Matthew G. Knepley

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Education

Ph.D. Computer Science, Purdue University, 2000 (Advisor: Prof. Ahmed H. Sameh).

M.S. Computer Science, University of Minnesota, 1996.

B.S. Mathematical Physics, *summa cum laude*, Case Western Reserve University, 1994.

Professional Experience

Assistant Professor, Computational and Applied Mathematics, Rice Univ., 2015–*Present*

Assistant Professor by Courtesy, Computer Science, Rice Univ., 2017–*Present*

Training Faculty, Systems, Synthetic and Physical Biology Graduate Program, Rice Univ., 2017–*Present*

Director, Intel Parallel Computing Center, Rice Univ., 2016–*Present*

Senior Research Associate, Computation Institute, Univ. of Chicago, 2009–2015

Fellow, Computation Institute, Univ. of Chicago, 2008–2015

Vis. Asst. Professor, Molecular Biophysics and Physiology, Rush Univ. Medical Center, 2006–2014

Adj. Sen. Res. Fellow, School of Mathematical Sciences, Monash Univ., 2010–2013

Asst. Comp. Mathematician, Mathematics and Computer Science, Argonne Nat. Lab., 2005–2009

Postdoctoral Researcher, Mathematics and Computer Science, Argonne Nat. Lab., 2001–2004

Research Scientist, Distributed Data Collection, Akamai Technologies Inc., 2000–2001

Teaching

CAAM 520, Computational Science II (Spring 2016, Spring 2017)

CAAM 519, Computational Science I (Fall 2015, Fall 2016)

Numerical Analysis, with Prof. Ahmed H. Sameh, Purdue University (1999)

Guest Lecturer, AMCS 4302, *Parallel Scientific Computing*, Columbia University (2006)

2 Week Short Course on Scientific Computing

- Graduate University, Chinese Academy of Sciences, Beijing, China, (2010)
- Graduate University, Chinese Academy of Sciences, Beijing, China, (2009)

1 Week Crustal Deformation Modeling Tutorial

- NSF CIG CIG All Hands Conference (2016)
- NSF CIG Crustal Deformation Modeling Conference (2015)
- NSF CIG Crustal Deformation Modeling Conference (2013)
- NSF CIG Crustal Deformation Modeling Conference (2011)

1 Week PETSc Short Course

Maison de la Simulation, Orsay, France (2013)

EuropeAid *Scientific Computing Advanced Training*, Valparaiso, Chile (2007)

Idaho National Laboratory, Idaho Falls, ID (2005)

Parallel CFD 2004, Gran Canaria (2004)

1 Week GPU Computing Course

NSF Pan-American Advanced Studies Institute, *Scientific Computing in the Americas: the challenge of massive parallelism*, Valparaiso, Chile, (2011)

8 single day PETSc tutorials, and 9 half day tutorials

1 single day Python HPC tutorial

Graduate Students Advised

Andy Terrel (with Prof. L. Ridgway Scott), University of Chicago Ph.D. 2010,
Finite Element Method Automation for Non-Newtonian Fluid Models.

Peter Brune (with Prof. L. Ridgway Scott), University of Chicago Ph.D. 2011,
Fast Numerical Methods and Biological Problems.

Eric Buras, Rice University MS 2016,
A Multigrid Solver for Graph Laplacian Linear Systems on Power-Law Graphs

Jingchen Ye (with Prof. Maarten De Hoop), Rice University MS 2017

Tom Klotz, Rice University Phd 2019

Maurice Fabien (with Prof. Beatrice Rivere), Rice University Phd 2019

Hannah Morgan (with Prof. Ridgway Scott), University of Chicago Phd 2020

Jeremy Tillay, Rice University Phd 2021

Jonas Actor, Rice University Phd 2022

Logan Smith, Rice University Phd 2022

Summer Graduate Students Advised

Hannah Morgan (with Prof. Ridgway Scott), University of Chicago (2014)

Sean Laguna (with Prof. Ridgway Scott), University of Chicago (2014)

Peter Brune, ANL Givens Fellow (2009)

Samuel Daitch, ANL Givens Fellow (2007)

Emma Rainey, Krell Institute Computational Science Graduate Fellow (2005)

Richard Katz, Krell Institute Computational Science Graduate Fellow (2004)

Dmitry Leykekhman, ANL Givens Fellow (2003)

Nessy Tania, ANL Givens Fellow (2003)

Undergraduate Students Advised

David Clark, Plasma Dynamics, (2017 spring)

David Clark and Victor Gonzalez, Magma Dynamics, (2016 Fall)

Ian Alevy, Probablistic Performance Modeling, (2012 academic year)

Seth Davidovitz, Ion Channel Modeling, (2010 summer)

Thesis Committees

Xiaodi Deng, Phd, Computational and Applied Mathematics, Rice University 2018

Kirstie Haynie, Phd, Earth and Atmospheric Sciences, University of Houston 2018

Justin Chang, Phd, Civil Engineering, University of Houston 2018

John Gomez, MS, Applied Physics, Rice University 2017

Bryan Doyle, MS, Computational and Applied Mathematics, Rice University 2017

Caleb Magruder, Phd, Computational and Applied Mathematics, Rice University 2017

Arturo Vargas, Phd, Computational and Applied Mathematics, Rice University 2017

Chen Liu, MS, Computational and Applied Mathematics, Rice University 2016

Rujeko Chinomona, MS, Computational and Applied Mathematics, Rice University 2016

Frankie Camacho, MS, Computational and Applied Mathematics, Rice University 2016

Sri Raj Paul, MS, Computer Science, Rice University 2015

Hannah Morgan, MS, Computer Science, University of Chicago 2015

John Riehl, Phd, Computer Science, University of Chicago 2008

Grants Held

Subcontract, NSF *Computational Infrastructure for Geodynamics*, $585,000, 2016–2021

co-PI, NSF SI2-SSI: *Scalable Infrastructure for Enabling Multiscale and Multiphysics Applications in Fluid Dynamics, Solid Mechanics, and Fluid-Structure Interaction*, $262,655, 2015–2020

PI, Intel Parallel Computing Center, *Extending PETSc with Adaptive Mesh Refinement and Optimal Solvers, Applied to PFLOTRAN, and Optimized for Modern Intel Processors*, $400,000, 2015–2017

Co-PI, DOE Applied Math Research, *Extending PETSc's Composable Hierarchically Nested Linear Solvers*, $240,000, 2015–2018

Co-PI, NSF SI2-SSE: *SPIKE — An Implementation of a Recursive Divide-and-Conquer Parallel Strategy for Solving Large Systems of Linear Equations*, $117,710, 2012–2015

