

Publications of Patrick E. Farrell

Articles in review

- [60] **P. E. Farrell**, R. C. Kirby, and J. Marchena-Menendez (2020). *Irksome: automating Runge–Kutta time-stepping for finite element methods*. arXiv:2006.16282
- [59] J. H. Adler, T. Benson, E. C. Cyr, **P. E. Farrell**, S. MacLachlan, and R. Tuminaro (2020). *Monolithic multigrid for magnetohydrodynamics*. arXiv:2006.15700
- [58] A. Van-Brunt, **P. E. Farrell**, and C. Monroe (2020). *Augmented saddle point formulation of the steady-state Stefan–Maxwell diffusion equations*. arXiv:2006.03321
- [57] 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*. arXiv:2004.10446
- [56] **P. E. Farrell**, L. Mitchell, L. R. Scott, and F. Wechsung (2020a). *A Reynolds-robust preconditioner for the Reynolds-robust Scott–Vogelius discretization of the stationary incompressible Navier–Stokes equations*. arXiv:2004.09398
- [55] J. Xia, **P. E. Farrell**, and F. Wechsung (2020). *Augmented Lagrangian preconditioners for the Oseen–Frank model of cholesteric liquid crystals*. arXiv:2004.07329
- [54] I. A. P. Papadopoulos, **P. E. Farrell**, and T. M. Surowiec (2020). *Computing multiple solutions of topology optimization problems*. arXiv:2004.11797
- [53] **P. E. Farrell**, L. Mitchell, L. R. Scott, and F. Wechsung (2020b). *Robust multigrid for nearly incompressible elasticity using macro elements*. arXiv:2002.02051
- [52] **P. E. Farrell**, M. G. Knepley, L. Mitchell, and F. Wechsung (2019). *PCPATCH: Software for the topological construction of multigrid relaxation methods*. arXiv:1912.08516
- [51] M. Croci, M. B. Giles, and **P. E. Farrell** (2019). *Multilevel quasi Monte Carlo methods for elliptic PDEs with random field coefficients via fast white noise sampling*. arXiv:1911.12099

Refereed journal papers

- [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*. arXiv:2005.03150
- [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*
- [48] H. A. Alawiye, **P. E. Farrell**, and A. Goriely (2020). “Revisiting the wrinkling of elastic bilayers II: post-bifurcation analysis”. In: *Journal of the Mechanics and Physics of Solids*. arXiv:2002.02051
- [47] **P. E. Farrell**, Y. He, and S. P. MacLachlan (2019). “A local Fourier analysis of additive Vanka relaxation for the Stokes equations”. In: *Numerical Linear Algebra with Applications*. arXiv:1908.09949. DOI: 10.1002/nla.2306

