

David J. Silvester

Publications—Books

- B2 David F. Griffiths, John W. Dold, David J. Silvester. *Essential Partial Differential Equations*, Springer, Heidelberg, 2015. xi+368 pp. ISBN: 978-3-319-22568-5.
- B1 Howard Elman, David Silvester, Andy Wathen. *Finite Elements and Fast Iterative Solvers: with applications in incompressible fluid dynamics*, Second Edition, Oxford University Press, Oxford, 2014. xiv+479 pp. ISBN: 978-0-19-967879-2.

Publications—Invited

- I6 Silvester, D. Preconditioning, in *Encyclopedia of Applied and Computational Mathematics*, Engquist B. (Ed), Springer, Berlin, pp.1170–1173, 2015.
<https://doi.org/10.1007/978-3-540-70529-1>.
- I5 Powell, C and Silvester, D. Black-box preconditioning for mixed formulation of self-adjoint elliptic PDEs, *Challenges in Scientific Computing — CISC 2002*. Bänsch E. (Ed), Springer Lecture Notes in Computational Science and Engineering **35**, pp. 268–285, 2003.
- I4 Wathen, A., Fischer, B. and Silvester, D. The convergence of iterative solution methods for symmetric and indefinite systems. *Numerical Analysis 1997*, Griffiths D., Higham D. and Watson G. (Eds), Longman Scientific, pp. 230–240, 1998.
- I3 Elman, H., Silvester, D. and Wathen. A. Iterative methods for problems in computational fluid dynamics. *Iterative Methods in Scientific Computing*, Chan R., Chan T. and Golub G. (Eds), Springer-Verlag, pp. 271–327, 1997.
- I2 Golub, G., Silvester, D. and Wathen. A. Diagonal dominance and positive definiteness of upwind approximations for advection diffusion problems. *Numerical Analysis: A.R. Mitchell 75th Birthday Volume*, Griffiths D. and Watson G. (Eds), World Scientific, pp. 125–131, 1996.
- I1 Silvester, D. and Wathen. A. Fast & robust solvers for time-discretised incompressible Navier–Stokes equations. *Numerical Analysis 1995*, Griffiths D. and Watson G. (Eds), Longman Scientific, pp. 154–168, 1996.

Publications—Refereed Journal Papers

- P62 Pestana, J. and Silvester D. Fast solution of incompressible flow problems with two-level pressure approximation, *Numerische Mathematik*, **156**, 1579–1602, 2024.
<https://doi.org/10.1007/s00211-024-01420-z>
- P61 Feng Yani, Liao Q. and Silvester D. Robin-type domain decomposition with stabilized mixed approximation for incompressible flow, *Computers and Mathematics with Applications*, **147**, 53–63, 2023. <https://doi.org/10.1016/j.camwa.2023.07.016>
- P60 Kent B., Powell, C., Silvester D. and Zimón, M. Efficient adaptive stochastic collocation strategies for advection-diffusion problems with uncertain inputs, *Journal of Scientific Computing*, **96**, 64, 2023. <https://doi.org/10.1007/s10915-023-02247-w>
- P59 Papanikos G., Powell, C. and Silvester, D. IFISS3D: A computational laboratory for investigating finite element approximation in three dimensions, *ACM Transactions on Mathematical Software*, 2023. <https://doi.org/10.1145/3604934>