Co-PI, DOE Applied Math Research, *Extending PETSc's Composable Hierarchically Nested Linear Solvers*, $240,000, 2012–2015

Co-PI, DOE Math-CS Institute, *Nonlinear Algorithms to Circumvent the Memory Bandwidth Limitations of Implicit PDE Simulations*, $550,000, 2009–2014

Co-PI, NSF STCI, *Mechanical Transformation of Knowledge to Libraries*, $90,000, 2009–2011

Co-PI, DOE SciDAC ISIC, *Towards Optimal Petascale Simulations*, $1,200,000, 2001–2011

Subcontract, NSF *Computational Infrastructure for Geodynamics*, $650,000, 2010–2015

Subcontract, NSF *Computational Infrastructure for Geodynamics*, $650,000, 2005–2010

Subcontract, Army Research Office W911NF-09-1-0488, *Classical Density Functional Theory of Fluids: Ions at a Dielectric Interface*, $45,000, 2010–2012

Subcontract, DOE Reactor Core Modeling, $210,000, 2005–2007

Research Areas

Scalable linear and nonlinear solvers for multiphysics problems

Bioelectrostatics and molecular modeling for ion channels

Geophysical modeling in crustal deformation, mantle convection, and magma dynamics

Scientific library development and automated scientific computing

Libraries and code generation for high performance computing

Efficient solvers and preconditioners for GPUs and accelerators

Finite element and boundary element discretizations for nonlinear problems

Classical density functional theory, theory and numerics

Fast multipole methods and boundary element preconditioning

Research Achievements

Matthew Knepley has made substantial and innovative contributions to the scalable solution of PDE and BIE problems. Through PETSc, his work has been used to model complex phenomena in a wide array of science and engineering research, including bioelectrostatics and molecular modeling, climate science, geodynamics, both fission and fusion, nanosimulations, subsurface flow, oil-reservoir modeling and optimization, combustion, fracture mechanics, real-time surgery, and micromagnetics. He has produced lasting software artifacts which form a solid foundation for the development of leading scientific applications and industrial simulators. Both Cray and Microsoft distribute versions of PETSc tuned to their platforms, and several commercial simulation packages, including FIDAP 8.5, TigerCAD, and RF3P, use PETSc for their algebraic solvers. PETSc has been used by Boeing and CFD Research for computational fluid dynamics simulations, by Shell for solving inverse problems for oil reservoir management, and by the South Florida Water Management District modeling the Everglades. He has published over 40 journal and proceedings articles, ranging from Molecular Based Mathematical Biology to the Journal of Geophysical Research to Journal of Chemical Physics to Transactions on Mathematical Software. His work has received over 3600 citations according to Google Scholar with an H-index of 17.

Four of his most noteworthy contributions are highlighted here. **1** Development of a scalable preconditioning strategy for the cohesive element formulation of Ortiz. This block, multilevel preconditioner was used in PyLith to solve quasi-static crustal deformation problems with complex fault rheologies on large parallel machines. It is generally applicable to the saddle-point problems arising from this discretization. **2** Development, with Jaydeep Bardhan, of a theory for approximation of the boundary integral operators describing molecular electrostatics which is used to precondition the high-fidelity system, but also to provide extremely efficient low-fidelity solutions for use in optimization and design iterations. This strategy has recently been employed to model protein-ligand binding, and favorably compared with experimental results. **3** Creation of the first 3D classical density functional theory simulation for ion channels using a new scalable, efficient algorithm for hard sphere interaction and electrostatic correlations. The electrostatic formulation of Gillespie allowed for much more accurate determination of channel fields than the standard bulk theory, but all previous implementations scaled as $\mathcal{O}(N^3)$. We developed a comprehensive $\mathcal{O}(N \log N)$, with Peter Brune, for the entire simulation, and applied the code to ryanodine receptor transport. **4** Development of the unstructured mesh component of PETSc. This reformulation allows physics routines to be formulated independently of the mesh dimension and cell shape, so that simulator code is written once, but multiple meshes even of different dimension may be compared dynamically. This component has been used in bioelectrostatic calculations, in PyLith for crustal deformation,and in magma dynamics, fracture mechanics, crop modeling, and airfoil simulation.

Academic Awards and Honors

SIAM/ACM Prize in Computational Science and Engineering (as part of PETSc team) (2015)

Keynote Address, GPU-SMP GPU Solutions to Multiscale Problems, Shenzhen, China (2012)

Keynote Address, GPU-SMP GPU Solutions to Multiscale Problems, Lanzhou, China (2011)

Lindbergh Lecture, Department of Mechanical Engineering, UW Madison, (2011)

R&D 100 Award as part of the PETSc team (2009)

J. T. Oden Faculty Research Fellow, ICES, UT Austin (2008)

Tuition scholarship, Case Western Reserve University (1990–1994)

Elected to Upsilon Pi Epsilon (2000)

Elected to Golden Key (1994)

Elected to Phi Beta Kappa (1994)

Elected to Sigma Xi (1993)

Academic Service

Chair, Rice CAAM Faculty Search Committee (2016–2017 AY)

Organizer, CDM 2017, Golden, CO (June 2017)

Program Committee, IPDPS, Orlando, FL (June 2017)

Program Committee, HPC, Virginia Beach, VA (April 2017)

Program Committee, NSF SI2 PI Meeting, Arlington, VA (February 2017)

Program Chair, PETSc 2016, Vienna, Austria, http://www.mcs.anl.gov/petsc/meetings/2016 (June 2016)

Program Committee, Scientific Software Days, Austin, TX, http://scisoftdays.org (Feb 2016)

Chair, Rice CAAM Data Science Search Committee (2016–2017 AY)

Rice CAAM Graduate Committee (2015–2017 AY)

Rice CAAM Faculty Search Committee (2015–2016 AY)

Program Committee, PETSc 20, Chicago, IL, http://www.mcs.anl.gov/petsc/petsc-20.html (June 2015)

Associate Editor, Cogent Geoscience, Taylor & Francis

Member Executive Committee, NSF Computational Infrastructure for Geodynamics, (2011–2014)

Chair, Computational Science Working Group, NSF Computational Infrastructure for Geodynamics, (2013–*Present*)

Guest Researcher, Center for Biomedical Computing, Simula Research, Oslo Norway (2007, 2008, 2010, 2011)

Guest Researcher, Széchenyi István University, Györ, Hungary (2010, 2011, 2012)

Advisory Computational Scientist, CIG (2004–*Present*)

