluids*, l'École de physique des Houches.
2025	Organiser of *EMS School on Mathematical Modelling, Numerical Analysis and Scientific Computing*, Kácov.
2025	Organiser of *Mixtures: Modelling, Analysis, and Computing*, Prague.
2023	Organiser of *Numerical Analysis in the 21st Century*, Oxford.
2022	Organiser of *Defects and Distortions of Layered Complex Fluids*, Banff International Research Station.
2021	Organiser of *Efficient simulation algorithms for viscoelastic and viscous non-Newtonian fluids*, Banff International Research Station.
2016	Organiser of the *7th International Conference on Algorithmic Differentiation*.
2015	Organiser of the *IMA Conference on Numerical Methods for Simulation*.
2013–date	Member of the EPSRC Peer Review College.
2013–date	PhD examiner for Politecnico di Milano, Katholieke Universiteit Leuven, Queen Mary University of London, University of Bath, Imperial College London, Charles University Prague, University of Cambridge, Loughborough University, University of Manchester.
2010–date	Peer reviewer for over 30 journals.

Internal administrative activities

2024–2025	Departmental REF coordinator.
2022–2024	Acting head of the Oxford Numerical Analysis group, following the retirement of Prof. Nick Trefethen FRS.
2018–date	Departmental open access coordinator.
2017–2022	Departmental colloquium organiser.
2017–date	Numerical analysis representative on the Oxford MSc in Mathematical Sciences committee.
2016–2022	Examiner's committee for the MSc in Mathematical Modelling and Scientific Computing.

Selected invited & plenary presentations

2026	Advances in Shape and Topology Optimization for Hyperelastic Materials, Barcelona
2026	**International Congress of Mathematicians**, Philadelphia
2026	Scientific Computing and Differential Equations (SciCADE), Edinburgh
2026	Geometric PDE Challenges in Science & Engineering, College Park
2026	Finite Element Tensor Calculus, Sanya
2026	International Conference on Structure-Preserving Finite Element Methods, Beijing
2025	Computational Materials Science and Mathematics, Edinburgh
2025	Frontiers in Numerical Methods for Nonlinear Partial Differential Equations, Lausanne
2025	European Conf. on Numerical Mathematics & Advanced Applications (ENUMATH), Heidelberg
2025	Gordon Research Conference on Liquid Crystals, New Hampshire
2025	International Conference on Domain Decomposition Methods (DD), Milano

2025 SIAM UKIE Annual Meeting, Didcot

2025 Taming Complexity in Partial Differential Systems, Vienna

2024 High Performance Computing in Science & Engineering, Ostrava

2024 New Trends in Numerical Analysis of PDEs, Lille

2024 Exploiting Algebraic and Geometric Structure in Time-Integration Methods, Pisa

2023 Mathematics and Microscopic Theory for Random Soft Matter Systems, Düsseldorf

2023 Irish Mathematical Society, Limerick

2022 Thirty Years of Acta Numerica, Poznań

2022 International Linear Algebra Society, Galway

2022 Equadiff, Brno

2019 Preconditioning, Minneapolis

2017 Canadian Applied & Industrial Mathematics Society Annual Meeting, Halifax

Scientific fieldwork

2015 Glaciological fieldwork on the Larsen ice shelf with the British Antarctic Survey, Rothera Research Station, Antarctica.

2011 Oceanographic cruise JC064 on the *RRS James Cook*, part of the RAPID programme organised by the National Oceanography Centre.

Articles in review

[107] B. D. Andrews and **P. E. Farrell** (2025a). *Conservative and dissipative discretisations of multi-conservative ODEs and GENERIC systems.*

[106] D. Hayashi Alonso, **P. E. Farrell**, J. R. Meneghini, and E. C. N. Silva (2025b). *Topology optimisation of transient turbulent compressible flow.*

[105] J. A. Carrillo, **P. E. Farrell**, A. Medaglia, and U. Zerbinati (2025). *A kinetic theory approach to ordered fluids.* DOI: 10.48550/arXiv.2508.10744