- P58 Bepalov, A. and Silvester, D. Error estimation and adaptivity for stochastic collocation finite elements Part II: multilevel approximation, *SIAM J. Scientific Computing*, **45**, A784–A800, 2023. <http://doi.org/10.1137/22M1479361>
- P57 Bepalov, A., Silvester, D. and Xu, F. Error estimation and adaptivity for stochastic collocation finite elements Part I: single-level approximation, *SIAM J. Scientific Computing*, **44**, A3393–A3412, 2022. <https://doi.org/10.1137/21M1446745>
- P56 Khan, A. and Silvester, D. Robust a posteriori error estimation for mixed finite element approximation of linear poroelasticity. *IMA J. of Numerical Analysis* **41**, 2000–2025, 2021. <https://doi.org/10.1093/imanum/draa058>
- P55 Khan, A., Bepalov, A., Powell, C. and Silvester, D. Robust a posteriori error estimators for stochastic Galerkin formulations of parameter-dependent linear elasticity equations, *Mathematics of Computation*, **90**, 613–636, 2021. <https://doi.org/10.1090/mcom/3572>
- P54 Bepalov, A., Rocchi, L. and Silvester, D. T-IFISS: a toolbox for adaptive FEM computation, *Computers and Mathematics with Applications*, **81**, 373–390 2021. <https://doi.org/10.1016/j.camwa.2020.03.005>
- P53 Lang, J., Scheichl, R. and Silvester, D. A fully adaptive multilevel collocation strategy for solving elliptic PDEs with random data, *J. Computational Physics*, **419**, 109692, 2020. <https://doi.org/10.1016/j.jcp.2020.109692>
- P52 Pranjali and Silvester, D. Balanced iterative solvers for linear nonsymmetric systems and nonlinear systems with PDE origins: efficient black-box stopping criteria, *J. Scientific Computing*, **81**, 271–290, 2019. <https://doi.org/10.1007/s10915-019-01018-w>
- P51 Khan, A., Powell, C. and Silvester, D. Robust a posteriori error estimators for mixed approximation of nearly incompressible elasticity, *International Journal for Numerical Methods in Engineering*, **119**, 1–20, 2019. <https://doi.org/10.1002/nme.6040>
- P50 Khan, A., Powell, C. and Silvester, D. Robust preconditioning for stochastic Galerkin formulations of parameter-dependent nearly incompressible linear elasticity equations, *SIAM J. Scientific Computing*, **41**, A402–A421, 2019. <https://doi.org/10.1137/18M117385X>
- P49 Elman, H and Silvester, D. Collocation methods for exploring perturbations in linear stability analysis, *SIAM J. Scientific Computing*, **40**, A2667–A2693, 2018. <https://doi.org/10.1137/17M1117689>
- P48 Pearson, J., Pestana, J. and Silvester, D. Refined saddle-point preconditioners for discretized Stokes problems, *Numerische Mathematik*, **138**, 331–363, 2018. <https://doi.org/10.1007/s00211-017-0908-4>
- P47 Powell, C., Silvester, D. and Simoncini, V. An efficient reduced basis solver for stochastic Galerkin matrix equations, *SIAM J. Scientific Computing*, **39**, A141–A163, 2017. <https://doi.org/10.1137/15M1032399>
- P46 Bepalov, A. and Silvester, D. Efficient adaptive stochastic Galerkin methods for parametric operator equations, *SIAM J. Scientific Computing*, **38**, A2118–A2140, 2016. <https://doi.org/10.1137/15M1027048>
- P45 Silvester, D. and Pranjali. An optimal solver for linear systems arising from stochastic FEM approximation of diffusion equations with random coefficients, *SIAM/ASA J. Uncertainty Quantification*, **4**, 298–311, 2016. <https://doi.org/10.1137/15M1017740>