Technical Papers Committee for Supercomputing 2014

Technical Papers Committee for Supercomputing 2013

Program Committee, PMAA 14, Lugano, Switerland, http://pmaa14.ics.usi.ch (July 2014)

Program Committee, CIG Implementing Solvers in CitcomCU and CitcomS Workshop (September 2013)

Program Committee, GPU-SMP Conference, Changchun, China, http://gpu-smp2013.csp.escience.cn/dct/page/1 (June 2013)

Program Committee, ICERM Workshop, Brown University, http://icerm.brown.edu/tw12-1-exascale (January 2012)

Program Committee, GPU-SMP Conference, Shenzhen, China, http://gpu-smp2012.csp.escience.cn/dct/page/1 (June 2012)

Program Committee, NSF Pan-American Advanced Studies Institute, *Scientific Computing in the Americas: the challenge of massive parallelism*, Valparaiso, Chile, (2011)

Program Committee, HPC^3 Workshop, KAUST, https://sites.google.com/site/hpc3atkaust/ (February 2011)

Program Committee, FEniCS Workshop, University of Chicago (March 2005)

Reviewer, Physics of Earth and Planetary Interiors

Reviewer, ACM Transactions on Mathematical Software

Reviewer, Journal of Scientific Computing

Reviewer, Journal of Chemical Physics

Reviewer, Journal of Computational Physics

Reviewer, Computer Methods in Applied Mechanics and Engineering

Reviewer, International Journal on Numerical Methods in Engineering

Reviewer, International Journal on Computational Science and Engineering

Reviewer, Concurrency: Theory and Practice

Reviewer, Parallel Computing

Reviewer, Operations Research

Reviewer, AMS Mathematics of Computation

Reviewer, SIAM Journal on Scientific Computing

Reviewer, IEEE Transaction on Parallel and Distributed Systems

Reviewer, IEEE International Parallel & Distributed Processing Symposium (IPDPS)

Reviewer, Springer-Verlag

Reviewer, Department of Energy

Reviewer, National Science Foundation

Reviewer, Alfred P. Sloan Foundation

Reviewer, Newton Institute, Cambridge University

Reviewer, Louisiana Board of Regents

Software Toolkits

Developer of the Portable, Extensible, Toolkit for Scientific Computation (PETSc) for PDE simulation

700+ scientific publications have used PETSc, including combustion, brain surgery, subsurface flow, fusion, and cardiology. See http://www.mcs.anl.gov/petsc/petsc-as/publications

30+ community scientific simulators are built on PETSc, ranging from micromagnetics to geosciences

300,000 processes have been used efficiently on the IBM BG/P

500 billion unknowns used in the simulation of neutron transport

3+ teraflops realized on groundwater reactive flow using PFLOTRAN

Used at all DOE laboratories and Supercomputing Centers, Boeing, Shell, GM

Designer and developer of the parallel unstructured grid component

Co-Creator of PyLith code for large, parallel seismic and post-seismic simulation

30+ scientific publications have used PyLith

Capable of simulating both dynamic and quasi-static problems in parallel

Can use both simplicial and tensor elements in 1D, 2D, and 3D

Fully documented and supported, http://geodynamics.org/cig/software/pylith/pylith_manual-1.6.2.pdf

Journal Articles

[1] Amneet Pal Singh Bhalla, Boyce E. Griffith, Matthew G. Knepley, Mark F. Adams, and Robert D. Guy. Scalable smoothing strategies for a geometric multigrid method for the immersed boundary equations. *Advances in Computational Mathematics*, 2017. submitted.

[2] Amirhossein Molavi Tabrizi, Spencer Goossens, Ali Mehdizadeh Rahimi, Matthew G. Knepley, and Jaydeep P. Bardhan. Predicting solvation free energies and thermodynamics in polar solvents and mixtures using a solvation-layer interface condition. *Journal of Chemical Physics*, 146(9):094103, 2017. PMCID: PMC5336475.

[3] Amirhossein Molavi Tabrizi, Spencer Goossens, Christopher D. Cooper, Matthew G. Knepley, and Jaydeep P. Bardhan. Extending the solvation-layer interface condition (SLIC) continuum electrostatic model to linearized poissonâĂŞboltzmann solvent. *Journal of Chemical Theory and Computation*, 2017.

[4] Tobin Isaac and Matthew G. Knepley. Support for non-conformal meshes in PETSc's DMPlex interface. *ACM Transaction on Mathematical Software*, 2017. In review.

[5] Matthew G. Knepley, Michael Lange, and Gerard J. Gorman. Unstructured overlapping mesh distribution in parallel. *ACM Transactions on Mathematical Software*, 2017. submitted.

[6] Amirhossein Molavi Tabrizi, Matthew G. Knepley, and Jaydeep P. Bardhan. Generalising the mean spherical approximation as a multiscale, nonlinear boundary condition at the solute-solvent interface. *Molecular Physics*, 114(16-17):2558–2567, 2016.

[7] Mark F. Adams, Jed Brown, Matthew G. Knepley, and Ravi Samtaney. Segmental refinement: A multigrid technique for data locality. *SIAM Journal on Scientific Computing*, 8(4):C426–C440, 2016.

[8] Hannah Morgan, Matthew G. Knepley, Patrick Sanan, and L. Ridgway Scott. A stochastic performance model for pipelined Krylov methods. *Concurrency and Computation: Practice and Experience*, 28:4532–4542, 2016.

[9] Michael Lange, Lawrence Mitchell, Matthew G. Knepley, and Gerard J. Gorman. Efficient mesh management in Firedrake using PETSc-DMPlex. *SIAM Journal on Scientific Computing*, 38(5):S143–S155, 2016.

[10] Peter R. Brune, Matthew G. Knepley, Barry F. Smith, and Xuemin Tu. Composing scalable nonlinear algebraic solvers. *SIAM Review*, 57(4):535–565, 2015. http://www.mcs.anl.gov/papers/P2010-0112.pdf.

[11] Jaydeep P. Bardhan, Matthew G. Knepley, and Peter R. Brune. Analytical nonlocal electrostatics using eigenfunction expansions of boundary-integral operators. *Molecular Based Mathematical Biology*, 3(1):1–22, 2015. http://dx.doi.org/10.1515/mlbmb-2015-0001.

[12] Jaydeep P. Bardhan and Matthew G. Knepley. Modeling charge-sign asymmetric solvation free energies with nonlinear boundary conditions. *Journal of Chemical Physics*, 141(13):131103, 2014. http://dx.doi.org/10.1063/1.4897324.