[104] P. D. Brubeck, **P. E. Farrell**, R. C. Kirby, and C. Parker (2025). *Fast solvers for the high-order FEM simplicial de Rham complex.* DOI: 10.48550/arXiv.2506.17406

[103] **P. E. Farrell**, T. van Beeck, and U. Zerbinati (2025). *Analysis and numerical analysis of the Helmholtz–Korteweg equation.* DOI: 10.48550/arXiv.2503.10771

Articles to appear

[102] M. He, **P. E. Farrell**, K. Hu, and B. D. Andrews (2025). "Topology-preserving discretization for the magneto-frictional equations arising in the Parker conjecture". In: *SIAM Journal on Scientific Computing.* DOI: 10.48550/arXiv.2501.11654

[101] **P. E. Farrell** (2026). "Computing multiple solutions of systems of nonlinear equations with deflation". In: *Proceedings of the International Congress of Mathematicians (2026), Vol. 7.* Philadelphia, USA: Society for Industrial and Applied Mathematics and International Mathematical Union

[100] B. D. Andrews and **P. E. Farrell** (2025b). "Enforcing conservation laws and dissipation inequalities numerically via auxiliary variables". In: *SIAM Journal on Scientific Computing* 47 (6). DOI: 10.1137/25M1756673

[99] A. Baier-Reinio and **P. E. Farrell** (2025). "High-order finite element methods for three-dimensional multicomponent convection-diffusion". In: *SIAM Journal on Scientific Computing.* DOI: 10.48550/arxiv.2408.17390

[98] D. Hayashi Alonso, **P. E. Farrell**, J. R. Meneghini, and E. C. N. Silva (2025a). "Topology optimisation of transient compressible flow". In: *Engineering with Computers.* DOI: 10.1007/s00366-025-02203-2

Published journal articles

[97] S. Leveque, M. Benzi, and **P. E. Farrell** (2025). "An augmented Lagrangian preconditioner for the control of the Navier–Stokes equations". In: *SIAM Journal on Scientific Computing* 47 (5), A2431–A2455. DOI: 10.1137/24M1683354

[96] K. Pentland, N. C. Amorisco, P. E. Farrell, and C. J. Ham (2025). "Multiple solutions to the static forward free-boundary Grad–Shafranov problem on MAST-U". in: *Nuclear Fusion* 65.8, p. 086053. DOI: 10.1088/1741-4326/adf3cc

[95] J. S. Dokken, **P. E. Farrell**, B. Keith, I. P. A. Papadopoulos, and T. M. Surowiec (2025). "The latent variable proximal point algorithm for variational problems with inequality constraints". In: *Computer Methods in Applied Mechanics and Engineering* 445, p. 118181. DOI: 10.1016/j.cma.2025.118181

[94] M. Hardman, M. Abazorius, J. Omotani, M. Barnes, S. L. Newton, J. W. S. Cook, **P. E. Farrell**, and F. I. Parra (2025). "A higher-order finite-element implementation of the exact Landau Fokker–Planck collision operator for charged particle collisions in a low density plasma". In: *Computer Physics Communications* 314, p. 109675. DOI: 10.1016/j.cpc.2025.109675

[93] **P. E. Farrell** and U. Zerbinati (2025). "Time-harmonic waves in Korteweg and nematic-Korteweg fluids". In: *Physical Review E* 111 (3), p. 035413. DOI: 10.1103/PhysRevE.111.035413

[92] F. R. A. Aznaran, **P. E. Farrell**, C. W. Monroe, and A. J. Van-Brunt (2024). "Finite element methods for multicomponent convection-diffusion". In: *IMA Journal of Numerical Analysis* 45 (1), pp. 188–222. DOI: 10.1093/imanum/drae001

[91] J. D. Betteridge, **P. E. Farrell**, M. Hochsteger, C. Lackner, J. Schöberl, S. Zampini, and U. Zerbinati (2024). "ngsPETSc: a coupling between NETGEN/NGSolve and PETSc". In: *Journal of Open Source Software* 9.104, p. 7359. DOI: 10.21105/joss.07359

