

David Moxey

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✍️ College of Engineering, Mathematics and Physical Sciences, University of Exeter, EX4 4QJ

Employment

- present **Senior Lecturer in Engineering, CEMPS, University of Exeter**
- My research aims to better understand the transition to turbulence in fluid flows.
 - I investigate both fundamental fluids problems and those of interest to industry.
 - To do this, I develop new methods for highly parallel computational simulations.
 - I lecture & administer courses and supervise a number of Ph.D./M.Sc. projects.
 - Project leader of the *Nektar++* spectral/hp element framework (www.nektar.info).
- 3/17 - 2/19 **Lecturer in Engineering, CEMPS, University of Exeter**
- 11/15 - 3/17 **Research & Teaching Fellow, Dept. of Aeronautics, Imperial College London**
- 6/11 - 11/15 **Research Associate, Department of Aeronautics, Imperial College London**

Education

- Jun. 2011 **Ph.D. Mathematics, University of Warwick**
thesis *Spatio-temporal dynamics in pipe flow*, supervised by [Prof. Dwight Barkley](#).
- Jun. 2007 **M.Math. Mathematics (1st class hon.), University of Warwick**
dissertation *Simulation of polymer chains using Monte Carlo methods*, supervised by [Prof. Mike Allen](#).

Research income

- Aug. 2018 **NVIDIA GPU Grant Program (£5,000)**
- Jul. 2018 **PRISM: Platform for Research In Simulation Methods (£1,612,965)**
Co-I on EPSRC Platform Grant PRISM ([EP/R029423/1](#)), which draws together expertise in designing, analysing and implementing sophisticated numerical methods and techniques, deploying them across a broad range of industrial, biomedical and environmental applications, and developing software tools that deliver portable parallel performance.
- Nov. 2015 **ARCHER Leadership Project (£165,796)**
Co-I on EPSRC leadership-scale computing resource (20 million CPU hours) on national supercomputer ARCHER. Produced first scale-resolving simulations for extremely complex Formula 1 geometries using high-order methods.
- Jun. 2015 **ARCHER Resource Allocation Panel (£22,256)**
- Apr. 2015 **PRISM platform grant project (0.5 person year)**
- Apr. 2015 **Horizon 2020 project ExaFLOW (€3,312,235)**
Co-I and main work package leader of the EU Horizon 2020 project ExaFLOW, developing numerical methods for CFD on exascale computing platforms. Consortium consists of 8 partners from academia and industry.
- Jul. 2014 **EPCC Embedded CSE grant (1 person year)**
- Jan. 2014 **ARCHER Resource Allocation Panel (£16,153)**
- Oct. 2007 **EPSRC Ph.D. scholarship (£45,500)**

Postgraduate supervision

- Edward Laughton (Exeter, main supervisor, since Oct. 2018)
- Mikkel Lykkegard (Exeter, main supervisor, since Oct. 2018)
- Michael Turner (Imperial, co-supervisor, 2013-2017, now CFD Engineer at Cambridge Flow Solutions)
- Daniele de Grazia (Imperial, mentor, 2012-2016, now CFD Engineer at Rolls Royce)

- Dirk Ekelschot (Imperial, mentor, 2011-2015, now Postdoctoral Fellow at NASA Ames)
- Gianmarco Mengaldo (Imperial, mentor, 2011-2015, now Senior Postdoctoral Fellow at California Institute of Technology)

Academic citizenship

- Fellow of the **Higher Education Academy**.
- Full member of the **Institute for Mathematics and its Applications**.
- **External postgraduate examiner:**
 - Jacopo Canton, KTH Stockholm (licentiate opponent)
 - Manuel Felipe Mejia De Alba, Universidad de Los Andes (Ph.D. committee member)
- Reviewer for various academic journals, including *J. Comp. Phys.*, *J. Sci. Comp.*, *Comp. Meth. Appl. Mech. Eng. Proc. Roy. Soc.*, *J. Fluid. Mech.*, *SIAM J. Sci. Comp.*
- Member of the Engineering education and Industrial Advisory Group committees, **University of Exeter**.
- Employability coordinator in Engineering, **University of Exeter**