- [46] M. Croci and **P. E. Farrell** (2020). “Complexity bounds on supermesh construction for quasi-uniform meshes.” In: *Journal of Computational Physics*. arXiv:1911.11589. DOI: 10.1016/j.jcp.2020.109459
- [45] E. G. Charalampidis, N. Boullé, **P. E. Farrell**, and P. G. Kevrekidis (2020). “Bifurcation analysis of stationary solutions of two-dimensional coupled Gross-Pitaevskii equations using deflated continuation”. In: *Communications in Nonlinear Science and Numerical Simulation*. arXiv:1912.00023. DOI: 10.1016/j.cnsns.2020.105255
- [44] J. Xia, **P. E. Farrell**, and S. G. P. Castro (2020). “Nonlinear bifurcation analysis of stiffener profiles via deflation techniques”. In: *Thin Walled Structures* 149, p. 106662. DOI: 10.1016/j.tws.2020.106662
- [43] E. Medina, **P. E. Farrell**, K. Bertoldi, and C. Rycroft (2020). “Navigating the landscape of nonlinear mechanical metamaterials for advanced programmability.” In: *Physical Review B* 101.6. DOI: 10.1103/PhysRevB.101.064101
- [42] **P. E. Farrell**, P. A. Gazca-Orozco, and E. Suli (2020). “Numerical analysis of unsteady implicitly constituted incompressible fluids: three-field formulation”. In: *SIAM Journal on Numerical Analysis* 58.1, pp. 757–787. DOI: 10.1137/19M125738X
- [41] **P. E. Farrell**, L. Mitchell, and F. Wechsung (2019). “An augmented Lagrangian preconditioner for the 3D stationary incompressible Navier–Stokes equations at high Reynolds number”. In: *SIAM Journal on Scientific Computing* 41 (5 2019). arXiv:1810.03315, A3073–A3096. DOI: 10.1137/18M1219370
- [40] **P. E. Farrell**, M. Croci, and T. M. Surowiec (2019). “Deflation for semismooth equations.” In: *Optimization Methods and Software*. DOI: 10.1080/10556788.2019.1613655
- [39] M. Croci, M. B. Giles, M. E. Rognes, and **P. E. Farrell** (2018). “Efficient white noise sampling and coupling for multilevel Monte Carlo with nonnested meshes”. In: *SIAM/ASA Journal on Uncertainty Quantification* 6.4, pp. 1630–1655. DOI: 10.1137/18M1175239
- [38] A. Paganini, F. Wechsung, and Patrick E. **Farrell** (2018). “Higher-order moving mesh methods for PDE-constrained shape optimization”. In: *SIAM Journal on Scientific Computing* 40.4, A2356–A2382. DOI: 10.1137/17m1133956
- [37] T. M. Kyrke-Smith, G. H. Gudmundsson, and **P. E. Farrell** (2018). “Basal drag and basal topography of Pine Island Glacier”. In: *Frontiers in Earth Science* 6. DOI: 10.3389/feart.2018.00033
- [36] T. M. Kyrke-Smith, G. Hilmar Gudmundsson, and **P. E. Farrell** (2017). “Can seismic observations of bed conditions on ice streams help constrain parameters in ice flow models?” In: *Journal of Geophysical Research: Earth Surface* 122 (11 2017), pp. 2269–2282. DOI: 10.1002/2017JF004373
- [35] E. G. Charalampidis, P. G. Kevrekidis, and **P. E. Farrell** (2018). “Computing stationary solutions of the two-dimensional Gross-Pitaevskii equation with deflated continuation.” In: *Communications in Nonlinear Science and Numerical Simulation* 54, pp. 482–499. DOI: 10.1016/j.cnsns.2017.05.024
- [34] M. E. Rognes, **P. E. Farrell**, S. W. Funke, J. E. Hake, and M. M. C. Maleckar (2017). “cbcbat: an adjoint-enabled framework for computational cardiac electrophysiology”. In: *The Journal of Open Source Software* 2.13. DOI: 10.21105/joss.00224
- [33] S. W. Funke, **P. E. Farrell**, and M. D. Piggott (2017). “Reconstructing wave profiles from inundation data”. In: *Computer Methods in Applied Mechanics and Engineering* 322, pp. 167–186. DOI: 10.1016/j.cma.2017.04.019