[90] **P. E. Farrell**, G. Russo, and U. Zerbinati (2024). "Kinetic derivation of an inviscid compressible Leslie–Ericksen equation for rarified calamitic gases". In: *Multiscale Modeling and Simulation* 22 (4), pp. 1585–1607. DOI: 10.1137/24M1630529

[89] E. Bueler and **P. E. Farrell** (2024). "A full approximation scheme multilevel method for nonlinear variational inequalities". In: *SIAM Journal on Scientific Computing* 46 (4), A2421–A2444. DOI: 10.1137/23M1594200

[88] C. Ham and **P. E. Farrell** (2024). "On multiple solutions of the Grad–Shafranov equation". In: *Nuclear Fusion Letters* 64.3, p. 034001. DOI: 10.1088/1741-4326/ad1d77

[87] P. D. Brubeck and **P. E. Farrell** (2024). "Multigrid solvers for the de Rham complex with optimal complexity in polynomial degree". In: *SIAM Journal on Scientific Computing* 46.3, A1549–A1573. DOI: 10.1137/22m1537370

[86] **P. E. Farrell**, L. Mitchell, and L. R. Scott (2024). "Two conjectures on the Stokes complex in three dimensions on Freudenthal meshes". In: *SIAM Journal on Scientific Computing* 46.2, A629–A644. DOI: 10.1137/22M1533943

[85] I. A. P. Papadopoulos and **P. E. Farrell** (2023). "Preconditioners for computing multiple solutions in three-dimensional fluid topology optimization". In: *SIAM Journal on Scientific Computing* 45 (6), B853–B883. DOI: 10.1137/22M1478598

[84] N. Boullé, **P. E. Farrell**, and M. E. Rognes (2023). "Optimization of Hopf bifurcations". In: *SIAM Journal on Scientific Computing* 45.3, B390–B411. DOI: 10.1137/22M1474448

[83] F. Martin-Vergara, J. Cuevas Maraver, **P. E. Farrell**, F. Villatoro, and P. G. Kevrekidis (2023). "Discrete breathers in Klein–Gordon lattices: a deflation-based approach". In: *Chaos* 33 (11), p. 113126. DOI: 10.1063/5.0161889

[82] R. Wittmann, P. A. Monderkamp, J. Xia, L. B. G. Cortes, I. Grobas, **P. E. Farrell**, D. G. A. L. Aarts, and H. Löwen (2023). "Colloidal smectics in button-like confinements: experiment and theory". In: *Physical Review Research* 5.3, p. 033135. DOI: 10.1103/PhysRevResearch.5.033135

[81] F. Laakmann, K. Hu, and **P. E. Farrell** (2023). "Structure-preserving and helicity-conserving finite element approximations and preconditioning for the Hall MHD equations". In: *Journal of Computational Physics* 492, p. 112410. DOI: 10.1016/j.jcp.2023.112410

[80] P. D. Brubeck and **P. E. Farrell** (2022). "A scalable and robust vertex-star relaxation for high-order FEM". in: *SIAM Journal on Scientific Computing* 44.5, A2991–A3017. DOI: 10.1137/21M1444187

[79] F. Laakmann, **P. E. Farrell**, and L. Mitchell (2022). "An augmented Lagrangian preconditioner for the magnetohydrodynamics equations at high Reynolds and coupling numbers". In: *SIAM Journal on Scientific Computing* 44.4, B1018–B1044. DOI: 10.1137/21M1416539

[78] G. G. de Diego, **P. E. Farrell**, and I. J. Hewitt (2022a). "Numerical approximation of viscous contact problems applied to glacial sliding". In: *Journal of Fluid Mechanics* 938, A21. DOI: 10.1017/jfm.2022.178

[77] F. R. A. Aznaran, **P. E. Farrell**, and R. C. Kirby (2022). "Transformations for Piola-mapped elements". In: *SMAI Journal of Computational Mathematics* 8, pp. 399–437. DOI: 10.5802/smai-jcm.91

[76] A. Van-Brunt, **P. E. Farrell**, and C. W. Monroe (2022). "Structural electroneutrality in Onsager–Stefan–Maxwell models with charged species". In: *Electrochimica Acta* 441, p. 141769. DOI: 10.1016/j.electacta.2022.141769