Publications

Journal Publications

- under review [A comparison of the shared-memory parallel programming models OpenMP, OpenACC and Kokkos in the context of implicit solvers for high-order FEM](#)
 J. Eichstädt, M. Vymazal, D. Moxey and J. Peiró
under review in Comput. Phys. Commun.
- On weak Dirichlet boundary conditions for elliptic problems in the continuous Galerkin method
 M. Vymazal, D. Moxey, S. Sherwin, C. D. Cantwell and R. M. Kirby
under review in J. Comput. Phys.
- in press [Interpolation error bounds for curvilinear finite elements and their implications on adaptive mesh refinement](#)
 D. Moxey, S. P. Sastry and R. M. Kirby
to appear in J. Comput. Phys. DOI: [10.1007/s10915-018-0795-6](#).
- [Turbulence in a localized puff in a pipe](#)
 A. Yakhot, Y. Feldman, D. Moxey, S. J. Sherwin and G. E. Karniadakis
to appear in Flow Turbul. Combust. DOI: [10.1007/s10494-018-0002-8](#).
- 2018 [Accelerating high-order mesh generation with an architecture-independent programming model](#)
 J. Eichstädt, M. Green, M. Turner, J. Peiró and D. Moxey
Comput. Phys. Commun. **229**, pp. 36–53. DOI: [10.1016/j.cpc.2018.03.025](#).
- [DNS of a compressible boundary layer flow past an isolated three-dimensional hump in a high-speed subsonic regime](#)
 D. de Grazia, D. Moxey, S. J. Sherwin, M. A. Kravtsova and A. I. Ruban
Phys. Rev. Fluids **3**, p. 024101. DOI: [10.1103/PhysRevFluids.3.024101](#).
- [Curvilinear mesh generation using a variational framework](#)
 M. Turner, J. Peiró and D. Moxey
Comput. Aided Design **103**, pp. 73–91. DOI: [10.1016/j.cad.2017.10.004](#).
- 2017 [A \$p\$ -adaptation method for compressible flow problems using a goal-based error estimator](#)
 D. Ekelschot, D. Moxey, S. J. Sherwin and J. Peiró
Comput. Struct. **181**, pp. 55–69. DOI: [10.1016/j.compstruc.2016.03.004](#).