- [32] D. B. Emerson, J. H. Adler, **P. E. Farrell**, S. P. MacLachlan, and T. J. Atherton (2017). “Computing equilibrium states of cholesteric liquid crystals in elliptical channels with deflation algorithms.” In: *Liquid Crystals*. DOI: [10.1080/02678292.2017.1365385](https://doi.org/10.1080/02678292.2017.1365385)
- [31] S. J. Chapman and **P. E. Farrell** (2017). “Analysis of Carrier’s problem.” In: *SIAM Journal on Applied Mathematics* 77.3, pp. 924–950. DOI: [10.1137/16M1096074](https://doi.org/10.1137/16M1096074)
- [30] M. Robinson, C. Luo, **P. E. Farrell**, R. Erban, and A. Majumdar (2017). “From molecular to continuum modelling of bistable liquid crystal devices.” In: *Liquid Crystals* 44.14-15, pp. 2267–2284. DOI: [10.1080/02678292.2017.1290284](https://doi.org/10.1080/02678292.2017.1290284)
- [29] **P. E. Farrell** and J. W. Pearson (2016). “A preconditioner for the Ohta-Kawasaki equation”. In: *SIAM Journal on Matrix Analysis and Applications* 38.1. DOI: [10.1137/16M1065483](https://doi.org/10.1137/16M1065483)
- [28] A. Beskos, M. Girolami, S. Lan, **P. E. Farrell**, and A. M. Stuart (2016). “Geometric MCMC for infinite-dimensional inverse problems”. In: *Journal of Computational Physics* 335, pp. 327–351. DOI: [10.1016/j.jcp.2016.12.041](https://doi.org/10.1016/j.jcp.2016.12.041)
- [27] J. H. Adler, D. B. Emerson, **P. E. Farrell**, and S. P. MacLachlan (2017). “Combining deflation and nested iteration for computing multiple solutions of nonlinear variational problems”. In: *SIAM Journal on Scientific Computing* 39. DOI: [10.1137/16M1058728](https://doi.org/10.1137/16M1058728)
- [26] **P. E. Farrell** and C. Maurini (2016). “Linear and nonlinear solvers for variational phase-field models of brittle fracture”. In: *International Journal for Numerical Methods in Engineering* 109.5, pp. 648–667. DOI: [10.1002/nme.5300](https://doi.org/10.1002/nme.5300)
- [25] **P. E. Farrell** (2016). “The number of distinct eigenvalues of a matrix after perturbation”. In: *SIAM Journal on Matrix Analysis and Applications* 37.2, pp. 572–576. DOI: [10.1137/15M1037603](https://doi.org/10.1137/15M1037603)
- [24] **P. E. Farrell**, Á. Birkisson, and S. W. Funke (2015). “Deflation techniques for finding distinct solutions of nonlinear partial differential equations”. In: *SIAM Journal on Scientific Computing* 37.4, A2026–A2045. DOI: [10.1137/140984798](https://doi.org/10.1137/140984798)
- [23] **P. E. Farrell**, C. J. Cotter, and S. W. Funke (2014). “A framework for the automation of generalised stability theory”. In: *SIAM Journal on Scientific Computing* 36.1, pp. C25–C48. DOI: [10.1137/120900745](https://doi.org/10.1137/120900745)
- [22] J. R. Maddison and **P. E. Farrell** (2014). “Rapid development and adjoining of transient finite element models”. In: *Computer Methods in Applied Mechanics and Engineering* 276.0, pp. 95–121. DOI: [10.1016/j.cma.2014.03.010](https://doi.org/10.1016/j.cma.2014.03.010)
- [21] H. R. Hiester, M. D. Piggott, **P. E. Farrell**, and P. A. Allison (2014). “Assessment of spurious mixing in adaptive mesh simulations of the two-dimensional lock-exchange”. In: *Ocean Modelling* 73, pp. 30–44. DOI: [10.1016/j.ocemod.2013.10.003](https://doi.org/10.1016/j.ocemod.2013.10.003)
- [20] S. W. Funke, **P. E. Farrell**, and M. D. Piggott (2014). “Tidal turbine array optimisation using the adjoint approach”. In: *Renewable Energy* 63.0, pp. 658–673. DOI: [10.1016/j.renene.2013.09.031](https://doi.org/10.1016/j.renene.2013.09.031)
- [19] A. G. Buchan, **P. E. Farrell**, G. J. Gorman, A. J. H. Goddard, M. D. Eaton, E. T. Nygaard, P. L. Angelo, R. P. Smedley-Stevenson, S. R. Merton, and P. N. Smith (2014). “The immersed body supermeshing method for modelling reactor physics problems with complex internal structures”. In: *Annals of Nuclear Energy* 63.0, pp. 399–408. DOI: [10.1016/j.anucene.2013.07.044](https://doi.org/10.1016/j.anucene.2013.07.044)
- [18] C. M. J. Baker, A. G. Buchan, C. C. Pain, **P. E. Farrell**, M. D. Eaton, and P. Warner (2013). “Multimesh anisotropic adaptivity for the Boltzmann transport equation”. In: *Annals of Nuclear Energy* 53.0, pp. 411–426. DOI: [10.1016/j.anucene.2012.07.023](https://doi.org/10.1016/j.anucene.2012.07.023)