[13] Brad T. Aagaard, Matthew G. Knepley, and Charles A. Williams. A domain decomposition approach to implementing fault slip in finite-element models of quasi-static and dynamic crustal deformation. *Journal of Geophysical Research: Solid Earth*, 118(6):3059–3079, 2013. http://dx.doi.org/10.1002/jgrb.50217.

[14] Amy Kreienkamp, Lucy Y. Liu, Mona S. Minkara, Matthew G. Knepley, Jaydeep P. Bardhan, and Mala L. Radhakrishnan. Analysis of fast boundary-integral approximations for modeling electrostatic contributions of molecular binding. *Molecular Based Mathematical Biology*, 1:124–150, June 2013. http://www.degruyter.com/view/j/mlbmb.2012.1.issue/mlbmb-2013-0007/mlbmb-2013-0007.xml.

[15] Peter R. Brune, Matthew G. Knepley, and L. Ridgway Scott. Unstructured geometric multigrid in two and three dimensions on complex and graded meshes. *SIAM Journal on Scientific Computing*, 35(1):A173–A191, 2013. http://arxiv.org/abs/1104.0261.

[16] Liang Zheng, Taras Gerya, Matthew G. Knepley, David A. Yuen, Huai Zhang, and Yaolin Shi. Implementation of a multigrid solver on GPU for Stokes equations with strongly variable viscosity based on Matlab and CUDA. *IJHPCA*, 28(1):50–60, 2013. http://hpc.sagepub.com/content/early/2013/03/03/1094342013478640.abstract.

[17] Matthew G. Knepley and Andy R. Terrel. Finite element integration on GPUs. *ACM Transactions on Mathematical Software*, 39(2), 2013. no. 10, http://arxiv.org/abs/1103.0066.

[18] Jaydeep P. Bardhan and Matthew G. Knepley. Computational science and re-discovery: open-source implementations of ellipsoidal harmonics for problems in potential theory. *Computational Science & Discovery*, 5:014006, 2012. http://arxiv.org/abs/1204.0267.

[19] David I. Ketcheson, Kyle T. Mandli, Aron J. Ahmadia, Amal Alghamdi, Manuel Quezada de Luna, Matteo Parsani, Matthew G. Knepley, and Matthew Emmett. PyClaw: Accessible, extensible, scalable tools for wave propagation problems. *SIAM Journal on Scientific Computing*, 34(4):C210–C231, 2012. http://arxiv.org/abs/1111.6583.

[20] Jaydeep P. Bardhan and Matthew G. Knepley. Mathematical analysis of the BIBEE approximation for molecular solvation: Exact results for spherical inclusions. *Journal of Chemical Physics*, 135(12):124107–124117, 2011. http://arxiv.org/abs/1109.0651.

[21] Dave A. May and Matthew G. Knepley. Optimal, scalable forward models for computing gravity anomalies. *Geophysical Journal International*, 187(1):161–177, 2011. http://arxiv.org/abs/1107.5951.

[22] Rio Yokota, Jaydeep P. Bardhan, Matthew G. Knepley, L.A. Barba, and Tsuyoshi Hamada. Biomolecular electrostatics using a fast multipole BEM on up to 512 GPUs and a billion unknowns. *Computer Physics Communications*, 182(6):1272–1283, 2011. http://arxiv.org/abs/1007.4591.

[23] Felipe A Cruz, Matthew G Knepley, and L A Barba. PetFMM – a dynamically load-balancing parallel fast multipole library. *International Journal of Numerical Methods in Engineering*, 85(4):403–428, 2010. http://arxiv.org/abs/0905.2637.

[24] Rio Yokota, L A Barba, and Matthew G Knepley. PetRBF – a parallel O(N) algorithm for radial basis function interpolation. *Computer Methods in Applied Mechanics and Engineering*, 199(25-28):1793–1804, 2010. http://arxiv.org/abs/0909.5413v1.

[25] Matthew G. Knepley, Dmitry A. Karpeev, Seth Davidovits, Robert S. Eisenberg, and Dirk Gillespie. An efficient algorithm for classical density functional theory in three dimensions: Ionic solutions. *Journal of Physical Chemistry*, 132(12):124101–124111, 2010.

[26] V. Stodden, M. G. Knepley, C. Wiggins, R. J. LeVeque, D. Donoho, S. Fomel, M. P. Friedlander, M. Gerstein, I. Mitchell, L. L. Ouellette, N. W. Bramble, P. O. Brown, V. Carey, L. DeNardis, R. Gentleman, D. Gezelter, J, A. Goodman, J. E. Moore, F. A. Pasquale, J. Rolnick, M. Seringhaus, and R. Subramanian. Reproducible Research: addressing the need for data and code sharing in computational science. *Computing in Science and Engineering*, 12(5):8–13, 2010.

[27] Matthew G. Knepley and Dmitry A. Karpeev. Mesh algorithms for PDE with Sieve I: Mesh distribution. *Scientific Programming*, 17(3):215–230, 2009. http://arxiv.org/abs/0908.4427.

[28] Jaydeep P. Bardhan, Matthew G. Knepley, and Mihai Anitescu. Bounding the electrostatic free energies associated with linear continuum models of molecular solvation. *Journal of Chemical Physics*, 130(10):104108, 2008. Selected for the March 15, 2009 issue of Virtual Journal of Biological Physics Research, http://dx.doi.org/10.1063/1.3081148.

[29] Andy R. Terrel, L. Ridgway Scott, Matthew G. Knepley, and Robert C. Kirby. Automated FEM discretizations for the Stokes equation. *BIT*, 48(2), 2008.

[30] Richard F. Katz, Matthew G. Knepley, Barry Smith, Marc Spiegelman, and Ethan Coon. Numerical simulation of geodynamic processes with the Portable Extensible Toolkit for Scientific Computation. *Phys. Earth Planet. In.*, 163:52–68, 2007.

[31] Robert C. Kirby, Matthew G. Knepley, Anders Logg, and L. Ridgway Scott. Optimizing the evaluation of finite element matrices. *SIAM Journal on Scientific Computing*, 27(3):741–758, 2005.

[32] Minimax Collaboration. Search for disoriented chiral condensate at the Fermilab Tevatron. *Physical Review D*, 61(3), 2000.

[33] Minimax Collaboration. Analysis of charged particle/photon correlations in hadronic multiparticle production. *Physical Review D*, 55(9), 1997.