- 2016 [An adaptable parallel algorithm for the direct numerical simulation of incompressible turbulent flows using a Fourier spectral/hp element method and MPI virtual topologies](#)
A. Bolis, C. D. Cantwell, D. Moxey, D. Serson and S. J. Sherwin
Comput. Phys. Commun. **206**, pp. 17–25. DOI: [10.1016/j.cpc.2016.04.011](#).
- [Implicit large-eddy simulation of a wingtip vortex](#)
J.-E. W. Lombard, D. Moxey, S. J. Sherwin, J. F. A. Hoessler, S. Dhandapani and M. J. Taylor
AIAA J. **54** (2), pp. 506–518. DOI: [10.2514/1.J054181](#).
- [Optimizing the performance of the spectral/hp element method with collective linear algebra operations](#)
D. Moxey, C. D. Cantwell, R. M. Kirby and S. J. Sherwin
Comput. Meth. Appl. Mech. Eng. **310**, pp. 628–645. DOI: [10.1016/j.cma.2016.07.001](#).
- [High-order curvilinear meshing using a thermo-elastic analogy](#)
D. Moxey, D. Ekelschot, Ü. Keskin, S. J. Sherwin and J. Peiró
Comput. Aided Design **72**, pp. 130–139. DOI: [10.1016/j.cad.2015.09.007](#).
- [To CG or to HDG: a comparative study in 3D](#)
S. Yakovlev, D. Moxey, S. J. Sherwin and R. M. Kirby
J. Sci. Comp. **67** (1), 192–220. DOI: [10.1007/s10915-015-0076-6](#).
- 2015 [Nektar++: An open-source spectral/hp element framework](#)
C. D. Cantwell, D. Moxey, A. Comerford, A. Bolis, G. Rocco et al.
Comput. Phys. Commun. **192**, pp. 205–219. DOI: [10.1016/j.cpc.2015.02.008](#).
- [Dealiasing techniques for high-order spectral element methods on regular and irregular grids](#)
G. Mengaldo, D. de Grazia, D. Moxey, P. E. Vincent and S. J. Sherwin
J. Comput. Phys. **299**, pp. 56–81. DOI: [10.1016/j.jcp.2015.06.032](#).
- [An isoparametric approach to high-order curvilinear boundary-layer meshing](#)
D. Moxey, M. D. Green, S. J. Sherwin and J. Peiró
Comput. Meth. Appl. Mech. Eng. **283**, pp. 636–650. DOI: [10.1016/j.cma.2014.09.019](#).
- 2014 [Simplifying the Development, Use and Sustainability of HPC Software](#)
J. Cohen, C. D. Cantwell, N. P. Chue Hong, D. Moxey, M. Illingworth et al.
J. Open Res. Soft. **2** (1). DOI: [10.5334/jors.az](#).
- [Stability of projection methods for incompressible flows using high order pressure-velocity pairs of same degree: Continuous and Discontinuous Galerkin formulations](#)
E. Ferrer, D. Moxey, S. J. Sherwin and R. H. J. Willden
Commun. Comp. Phys. **16** (3), pp. 817–840. DOI: [10.4208/cicp.290114.170414a](#).
- [Connections between the discontinuous Galerkin method and high-order flux reconstruction schemes](#)
D. de Grazia, G. Mengaldo, D. Moxey, P. E. Vincent and S. J. Sherwin
Int. J. Numer. Meth. Fl. **75** (12), pp. 860–877. DOI: [10.1002/flid.3915](#).
- 2011 [The onset of turbulence in pipe flow](#)
K. Avila, D. Moxey, A. de Lozar, M. Avila, D. Barkley and B. Hof
Science **333** (6039), pp. 192–196. published as a research article. DOI: [10.1126/science.1203223](#).
- 2010 [Distinct large-scale turbulent-laminar states in transitional pipe flow](#)
D. Moxey and D. Barkley
Proc. Nat. Acad. Sci. **107** (18), pp. 8091–8096. DOI: [10.1073/pnas.0909560107](#).

Book Chapters

- 2015 [On the generation of curvilinear meshes through subdivision of isoparametric elements.](#)
D. Moxey, M. D. Green, S. J. Sherwin and J. Peiró.
New Challenges in Grid Generation and Adaptivity for Scientific Computing, pp. 203–215.
DOI: [10.1007/978-3-319-06053-8_10](#).

Curvilinear mesh generation for boundary layer problems.

D. Moxey, M. Hazan, S. J. Sherwin and J. Peiró.

IDIHOM: Industrialization of High-Order Methods-A Top-Down Approach, pp. 41–64.

DOI: [10.1007/978-3-319-12886-3_3](https://doi.org/10.1007/978-3-319-12886-3_3).

High-order visualization with ELVis.

J. Peiró, D. Moxey, B. Jordi, S. J. Sherwin, B. W. Nelson et al.

IDIHOM: Industrialization of High-Order Methods-A Top-Down Approach, pp. 521–534.

DOI: [10.1007/978-3-319-12886-3_24](https://doi.org/10.1007/978-3-319-12886-3_24).