- [17] **P. E. Farrell**, D. A. Ham, S. W. Funke, and M. E. Rognes (2013). “Automated derivation of the adjoint of high-level transient finite element programs”. In: *SIAM Journal on Scientific Computing* 35.4, pp. C369–C393. DOI: 10.1137/120873558
- [16] A. Viré, J. Xiang, F. Milthaler, **P. E. Farrell**, M. D. Piggott, J.-P. Latham, D. Pavlidis, and C. C. Pain (2012). “Modelling of fluid–solid interactions using an adaptive mesh fluid model coupled with a combined finite discrete element model”. In: *Ocean Dynamics* 62.10–12, pp. 1487–1501. DOI: 10.1007/s10236-012-0575-z
- [15] J. R. Maddison and **P. E. Farrell** (2012). “Directional integration on unstructured meshes via supermesh construction”. In: *Journal of Computational Physics* 231.12, pp. 4422–4432. DOI: 10.1016/j.jcp.2012.02.009
- [14] G. J. Gorman, J. Southern, **P. E. Farrell**, M. D. Piggott, G. Rokos, and P. H. J. Kelly (2012). “Hybrid OpenMP/MPI anisotropic mesh smoothing”. In: *Procedia Computer Science* 9.0, pp. 1513–1522. DOI: 10.1016/j.procs.2012.04.166
- [13] J. Southern, G.J. Gorman, M.D. Piggott, and **P. E. Farrell** (2012). “Parallel anisotropic mesh adaptivity with dynamic load balancing for cardiac electrophysiology”. In: *Journal of Computational Science* 3.1–2, pp. 8–16. DOI: 10.1016/j.jocs.2011.11.002
- [12] **P. E. Farrell**, S. Micheletti, and S. Perotto (2011). “An anisotropic Zienkiewicz-Zhu error estimator for 3D applications”. In: *International Journal for Numerical Methods in Engineering* 85.6, pp. 671–692. DOI: 10.1002/nme.2980
- [11] **P. E. Farrell** (2011). “The addition of fields on different meshes”. In: *Journal of Computational Physics* 230.9, pp. 3265–3269. DOI: 10.1016/j.jcp.2011.01.028
- [10] J. R. Maddison, C. J. Cotter, and **P. E. Farrell** (2011). “Geostrophic balance preserving interpolation in mesh adaptive linearised shallow-water ocean modelling”. In: *Ocean Modelling*. DOI: 10.1016/j.ocemod.2010.12.007
- [9] **P. E. Farrell** and J. R. Maddison (2011). “Conservative interpolation between volume meshes by local Galerkin projection”. In: *Computer Methods in Applied Mechanics and Engineering* 200.1-4, pp. 89–100. DOI: 10.1016/j.cma.2010.07.015
- [8] J. Southern, G. J. Gorman, M. D. Piggott, **P. E. Farrell**, M. O. Bernabeu, and J. Pitt-Francis (2010*b*). “Simulating cardiac electrophysiology using anisotropic mesh adaptivity”. In: *Journal of Computational Science* 1.2, pp. 82–88. DOI: 10.1016/j.jocs.2010.03.010
- [7] J. Southern, G. J. Gorman, M. D. Piggott, **P. E. Farrell**, M. O. Bernabeu, and J. Pitt-Francis (2010*a*). “Anisotropic mesh adaptivity for cardiac electrophysiology”. In: *Procedia Computer Science* 1.1, pp. 935–944. DOI: 10.1016/j.procs.2010.04.103
- [6] **P. E. Farrell**, M. D. Piggott, G. J. Gorman, D. A. Ham, C. R. Wilson, and T. M. Bond (2011). “Automated continuous verification for numerical simulation”. In: *Geoscientific Model Development* 4.2, pp. 435–449. DOI: 10.5194/gmd-4-435-2011
- [5] M. D. Piggott, **P. E. Farrell**, C. R. Wilson, G. J. Gorman, and C. C. Pain (2009). “Anisotropic mesh adaptivity for multi-scale ocean modelling”. In: *Philosophical Transactions of the Royal Society A* 367.1907, pp. 4591–4611. DOI: 10.1098/rsta.2009.0155
- [4] D. A. Ham, **P. E. Farrell**, G. J. Gorman, J. R. Maddison, C. R. Wilson, S. C. Kramer, J. Shipton, G. S. Collins, C. J. Cotter, and M. D. Piggott (2009). “Spud 1.0: generalising and automating the user interfaces of scientific computer models”. In: *Geoscientific Model Development* 2.1, pp. 33–42. DOI: 10.5194/gmd-2-33-2009

- [3] F. Fang, C. C. Pain, I. M. Navon, G. J. Gorman, M. D. Piggott, P. A. Allison, **P. E. Farrell**, and A. J. H. Goddard (2009). “A POD reduced order unstructured mesh ocean modelling method for moderate Reynolds number flows”. In: *Ocean Modelling* 28.1-3, pp. 127–136. DOI: [10.1016/j.ocemod.2008.12.006](https://doi.org/10.1016/j.ocemod.2008.12.006)
- [2] **P. E. Farrell**, M. D. Piggott, C. C. Pain, G. J. Gorman, and C. R. G. Wilson (2009). “Conservative interpolation between unstructured meshes via supermesh construction”. In: *Computer Methods in Applied Mechanics and Engineering* 198.33-36, pp. 2632–2642. DOI: [10.1016/j.cma.2009.03.004](https://doi.org/10.1016/j.cma.2009.03.004)
- [1] F. Fang, C. C. Pain, I. M. Navon, M. D. Piggott, G. J. Gorman, **P. E. Farrell**, P. A. Allison, and A. J. H. Goddard (2008). “A POD reduced-order 4D-Var adaptive mesh ocean modelling approach”. In: *International Journal for Numerical Methods in Fluids* 60.7, pp. 709–732. DOI: [10.1002/flid.1911](https://doi.org/10.1002/flid.1911)