- P44 Elman, H., Ramage A. and Silvester D. IFISS: A computational laboratory for investigating incompressible flow problems, *SIAM Review*, **56**, 261–273, 2014. <https://doi.org/10.1137/120891393>
- P43 Bespalov, A., Powell C. and Silvester D. Energy norm a posteriori error estimation for parametric operator equations, *SIAM J. Scientific Computing*, **36**, A339–A363, 2014. <https://doi.org/10.1137/130916849>
- P42 Duminil, S., Sadok, H. and Silvester, D. Fast solvers for discretized Navier–Stokes problems using vector extrapolation, *Numerical Algorithms*, **66**, 89–104, 2013. <https://doi.org/10.1007/s11075-013-9726-7>
- R41 Smethurst, C., Silvester D. and Mihajlović, M. Unstructured finite element method for the solution of the Boussinesq problem in three dimensions, *Int. J. Numer. Meth. Fluids*, **73**, 791–812, 2013. <https://doi.org/10.1002/flid.3823>
- P40 Liao, Q. and Silvester, D. Implicit solvers using stabilized mixed approximation, *Int. J. Numer. Meth. Fluids*, **71**, 991–1006, 2013. <https://doi.org/10.1002/flid.3697>
- P39 Liao, Q. and Silvester, D. Robust stabilized Stokes approximation methods for highly stretched grids, *IMA J. Numerical Analysis*, **33**, 413–431, 2013. <https://doi.org/10.1093/imanum/drs012>
- P38 Silvester, D., Bespalov, A. and Powell, C. A framework for the development of implicit solvers for incompressible flow problems, *Discrete and Continuous Dynamical Systems — Series S (DCDS–S)*, **5**, 1195–1221, 2012. <https://doi.org/10.3934/dcdss.2012.5.1195>
- P37 Powell, C and Silvester, D. Preconditioning steady-state Navier–Stokes equations with random data, *SIAM J. Scientific Computing*, **34**, A2482–A2506, 2012. <https://doi.org/10.1137/120870578>
- P36 Bespalov, A., Powell, C and Silvester, D. A priori error analysis of stochastic Galerkin mixed approximations of elliptic PDEs with random data, *SIAM J. Numerical Analysis*, **50**, 2039–2063, 2012. <https://doi.org/10.1137/110854898>
- P35 Liao, Q. and Silvester, D. A simple yet effective a posteriori error estimator for classical mixed approximation of Stokes equations, *Applied Numerical Mathematics*, **62**, 1242–1256, 2012. <https://doi.org/10.1016/j.apnum.2010.05.003>
- P34 Elman H., Mihajlović M. and Silvester D. Fast iterative solvers for buoyancy driven flow problems, *J. Computational Physics*, **230**, 3900–3914, 2011. <https://doi.org/10.1016/j.jcp.2011.02.014>
- P33 Silvester, D. and Simoncini, V. An optimal iterative solver for symmetric indefinite systems stemming from mixed approximation, *ACM Transactions on Mathematical Software*, **37**, 4, Article 42, 2011. <https://doi.org/10.1145/1916461.1916466>
- P32 Kay, D., Gresho, P., Griffiths, D. and Silvester, D. Adaptive time-stepping for incompressible flow; part II: Navier–Stokes equations, *SIAM J. Scientific Computing*, **32**, 111–128, 2010. <https://doi.org/10.1137/080728032>
- P31 Ernst, O., Powell, C., Silvester, D. and Ullmann, E. Efficient solvers for a linear stochastic Galerkin mixed formulation of diffusion problems with random data, *SIAM J. Scientific Computing*, **31**, 1424–1447, 2009. <https://doi.org/10.1137/070705817>

- P30 Gresho, P., Griffiths, D. and Silvester, D. Adaptive time-stepping for incompressible flow; part I: scalar advection-diffusion, *SIAM J. Scientific Computing*, **30**, 2018–2054, 2008. <https://doi.org/10.1137/070688018>
- P29 Elman H., Howle V., Shadid J., Silvester, D. and Tuminaro R. Least squares preconditioners for stabilized discretizations of the Navier–Stokes equations, *SIAM J. Scientific Computing*, **30**, 290–311, 2007. <https://doi.org/10.1137/060655742>
- P28 Elman, H., Ramage, A. and Silvester, D. Algorithm 866: IFISS, a Matlab toolbox for modelling incompressible flow, *ACM Transactions on Mathematical Software*, **33**, 2–14, 2007. <https://doi.org/10.1145/1236463.1236469>
- P27 Silvester, D. and Mihajlović, M. A black-box multigrid preconditioner for the biharmonic equation, *BIT*, **44**, pp. 151–163, 2004
- P26 Powell, C and Silvester, D. Optimal preconditioning for Raviart–Thomas mixed formulation of second-order elliptic problems, *SIAM J. Matrix Analysis and Applications*, **25**, pp. 718–738, 2004. <https://doi.org/10.1137/S0895479802404428>
- P25 Mihajlović, M. and Silvester, D. Efficient parallel solvers for the biharmonic equation, *Parallel Computing*, **30**, pp. 35–55, 2004. <https://doi.org/10.1016/j.parco.2003.07.002>
- P24 Syamsudhuha and Silvester, D. Efficient solution of the steady-state Navier–Stokes equations using a multigrid preconditioned Newton–Krylov method, *Int. J. Numer. Meth. Fluids*, **43**, pp. 1407–1427, 2003. <https://doi.org/10.1002/fld.627>
- P23 Elman, H., Silvester, D. and Wathen, A., Block preconditioners for the discrete incompressible Navier–Stokes equations, *Int. J. Numer. Meth. Fluids*, **40**, pp. 333–344, 2002. <https://doi.org/10.1002/fld.311>
- P22 Elman, H., Silvester, D. and Wathen, A., Performance and analysis of saddle point preconditioners for the discrete steady-state Navier–Stokes equations, *Numerische Mathematik*, **90**, pp. 665–688, 2002. <https://doi.org/10.1007/s002110100300>
- P21 Norburn, S. and Silvester, D. Fourier analysis of stabilised Q_1 – Q_1 mixed finite element approximation, *SIAM J. Numerical Analysis*, **39**, pp. 817–833, 2001. <https://doi.org/10.1137/S0036142999362274>
- P20 Kay, D. and Silvester, D. The reliability of local error estimators for convection–diffusion equations, *IMA J. Numerical Analysis*, **21**, pp. 107–122, 2001. <https://doi.org/10.1093/imanum/21.1.107>
- P19 Silvester, D., Elman, H., Kay, D. and Wathen, A. Efficient preconditioning of the linearised Navier–Stokes equations for incompressible flow, *J. Computational and Applied Mathematics* (special millennium issue vol. 7), **128**, pp. 261–279, 2001. [https://doi.org/10.1016/S0377-0427\(00\)00515-X](https://doi.org/10.1016/S0377-0427(00)00515-X)
- P18 Kay, D. and Silvester, D. A posteriori error estimation for stabilised mixed approximations of the Stokes equations, *SIAM J. Scientific Computing*, **21**, pp. 1321–1336, 1999. <https://doi.org/10.1137/S1064827598333715>
- P17 Fischer, B., Ramage, A., Silvester, D. and Wathen, A. On parameter choice and iterative convergence for stabilised discretisations of advection–diffusion problems, *Computer Methods in Applied Mechanics and Engineering*, **179**, pp. 185–202, 1999. [https://doi.org/10.1016/S0045-7825\(99\)00037-7](https://doi.org/10.1016/S0045-7825(99)00037-7)