[34] Mary E. Convery, W. L. Davis, Ken W. Del Signore, Tom L. Jenkins, Erik Kangas, Matthew G. Knepley, Ken L. Kowalski, Cyrus C. Taylor, C. H. Wang, S. H. Oh, W. D. Walker, P. L. Colestock, B. Hanna, M. Martens, J. Streets, R. C. Ball, H. R. Gustafson, L. W. Jones, M. J. Longo, J. D. Bjorken, N. Morgan, and C. A. Pruneau. Minimax: What has been learned thus far. *Nuovo Cimento*, 19(1):1045–1049, 1996.

[35] Robert W. Brown, Mary Convery, Scott Hotes, Matthew G. Knepley, and Labros Petropolous. Closed strings with low harmonics and kinks. *Physical Review D*, 48(6), 1993.

Peer-Reviewed Conference Papers

[1] Nicolas Barral, Matthew G. Knepley, Michael Lange, Matthew D. Piggott, and Gerard J. Gorman. Anisotropic mesh adaptation in Firedrake with PETSc DMPlex, September 2016.

[2] Dave A. May, Patrick Sanan, Karl Rupp, Matthew G. Knepley, and Barry F. Smith. Extreme-scale multigrid components within PETSc. In *Proceedings of the Platform for Advanced Scientific Computing Conference*, PASC '16, pages 5:1–5:12, New York, NY, USA, 2016. ACM.

[3] Jaydeep P. Bardhan and Matthew G. Knepley. Multiscale models and approximation algorithms for protein electrostatics. In *Boundary Elements and Other Mesh Reduction Methods XXXVIII*, volume 61, pages 163–174. WIT Press, 2015.

[4] Matthew G. Knepley and Jaydeep P. Bardhan. Work/precision tradeoffs in continuum models of biomolecular electrostatics. In *Proceedings of ASME 2015 International Mechanical Engineering Congress & Exposition*, volume 9, page V009T12A04, 2015.

[5] Michael Lange, Matthew G. Knepley, and Gerard J. Gorman. Flexible, scalable mesh and data management using PETSc DMPlex. In *Proceedings of the Exascale Applications and Software Conference*, April 2015.

[6] Jaydeep P. Bardhan, D. A. Tejani, N. S. Wieckowski, A. Ramaswamy, and Matthew G. Knepley. A nonlinear boundary condition for continuum models of biomolecular electrostatics. In *Proceedings of PIERS*, pages 1215–1221, July 2015.

[7] Jed Brown, Matthew G. Knepley, and Barry Smith. Run-time extensibility and librarization of simulation software. *IEEE Computing in Science and Engineering*, 17(1):38–45, Jan 2015.

[8] Victor Minden, Barry F. Smith, and Matthew G. Knepley. Preliminary implementation of PETSc using GPUs. In David A. Yuen, Long Wang, Xuebin Chi, Lennart Johnsson, Wei Ge, and Yaolin Shi, editors, *GPU Solutions to Multi-scale Problems in Science and Engineering*, Lecture Notes in Earth System Sciences, pages 131–140. Springer Berlin Heidelberg, 2013.

[9] Dmitry A. Karpeev, Matthew G. Knepley, and Peter R. Brune. Accurate evaluation of local averages on GPGPUs. In David A. Yuen, Long Wang, Xuebin Chi, Lennart Johnsson, Wei Ge, and Yaolin Shi, editors, *GPU Solutions to Multi-scale Problems in Science and Engineering*, Lecture Notes in Earth System Sciences, pages 487–501. Springer Berlin Heidelberg, 2013.

[10] Mark F. Adams, Jed Brown, and Matthew G. Knepley. Low-communication techniques for extreme-scale multilevel solvers. In *Exascale Mathematics Workshop, Aug 21–22, Washington, DC*. DOE Office of Advanced Scientific Computing Research, 2013.

[11] Liang Zheng, Taras Gerya, Matthew G. Knepley, David A. Yuen, Huai Zhang, and Yaolin Shi. GPU implementation of multigrid solver for Stokes equation with strongly variable viscosity. In David A. Yuen, Long Wang, Xuebin Chi, Lennart Johnsson, Wei Ge, and Yaolin Shi, editors, *GPU Solutions to Multi-scale Problems in Science and Engineering*, Lecture Notes in Earth System Sciences, pages 321–333. Springer Berlin Heidelberg, 2013.

[12] Matthew G. Knepley and David A. Yuen. Why scientists and engineers need GPUs today. In David A. Yuen, Long Wang, Xuebin Chi, Lennart Johnsson, Wei Ge, and Yaolin Shi, editors, *GPU Solutions to Multi-scale Problems in Science and Engineering*, Lecture Notes in Earth System Sciences, pages 131–140. Springer Berlin Heidelberg, 2013.

[13] J. Brown, M. G. Knepley, D. A. May, L. C. McInnes, and B. F. Smith. Composable linear solvers for multiphysics. In *Proceeedings of the 11th International Symposium on Parallel and Distributed Computing (ISPDC 2012)*, pages 55–62. IEEE Computer Society, 2012.

[14] Amal Alghamdi, Aron Ahmadia, David I. Ketcheson, Matthew G. Knepley, Kyle T. Mandli, and Lisandro Dalcin. PetClaw: A scalable parallel nonlinear wave propagation solver for Python. In *Proceedings of SpringSim 2011*. ACM, 2011.

[15] Blaise Bourdin, Matthew G. Knepley, and C. Maurini. Numerical simulation of reservoir stimulation - a variational approach. In *Proceedings of the 37th Stanford Geothermal Workshop*, Stanford, CA, 2010. http://www.geothermal-energy.org/pdf/IGAstandard/SGW/2011/bourdin.pdf.

[16] Blaise Bourdin, Matthew G. Knepley, and C. Maurini. Secondary thermal cracks in EGS: a variational approach. In *Proceedings of the 34th Annual Meeting of the Geothermal Resources Council*, Sacramento, CA, 2010. https://www.math.lsu.edu/~bourdin/Biography_assets/Bourdin-Knepley-Maurini-2010.pdf.

[17] Felipe A. Cruz, Lorena A. Barba, and Matthew G. Knepley. Fast multipole method for particle interactions: an open source parallel library component. In Tromeur-Dervout et. al., editor, *Proceedings of ParCFD2008*. Elsevier, 2008.

[18] Charles A. Williams, Carl Gable, Bradford H. Hager, Brendan Meade, Brad Aagaard, and Matthew G. Knepley. Modeling of multiple earthquake cycles in southern california using the SCEC community fault model. In *Proceedings of Geosciences '08*, Wellington, NZ, November 2008.