[75] J. Xia and **P. E. Farrell** (2023). "Variational and numerical analysis of a $\mathbf{Q}$-tensor model for smectic-A liquid crystals". In: *ESIAM: Mathematical Modelling and Numerical Analysis* 57 (2), pp. 693–716. DOI: 10.1051/m2an/2022083

[74] R. Abu-Labdeh, S. P. MacLachlan, and **P. E. Farrell** (2023). "Monolithic multigrid for implicit Runge–Kutta discretizations of incompressible fluid flow". In: *Journal of Computational Physics* 478, p. 111961. DOI: 10.1016/j.jcp.2023.111961

[73] N. Boullé, I. Newell, **P. E. Farrell**, and P. G. Kevrekidis (2022). "Two-component 3D atomic Bose-Einstein condensates support complex stable patterns". In: *Physical Review A*. DOI: 10.1103/PhysRevA.107.012813

[72] **P. E. Farrell**, A. Hamdan, and S. P. MacLachlan (2022). "A new mixed finite-element method for H^2-elliptic problems". In: *Computers and Mathematics with Applications* 128, pp. 300–319. DOI: 10.1016/j.camwa.2022.10.024

[71] G. G. de Diego, **P. E. Farrell**, and I. J. Hewitt (2022b). "On the finite element approximation of a semicoercive Stokes variational inequality arising in glaciology". In: *SIAM Journal on Numerical Analysis* 61.1, pp. 1–25. DOI: 10.1137/21m1437640

[70] N. Boullé, V. Dallas, and **P. E. Farrell** (2021). "Bifurcation analysis of two-dimensional Rayleigh–Bénard convection using deflation". In: *Physical Review E* 105 (5), p. 055106. DOI: 10.1103/PhysRevE.105.055106

[69] A. Van-Brunt, **P. E. Farrell**, and C. W. Monroe (2021). "Consolidated theory of fluid thermodiffusion". In: *AIChE Journal* 68 (5), e17599. DOI: 10.1002/aic.17599

[68] J. Dalby, **P. E. Farrell**, A. Majumdar, and J. Xia (2021). "One-dimensional ferronematics in a channel: order reconstruction, bifurcations and multistability". In: *SIAM Journal on Applied Mathematics* 82.2, pp. 694–719. DOI: 10.1137/21M1400171

[67] A. J. Ellingsrud, N. Boullé, **P. E. Farrell**, and M. E. Rognes (2021). "Accurate numerical simulation of electrodiffusion and water movement in brain tissue". In: *Mathematical Medicine and Biology*. DOI: 10.1093/imammb/dqab016

[66] **P. E. Farrell**, L. Mitchell, L. R. Scott, and F. Wechsung (2021b). "Robust multigrid for nearly incompressible elasticity using macro elements". In: *IMA Journal on Numerical Analysis*. DOI: 10.1093/imanum/drab083

[65] N. Boullé, **P. E. Farrell**, and A. Paganini (2021). "Control of bifurcation structures using shape optimization". In: *SIAM Journal on Scientific Computing* 44 (1), A57–A76. DOI: 10.1137/21M1418708

[64] **P. E. Farrell**, P. A. Gazca Orozco, and E. Süli (2022). "Finite element approximation and augmented Lagrangian preconditioning for anisothermal implicitly-constituted non-Newtonian flow". In: *Mathematics of Computation* 91, pp. 659–697. DOI: 10.1090/mcom/3703

[63] A. J. Van-Brunt, **P. E. Farrell**, and C. W. Monroe (2022). "Augmented saddle point formulation of the steady-state Stefan–Maxwell diffusion equations". In: *IMA Journal of Numerical Analysis* 42, pp. 3272–3305. DOI: 10.1093/imanum/drab067

[62] M. Croci, M. B. Giles, and **P. E. Farrell** (2021). "Multilevel quasi Monte Carlo methods for elliptic partial differential equations driven by spatial white noise". In: *SIAM Journal on Scientific Computing* 43.4, A2840–A2868. DOI: 10.1137/20M1329044