- P16 Norburn, M. D. S. and Silvester, D. Stable vs. stabilised mixed methods for incompressible flow, *Computer Methods in Applied Mechanics and Engineering*, **166**, pp. 131–141, 1998. [https://doi.org/10.1016/S0045-7825\(98\)00087-5](https://doi.org/10.1016/S0045-7825(98)00087-5)
- P15 Fischer, B., Ramage, A., Silvester, D. and Wathen, A. Minimum residual methods for augmented systems, *BIT*, **38**, pp. 527–543, 1998. <https://doi.org/10.1007/bf02510258>
- P14 Smith, A. and Silvester, D. Implicit algorithms and their linearisation for the transient Navier–Stokes equations, *IMA J. Numerical Analysis*, **17**, pp. 527–545, 1997. <https://doi.org/10.1093/imanum/17.4.527>
- P13 Hanby, R., Silvester, D. and Chew, J. A comparison of coupled and segregated iterative solution techniques for incompressible swirling flow, *Int. J. Numer. Meth. Fluids*, **22**, pp. 353–373, 1996.
- P12 Elman, H. and Silvester, D. Fast nonsymmetric iterations and preconditioning for Navier–Stokes equations, *SIAM J. Scientific Computing*, **17**, pp. 33–46, 1996. <https://doi.org/10.1137/0917004>
- P11 Wathen, A., Fischer, B. and Silvester, D. The convergence rate of the minimal residual method for the Stokes problem, *Numerische Mathematik*, **71**, pp. 121–134, 1995. <https://doi.org/10.1007/s002110050138>
- P10 Silvester, D. and Wathen, A. Fast iterative solution of stabilised Stokes systems part II: using general block preconditioners, *SIAM J. Numerical Analysis*, **31**, pp. 1352–1367, 1994. <https://doi.org/10.1137/0731070>
- P9 Silvester, D. Optimal low order finite element methods for incompressible flow, *Computer Methods in Applied Mechanics and Engineering* **111**, pp. 357–368, 1994. [https://doi.org/10.1016/0045-7825\(94\)90139-2](https://doi.org/10.1016/0045-7825(94)90139-2)
- P8 Wathen, A. and Silvester, D. Fast iterative solution of stabilised Stokes systems part I: using simple diagonal preconditioners, *SIAM J. Numerical Analysis* **30**, pp. 630–649, 1993. <https://doi.org/10.1137/0730031>
- P7 Kechkar, N. and Silvester, D. Analysis of locally stabilised mixed finite element methods for the Stokes problem, *Mathematics of Computation* **58**, pp. 1–10, 1992. <https://doi.org/10.2307/2153016>
- P6 Atanga, J. and Silvester, D. Iterative methods for stabilized mixed velocity–pressure finite elements, *Int. J. Numer. Meth. Fluids*, **14**, pp. 71–81, 1992. <https://doi.org/10.1002/flid.1650140106>
- P5 Silvester, D. and Kechkar, N. Stabilised bilinear–constant velocity–pressure finite elements for the conjugate gradient solution of the Stokes problem, *Computer Methods in Applied Mechanics and Engineering* **79**, pp. 71–86, 1990. [https://doi.org/10.1016/0045-7825\(90\)90095-4](https://doi.org/10.1016/0045-7825(90)90095-4)
- P4 Durham, A., Silvester, D. and Thatcher, R. A study of flow through a vortex amplifier at low Reynolds number using the finite element method, *J. Fluid Control* **18**, pp. 47–61, 1988.
- P3 Silvester, D. Optimising finite element matrix calculations using the general technique of element vectorisation, *Parallel Computing* **6**, pp. 157–164, 1988. [https://doi.org/10.1016/0167-8191\(88\)90081-6](https://doi.org/10.1016/0167-8191(88)90081-6)