[19] Matthew G. Knepley, Vivek Sarin, and Ahmed H. Sameh. Multilevel preconditioning for parallel CFD. In *International Conference On Preconditioning Techniques For Large Sparse Matrix Problems In Industrial Applications*, Minneapolis, MN, June 1999.

[20] Matthew Knepley, Ahmed H. Sameh, and Vivek Sarin. Design of large scale parallel simulations. In *Proceedings of Parallel CFD'99*. Elsevier, 1999.

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[23] Matthew Knepley, Ahmed H. Sameh, and Vivek Sarin. Parallel simulation of particulate flows. In *Solving Irregularly Structured Problems in Parallel*, volume 1457 of *Lecture Notes in Computer Science*, pages 226–237, 1998.

Book Chapters

[1] Satish Balay, Jed Brown, Matthew G. Knepley, Lois McInnes, and Barry Smith. *Software Engineering for Science*, chapter Providing Mixed Language and Legacy Support within a Library. Taylor & Francis, 2015.

[2] Shijie Zhong, David A. Yuen, Louis N. Moresi, and Matthew G. Knepley. Numerical methods for mantle convection. In Gerald Schubert, editor, *Treatise on Geophysics*, volume 7. Elsevier, second edition edition, 2015.

[3] Matthew G. Knepley. Programming languages for scientific computing. In Björn Engquist, editor, *Encyclopedia of Applied and Computational Mathematics*. Springer, 2012. http://arxiv.org/abs/1209.1711.

[4] Andy R. Terrel, Robert C. Kirby, Matthew G. Knepley, L. Ridgway Scott, and Garth N. Wells. Finite elements for incompressible fluids. In *Automated solutions of differential equations by the finite element method*, volume 84 of *Lecture Notes in Computational Science and Engineering*, pages 163–169. Springer-Verlag, 2012.

[5] Robert C. Kirby, Matthew G. Knepley, Anders Logg, L. Ridgway Scott, and Andy R. Terrel. Discrete optimization of finite element matrix evaluation. In *Automated solutions of differential equations by the finite element method*, volume 84 of *Lecture Notes in Computational Science and Engineering*, pages 385–397. Springer-Verlag, 2012.

[6] Matthew G. Knepley, Richard F. Katz, and Barry Smith. Developing a geodynamics simulator with PETSc. In Are Magnus Bruaset and Aslak Tveito, editors, *Numerical Solution of Partial Differential Equations on Parallel Computers*, volume 51 of *Lecture Notes in Computational Science and Engineering*, pages 413–438. Springer Berlin Heidelberg, 2006. 10.1007/3-540-31619-1_12.

Other Conference Papers and Technical Reports

[1] Matthew G. Knepley, Jed Brown, Lois Curfman McInnes, Barry Smith, Karl Rupp, and Mark Adams. Exascale computing without threads. 2015. Whitepaper for the DOE High Performance Computing Operational Review (HPCOR) on Scientific Software Architecture for Portability and Performance.

[2] Matthew G. Knepley, Jed Brown, Lois Curfman McInnes, Barry Smith, Karl Rupp, and Mark Adams. Overview of the PETSc library. 2015. Whitepaper for the DOE High Performance Computing Operational Review (HPCOR) on Scientific Software Architecture for Portability and Performance.

[3] Karl Rupp, Satish Balay, Jed Brown, Matthew G. Knepley, Lois Curfman McInnes, and Barry F. Smith. On the evolution of user support topics in computational science and engineering software. *ArXiv e-prints*, 2015. Whitepaper for Computational Science & Engineering Software Sustainability and Productivity Challenges.

[4] Barry Smith, Lois Curfman McInnes, Emil Constantinescu, Mark Adams, Satish Balay, Jed Brown, Matthew Knepley, and Hong Zhang. PETSc's software strategy for the design space of composable extreme-scale solvers. Preprint ANL/MCS-P2059-0312, Argonne National Laboratory, 2012. DOE Exascale Research Conference, April 16-18, 2012, Portland, OR.

[5] Peter R. Brune, Matthew G. Knepley, Barry F. Smith, and Xuemin Tu. Composing scalable nonlinear algebraic solvers. Preprint ANL/MCS-P2010-0112, Argonne National Laboratory, 2013.

[6] L. Ridgway Scott, Jed Brown, George W. Bergantz, Dan Cooley, Clint Dawson, Maarten de Hoop, Donald Estep, Natasha Flyer, Efi Foufoula-Georgiou, Michael Ghil, Matthew G. Knepley, Randall J. LeVeque, Lek-Heng Lim, Serge Prudhomme, Adrian Sandu, Frederik J. Simons, Philip B. Stark, Michael Stein, Seth Stein, Toshiro Tanimoto, Daniel Tartakovsky, Jonathan Weare, Robert Weiss, Grady B. Wright, and Dave Yuen. Fostering interactions between the geosciences and mathematics, statistics, and computer science. Technical Report 2012-02, University of Chicago, 2012.

[7] Peter R. Brune, Matthew G. Knepley, and L. Ridgway Scott. Exponential grids in high-dimensional space. Technical Report TR-2011-07, University of Chicago, December 2011. http://www.cs.uchicago.edu/research/publications/techreports/TR-2011-07.

[8] David I. Ketcheson, Aron Ahmadia, and Matthew G. Knepley. Conference review: High performance computing and hybrid programming concepts for hyperbolic pde codes. *SIAM News*, 44(7), September 2011. http://www.siam.org/pdf/news/1912.pdf.

[9] Liang Zheng, Taras Gerya, Matthew G. Knepley, David A. Yuen, Huai Zhang, and Yaolin Shi. Implementation of a multigrid solver on GPU for Stokes equations with strongly variable viscosity based on Matlab and CUDA. Research Report UMSI 2011/33, University of Minnesota Supercomputing Institute, March 2011. http://static.msi.umn.edu/rreports/2011/33.pdf.

[10] Satish Balay, Shrirang Abhyankar, Mark F. Adams, Jed Brown, Peter Brune, Kris Buschelman, Lisandro Dalcin, Victor Eijkhout, William D. Gropp, Dinesh Kaushik, Matthew G. Knepley, Lois Curfman McInnes, Karl Rupp, Barry F. Smith, Stefano Zampini, Hong Zhang, and Hong Zhang. PETSc users manual. Technical Report ANL-95/11 - Revision 3.7, Argonne National Laboratory, 2016.

[11] Charles A. Williams, Brad Aagaard, and Matthew G. Knepley. PyLith: A finite-element code for modeling quasi-static and dynamic crustal deformation. In *Eos Transactions of the AGU*. American Geophysical Union, 2011. Fall Meeting Supplemental, Abstract DI14A-08.