Conference Proceedings

- 2018 [High-order curvilinear hybrid mesh generation for CFD simulations](#)
J. Marcon, M. Turner, J. Peiró, D. Moxey, C. R. Pollard et al.
2018 AIAA Aerospace Sciences Meeting.
DOI: [10.2514/6.2018-1403](https://doi.org/10.2514/6.2018-1403).
- 2017 [Towards \$p\$ -adaptive spectral/ \$hp\$ element methods for modelling industrial flows](#)
D. Moxey, C. D. Cantwell, G. Mengaldo, D. Serson, D. Ekelschot et al.
Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2016, pp. 63–79.
DOI: [10.1007/978-3-319-65870-4_4](https://doi.org/10.1007/978-3-319-65870-4_4).
- [A framework for the generation of high-order curvilinear hybrid meshes for CFD simulations](#)
M. Turner, D. Moxey, J. Peiró, M. Gammon, C. R. Pollard and H. Bucklow.
Procedia Engineering. Vol. 203, pp. 206–218.
DOI: [10.1016/j.proeng.2017.09.808](https://doi.org/10.1016/j.proeng.2017.09.808).
- 2016 [The wing-tip vortex test case](#)
J.-E. Lombard, D. Moxey and S. J. Sherwin.
European Congress on Computational Methods in Applied Sciences and Engineering, Crete, Greece.
[Automatic generation of 3D unstructured high-order curvilinear meshes](#)
M. Turner, D. Moxey, S. J. Sherwin and J. Peiró.
Proceedings of the European Congress on Computational Methods in Applied Sciences and Engineering, pp. 428–433.
DOI: [10.7712/100016.1825.8410](https://doi.org/10.7712/100016.1825.8410).
- [A variational framework for high-order mesh generation](#)
M. Turner, J. Peiró and D. Moxey.
Procedia Engineering. Vol. 82, pp. 127–135.
DOI: [10.1016/j.proeng.2016.11.069](https://doi.org/10.1016/j.proeng.2016.11.069).
- 2015 [TemPSS: A service providing software parameter templates and profiles for scientific HPC](#)
J. Cohen, C. Cantwell, D. Moxey, J. Nowell, P. Austing et al.
IEEE eScience (Munich, Germany).
DOI: [10.1109/eScience.2015.43](https://doi.org/10.1109/eScience.2015.43).
- [Ensuring an effective user experience when managing and running scientific HPC software](#)
J. Cohen, D. Moxey, C. D. Cantwell, P. Austing, J. Darlington and S. J. Sherwin.
2015 IEEE/ACM 1st International Workshop on Software Engineering for High Performance Computing in Science (SE4HPCS), pp. 56–59.
DOI: [10.1109/SE4HPCS.2015.16](https://doi.org/10.1109/SE4HPCS.2015.16).
- [Automatic mesh sizing specification of complex three dimensional domains using an octree structure](#)
M. Turner, D. Moxey and J. Peiró.
24th International Meshing Roundtable.

- 2014 [A thermo-elastic analogy for high-order curvilinear meshing with control of mesh validity and quality](#)
D. Moxey, D. Ekelschot, U. Keskin, S. J. Sherwin and J. Peiró.
Procedia Engineering. Vol. 82, pp. 127–135.
DOI: [10.1016/j.proeng.2014.10.378](#).
- 2013 [Simplifying the Development, Use and Sustainability of HPC Software](#)
J. Cohen, C. D. Cantwell, N. P. Chue Hong, D. Moxey, M. Illingworth et al.
WSSPE13 Workshop, Supercomputing.
[Nekkloud: A software environment for high-order finite element analysis on clusters and clouds](#)
J. Cohen, D. Moxey, C. D. Cantwell, P. Burovskiy, J. Darlington and S. J. Sherwin.
2013 IEEE International Conference on Cluster Computing, pp. 1–5.
DOI: [10.1109/cluster.2013.6702616](#).
- 2012 [libHPC: Software sustainability and reuse through metadata preservation](#)
J. Cohen, J. Darlington, B. Fuchs, D. Moxey, C. D. Cantwell et al.
First Workshop on Maintainable Software Practices in e-Science, 8th IEEE International Conference on eScience.
- Dissertations**
- 2011 [Spatio-temporal dynamics in pipe flow](#)
D. Moxey
Ph.D. thesis. University of Warwick, Oct. 2011.
- 2007 [“Snakes on a plane”: An introduction to the study of polymer chains using Monte Carlo methods](#)
D. Moxey
Master’s thesis. University of Warwick, July 2007.