- P2 Silvester, D. and Thatcher, R. The effect of the stability of mixed finite element approximations on the accuracy and rate of convergence of solution when solving incompressible flow problems, *Int. J. Numer. Meth. Fluids*, **6**, pp. 841–853, 1986.
<https://doi.org/10.1002/flid.1650061106>
- P1 Silvester, D., Thatcher, R. and Duthie, J. The specification and numerical solution of a benchmark swirling laminar flow problem, *Computers and Fluids* **12**, pp. 281–292, 1984.
[https://doi.org/10.1016/0045-7930\(84\)90010-0](https://doi.org/10.1016/0045-7930(84)90010-0)

Publications—Conference Proceedings and Book Chapters

- C6 Wathen, A., Loghin, D., Kay, D., Elman, H., and Silvester, D. A new preconditioner for the Oseen equations, *Numerical Mathematics and Advanced Applications*, Editors F. Brezzi, A. Buffa, S. Corsaro and A. Murli, Springer, Milan, 2003.
- C5 Silvester, D. Stabilised mixed finite element methods, in *Incompressible Flow and the Finite Element Method*, Gresho P. and Sani R., Wiley, New York, pp. 533–549, 1998.
- C4 Ramage, A., Fischer, B., Silvester, D. and Wathen, A. Minimum residual methods for the Navier–Stokes equations: indefiniteness vs asymmetry, *Numerical Methods for Fluid Dynamics V*, Editors K. Morton and M. Baines, Oxford University Press, pp. 541–547, 1995.
- C3 Atanga, J. and Silvester, D. Preconditioning techniques for the numerical solution of the Stokes problem, *Proceedings of the Second International Conference on the Application of Supercomputers in Engineering (ASE 91)*. Editors C. Brebbia, D. Howard and A. Peters, Computational Mechanics Publications, pp. 293–305, 1991.
- C2 Kechkar, N. and Silvester, D. The stabilisation of low order mixed finite element methods for incompressible flow, *Proceedings of the fifth International Symposium on Numerical Methods in Engineering*. Editors R. Gruber, J. Periaux and R. Shaw, Computational Mechanics Publications. Vol.2, pp. 111–116, 1989.
- C1 Silvester, D. Optimising finite element calculations using the technique of element vectorisation, *The Mathematics of Finite Elements and Applications VI*. Editor J. Whiteman, Academic Press. pp. 443–450, 1988.

Publications—Book Reviews

- X2 Silvester, D. *Iterative Methods for Solving Linear Systems*, by A. Greenbaum, *Mathematics of Computation* **68**, pp. 890–891, 1999.
- X1 Silvester, D. *Templates for the Solution of Linear Systems: Building Blocks for Iterative Methods*, by R. Barrett et al. *IMA Bulletin* **30**, pp. 127–128, 1994.

Publications—Preprints

- R3 Silvester, D. Machine learning for hydrodynamic stability, arXiv:2407.09572,
<https://arxiv.org/abs/2407.09572>
- R2 Griffiths, D. and Silvester, D. Unstable modes of the Q1–P0 element, MIMS Eprint 2011.44
<http://eprints.ma.man.ac.uk/1628/>
- R1 Thatcher, R. and Silvester, D. A locally mass conserving quadratic velocity, linear pressure element, Manchester NA report 147, arXiv:2001.11878
<https://arxiv.org/abs/2001.11878>