[12] Liang Zheng, Taras Gerya, David A. Yuen, Matthew G. Knepley, Huai Zhang, and Yaolin Shi. GPU implementation of Stokes equation with strongly variable coefficients. In *Eos Transactions of the AGU*. American Geophysical Union, 2010. Fall Meeting Supplemental, Abstract IN41A-1350.

[13] Robert C. Kirby, Matthew G. Knepley, and L. Ridgway Scott. Languages and compilers for variational forms. Technical Report TR-2010-09, University of Chicago, October 2010. http://www.cs.uchicago.edu/research/publications/techreports/TR-2010-09.

[14] Robert C. Kirby, Matthew G. Knepley, and L. Ridgway Scott. Evaluation of the action of finite element operators. Technical Report TR-2010-08, University of Chicago, October 2010. http://www.cs.uchicago.edu/research/publications/techreports/TR-2010-08.

[15] M. G. Knepley, D. A. Karpeev, R. S. Eisenberg, and D. Gillespie. Energetics of Calcium Selectivity: A Three-Dimensional Classical Density Functional Theory Approach. *Biophysical Journal*, 96:661, feb 2009.

[16] Dave A. May, Matthew G. Knepley, and Michael Gurnis. CitcomSX: Robust preconditioning in CitcomS via PETSc. In *Eos Transactions of the AGU*. American Geophysical Union, 2009. Fall Meeting Supplemental, Abstract P31A-A1241.

[17] David A. Yuen, Matthew G. Knepley, Gordon Erlebacher, and Grady B. Wright. The coming role of GPU in computational geodynamics. In *Eos Transactions of the AGU*. American Geophysical Union, 2009. Fall Meeting Supplemental, Abstract DI22A-05.

[18] Brad Aagaard, Charles A. Williams, and Matthew G. Knepley. PyLith: A finite-element code for modeling quasi-static and dynamic crustal deformation. In *Eos Transactions of the AGU*, volume 89. American Geophysical Union, 2007. Fall Meeting Supplemental, Abstract T41A-1925.

[19] Charles A. Williams, Brad Aagaard, and Matthew G. Knepley. PyLith: A finite-element code for modeling quasi-static and dynamic crustal deformation. In *Eos Transactions of the AGU*, volume 88. American Geophysical Union, 2007. Fall Meeting Supplemental, Abstract T21B-1798.

[20] C. Zhang, M. G. Knepley, D. A. Yuen, and Y. Shi. Two new approaches in solving the nonlinear shallow water equations for tsunamis. Preprint ANL/MCS-P1459-0907, ANL, September 2007.

[21] Matthew G. Knepley and Dmitry A. Karpeev. Mesh algorithms for PDE with Sieve I: Mesh distribution. Technical Report ANL/MCS-P1455-0907, Argonne National Laboratory, February 2007. ftp://info.mcs.anl.gov/pub/tech_reports/reports/P1455.pdf.

[22] Charles A. Williams, Brad Aagaard, and Matthew G. Knepley. Development of software for studying earthquakes across multiple spatial and temporal scales by coupling quasi-static and dynamic simulations. In *Eos Transactions of the AGU*, volume 86. American Geophysical Union, 2005. Fall Meeting Supplemental, Abstract S53A-1072.

[23] Matthew G. Knepley and Dmitry A. Karpeev. Flexible representation of computational meshes. Technical Report ANL/MCS-P1295-1005, Argonne National Laboratory, October 2005. ftp://info.mcs.anl.gov/pub/tech_reports/reports/P1295.pdf.

[24] Robert C. Kirby, Matthew G. Knepley, and L. Ridgway Scott. Optimal evaluation of finite element matrices. Technical Report TR-2004-04, University of Chicago, May 2004. http://www.cs.uchicago.edu/research/publications/techreports/TR-2004-04.

[25] Andrew Cleary and Matthew G. Knepley. Solvers as operators. Technical Report UCRL-ID-135342, Lawrence Livermore National Laboratory, 1999.

Presentations

Tutorial Presentations

PETSc Tutorial, CEMRACS, CIRM, Luminy, France, July 2016

PyLith Tutorial, CIG All-Hands Meeting, UC Davis, CA, June 2016

PETSc Tutorial, Rice Oil & Gas HPC, Houston, TX, March 2016

SC 14 PyHPC Tutorial, New Orleans, LA, November 2014

PETSc Tutorial, Imperial College, London, March 2014

PETSc Tutorial, Minnesota Supercomputing Institute, University of Minnesota, Minneapolis MN, September 2013

Crustal Deformation Modeling Tutorial Week, June 2013

Advanced PETSc Tutorial, Maison de la Simulation, Orsay, France June 2013

PETSc Tutorial, ACTS Workshop, University of California, Berkeley, August 2012

PETSc Tutorial, ICES, University of Texas at Austin, September 2011

PETSc Tutorial, UW Madison, April 2011

NSF PASI Institute, Scientific Computing in the Americas, Valparaíso, Chile, January 2011

Széchenyi István University, Györ, Hungary, October 2010

ACTS Toolkit Workshop, LBL, Berkeley, CA, August 2010

Short Course on Sci. Comp., Graduate Univ., Chinese Academy of Sciences, Beijing, China, July 2010

PETSc Tutorial, T.J. Watson Research Center, NY, October 2009

Short Course on Sci. Comp., Graduate Univ., Chinese Academy of Sciences, Beijing, China, July 2009

PETSc Tutorial, TACC, Austin, TX, May 2009

Short Course on Foundations of Finite Element Computing, Simula Research, Oslo, Norway, August 2008

PETSc Tutorial, TACC, Austin, TX, August 2008

ACTS Toolkit Workshop, LBL, Berkeley, CA, August 2007

PETSc short course, Parallel CFD 07, Antalya, Turkey, May 2007

Summer school, SCAT 2007, UTFSM, Valparaiso, Chile, January 2007

PETSc Tutorial, AMCS 4302, Columbia University, New York, NY, October 2006

ACTS Toolkit Workshop, LBL, Berkeley, CA, August 2006

PETSc Tutorial, SIAM PP, San Francisco, CA, February 2006

ACTS Toolkit Workshop, LBL, Berkeley, CA, August 2005

Parallel Computing Workshop, University of Houston, Houston, TX, April 2005

Week long PETSc short course, INL, Idaho Falls, ID, March 2005

PETSc Tutorial, DD16, Courant Institute, New York, NY, January 2005

ACTS Toolkit Workshop, LBL, Berkeley, CA, August 2004

Week long PETSc short course, Parallel CFD 2004, Gran Canaria, May 2004

Invited Presentations

Keynote Address, Computational and Data-Enabled Science and Engineering Days, Univ. of Buffalo, Buffalo NY, April 2017