Teaching Experience

- ’08 – today **Lecturer, *Fundamental Tools*, University of Warwick**
Fundamental Tools is an intensive week-long course, designed to prepare students for the Financial Mathematics M.Sc. and test their mathematical ability. It covers topics in linear algebra, differential equations and basic statistics. My responsibilities include setting a course syllabus, providing lectures and comprehensive lecture notes, organising seminar sessions/problem sheets and setting and marking examinations.
- ’15 – today **Lecturer, *Introductory Mathematics*, Imperial College London**
This introductory mathematics course, taken by around 60 students, is part of two M.Sc. courses in the Department of Aeronautics, covering topics in vector calculus, linear algebra and basic real analysis. Responsibilities include setting lecture notes, delivering lectures to students and providing support.
- 2009 – 2011 **Lecturer, *Programming for Scientists*, University of Warwick**
This popular first-year undergraduate mathematics course of around 150 students introduces the basic concepts of mathematical and object-oriented programming using Java. My responsibilities included renewing the course syllabus to incorporate the latest Java techniques, rewriting lecture notes and programming lab sessions to adopt a more interactive lecturing style, as well as general course administration, setting assessments and marking the projects comprising the students’ final grades.
- 2008 – 2011 **Lecturer, *C++ for Financial Mathematics*, University of Warwick**
This course is taken by students enrolled on the Financial Mathematics M.Sc. and provides a comprehensive overview of C++ from basics to multiple inheritance and STL usage, culminating in a project where students implement a finite-difference numerical solver for the Black-Scholes equation.
- 2011 **Teaching Assistant, Imperial College London**
- 2008 – 2011 **Teaching Assistant, University of Warwick**
- 2006 – 2010 **Undergraduate Supervisor, University of Warwick**

Presentations & Conferences

Recent presentations

- 2018 Advances in high-order mesh generation
ICOSAHOM 2018, London, UK, July 2018.
- Developing methods for exascale CFD simulations at high orders
Platform for Advanced Scientific Computing Conference, Basel, Switzerland, July 2018.
- Organiser of the International Conference on Spectral and High-Order Methods (ICOSAHOM)
ICOSAHOM 2018, **Conference organiser**, London, UK, July 2018.
- [Towards automatic high-order mesh generation for industrial geometries](#)
ICOSAHOM 2018, **Minisymposium organiser**, London, UK, July 2018.
- [Recent developments in high-order mesh generation](#)
European Conference on Computational Fluid Dynamics, **Minisymposium organiser**, Glasgow,
UK, June 2018.
- Spectral/hp element modelling for high fidelity simulation
Culham Centre for Fusion Energy, Culham, United Kingdom, June 2018.
- 2017 [Targeting the spectral/hp element method for exascale platforms](#)
Platform for Advanced Scientific Computing Conference, Lugano, Switzerland, June 2017.
- [h-to-p efficiently: the use of collections with accelerators within Nektar++](#)
SIAM Computational Science & Engineering, Atlanta, GA, USA, Feb. 2017.

Referees

- **Prof. Spencer Sherwin**, *Professor of Computational Fluid Mechanics*. Department of Aeronautics, Imperial College London, London, SW7 2AZ, UK. s.sherwin@imperial.ac.uk.
- **Dr. Joaquim Peiró**, *Reader in Aerodynamics*. Department of Aeronautics, Imperial College London, London, SW7 2AZ, UK. j.peiro@imperial.ac.uk.
- **Prof. Dwight Barkley**, *Professor of Mathematics*. Mathematics Institute, University of Warwick, Coventry, CV4 7AL, UK. D.Barkley@warwick.ac.uk.