[61] J. D. Betteridge, **P. E. Farrell**, and D. A. Ham (2021). "Code generation for productive portable scalable finite element simulation in Firedrake". In: *IEEE Computing in Science and Engineering*. DOI: 10.1109/MCSE.2021.3085102

[60] **P. E. Farrell**, R. C. Kirby, and J. Marchena-Menendez (2021). "Irksome: automating Runge–Kutta time-stepping for finite element methods". In: *ACM Transactions on Mathematical Software* 47 (4). DOI: 10.1145/3466168

[59] J. Xia, S. MacLachlan, T. J. Atherton, and **P. E. Farrell** (2021). "Structural landscapes in geometrically frustrated smectics". In: *Physical Review Letters* 126.17, p. 177801. DOI: 10.1103/PhysRevLett.126.177801

[58] **P. E. Farrell**, L. Mitchell, L. R. Scott, and F. Wechsung (2021a). "A Reynolds-robust preconditioner for the Scott–Vogelius discretization of the stationary incompressible Navier–Stokes equations". In: *SMAI Journal of Computational Mathematics* 7, pp. 75–96. DOI: 10.5802/smai-jcm.72

[57] K. Tůma, M. Rezaee-Hajidehi, J. Hron, **P. E. Farrell**, and S. Stupkiewicz (2021). "Phase-field modelling of multivariant martensitic transformation at finite-strain: computational aspects and large-scale finite-element simulations". In: *Computer Methods in Applied Mechanics and Engineering* 377, p. 113705. DOI: 10.1016/j.cma.2021.113705

[56] I. P. A. Papadopoulos, **P. E. Farrell**, and T. M. Surowiec (2021). "Computing multiple solutions of topology optimization problems". In: *SIAM Journal on Scientific Computing* 43.3, A1555–A1582. DOI: 10.1137/20M1326209

[55] **P. E. Farrell**, M. G. Knepley, L. Mitchell, and F. Wechsung (2021). "PCPATCH: Software for the topological construction of multigrid relaxation methods." In: *ACM Transactions on Mathematical Software* 47 (3), pp. 1–22. DOI: 10.1145/3445791

[54] J. Xia, **P. E. Farrell**, and F. Wechsung (2020). "Augmented Lagrangian preconditioners for the Oseen–Frank model of cholesteric liquid crystals". In: *BIT Numerical Mathematics*. DOI: 10.1007/s10543-020-00838-9

[53] **P. E. Farrell**, L. F. Gatica, B. P. Lamichhane, R. Oyarzúa, and R. Ruiz-Baier (2020). "Mixed Kirckhhoff stress–displacement–pressure formulations for incompressible hyperelasticity". In: *Computer Methods in Applied Mechanics and Engineering* 374, p. 113562. DOI: 10.1016/j.cma.2020.113562

[52] J. H. Adler, T. Benson, E. C. Cyr, **P. E. Farrell**, S. MacLachlan, and R. Tuminaro (2021). "Monolithic multigrid for magnetohydrodynamics". In: *SIAM Journal on Scientific Computing*, S70–S91. DOI: 10.1137/20M1348364

[51] N. Boullé, E. G. Charalampidis, **P. E. Farrell**, and P. G. Kevrekidis (2020). "Deflation-based Identification of Nonlinear Excitations of the 3D Gross–Pitaevskii equation." In: *Physical Review A* 102 (5), p. 053307. DOI: 10.1103/PhysRevA.102.053307

[50] **P. E. Farrell** and P. A. Gazca-Orozco (2020). "An augmented Lagrangian preconditioner for implicitly-constituted non-Newtonian incompressible flow". In: *SIAM Journal on Scientific Computing* 42.6, B1329–B1349. DOI: 10.1137/20M1336618

[49] J. G. Williams, A. A. Castrejon-Pita, B. W. Turney, **P. E. Farrell**, S. J. Tavener, D. E. Moulton, and S. L. Waters (2020). "Cavity flow characteristics and applications to kidney stone removal". In: *Journal of Fluid Mechanics* 902, A16. DOI: 10.1017/jfm.2020.583

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