ICL Earth Sciences Seminar, London UK, March 2017

SIAM CS&E, Minisymposterium, Atlanta GA, March 2017

Rice Laboratory for Space and Astrophysical Plasmas Seminar, Houston TX, October 2016

ICL Earth Sciences Seminar, London UK, October 2016

UNC Mathematics Seminar, Chapel Hill NC, September 2016

MIT AeroAstro Seminar, Boston MA, May 2016

SIAM PP, Paris, FR Apr 2016

Ken Kennedy Institute Seminar, Houston, TX Mar 2016

Melt in the Mantle 2016, Cambridge UK Feb 2016

SPPEXA 2016, Munich DE Jan 2016

ASME IMECE 2015, Houston TX Nov 2015

Composing Nonlinear Solvers, ICERM, Providence RI Sept 2015

ME & IE Seminar, Northeastern University, Boston, MA Mar 2015

SIAM CS&E, Salt Lake City, UT Mar 2015

CAAM Seminar, Rice University, Houston, TX Feb 2015

Numerical Analysis Seminar, Texas A&M University, College Station, TX Jan 2015

Numerical Analysis Seminar, Texas A&M University, College Station, TX Dec 2014

High Performance Python Libraries, Keynote for PyHPC Workshop, SC 14, New Orleans, LA Nov 2014

Nonlinear Preconditioning in PETSc, ICERM, Providence RI July 2014

Scalable Nonlinear Solvers for Geophysical Problems, SIAM Annual Meeting, Chicago IL July 2014

Nonlinear Preconditioning in PETSc, PMAA 14, Lugano CH July 2014

PETSc Solvers for Crustal Deformation, Stanford University, Palo Alto CA June 2014

Composble Solvers in PETSc, CACDS Seminar, University of Houston, Houston TX June 2014

Nonlinear Preconditioning in PETSc, Oxford University, Oxford UK March 2014

Nonlinear Preconditioning in PETSc, Imperial College, London UK March 2014

Runtime Configurability in PETSc, SIAM PP, Portland OR February 2014

Algorithms for Exascale Computational Mesoscience, ExaMath13 Workshop, Wash. D.C. August 2013

Finite Element Integration using CUDA and OpenCL, GPU-SMP 13, Changchun, China July 2013

The Process of Computational Science, Maison de la Simulation, Orsay, France June 2013

Nested and Hierarchical Solvers in PETSc, SIAM CS&E, Boston, February 2013

APAM Colloquium, Columbia University, New York February 2013

Mathematics Colloquium, Széchenyi István University, Győr, Hungary November 2012

School of Mathematical Sciences Colloquium, Monash University, VIC Australia October 2012

Bridging the Gap Between the Geosciences and Mathematics, Statistics, and Computer Science, Princeton, NJ October 2012

ACTS Workshop, Berkeley, CA August 2012

SIAM Annual Meeting, Minneapolis, MN July 2012

CIG Crustal Deformation Modeling workshop, Golden, CO June 2012

Keynote Address, GPU-SMP GPU Solutions to Multiscale Problems, Shenzhen, China June 2012
Specialized Topics Workshop, Center for Biomedical Computing, Simula Reseach, Norway, August 2011
Keynote Address, GPU-SMP GPU Solutions to Multiscale Problems, Lanzhou, China July 2011
Conference on Simulation and Optimization, Győr, Hungary, June 2011
Lindbergh Lecture, Department of Mechanical Engineering, UW Madison, April 2011
HPC^3 Workshop, KAUST, March 2011
Advanced Algorithms on GPUs, SIAM CS&E, Reno, March 2011
IMA Workshop on High Performance Computing and Emerging Architectures, January 2011
NSF PASI Institute, Valparaiso, Chile, January 2011
AGU: Large-Scale Geosciences Applications using GPU and Multicore Architectures, December 2010
Conference in Honor of Prof. Ahmed Sameh, Purdue University, October 2010
Plenary, Parallel and Accelerated Computing, Széchenyi István University, Györ, Hungary, October 2010
39th SPEEDUP Workshop on High Performance Computing, ETH Zurich, September 2010
Geophysical Fluid Dynamics Seminar, Department of Earth Sciences, ETH Zurich, September 2010
Automated and Distributed Computing Seminar, Simula Res. Lab., Oslo Norway, August 2010
Int. Workshop of GPU Solutions to Multiscale Problems in Sci. and Eng., Harbin China, July 2010
ESCO 2nd European Seminar on Coupled Problems, Pilsen Czech Republic, July 2010
KAUST Applied Math & Computer Science Seminar, Saudi Arabia, March 2010
Tufts Mathematics Department Seminar, Medford, MA, February 2010
AGU Fall Meeting, San Francisco, CA, December 2009
Sharing Data and Code in Computational Science, New Haven, CT, November 2009
NSF-NAIS Intelligent Software Workshop, Edinburgh, Scotland, October 2009
Department of Mathematics Colloquim, LSU, Baton Rouge, September 2009
International Workshop on Geodynamical Phenomena, Suzdal, Russia, August 2009
HPC Group, SSC, Shanghai, July 2009
International Workshop on Modern Computational Geoscience Frontiers, GUCAS, Beijing, July 2009
Path to Petascale (GPU Meeting), UIUC, IL, March 2009
SIAM CS&E, Miami, FL, March 2009
ICES Seminar, Austin, TX, August 2008
SIAM Annual Meeting, San Diego, CA, July 2008
Advancing Num. Mod. of Mantle Convection and Lithospheric Dynamics, UC Davis, CA, July 2008
Num. Mod. of Crustal Deformation and Earthquake Faulting, Colordao School of Mines, CO, June 2008
Sandia CSRI Workshop on Next-Generation Scalable Applications, Albuquerque, NM, June 2008
Workshop on Automating the Development of Sci. Comp. Software, LSU, Baton Rouge, LA, March 2008
AuScope Inaugural Conference, Monash University, Victoria, Australia, February 2008
Role of Symbolic, Numeric and Algebraic Comp. in CDI, NSF, Washington D.C., October 2007

Adaptive Mesh Refinement Workshop, UC Boulder, Boulder, CO, October 2007
Seminar, University of Duisberg-Essen, Essen, Germany, October 2007
Special Semester on Biological Computing, University of Linz, Linz, Austria, October 2007
VLAB Seminar, University of Minnesota, Minneapolis, MN, August 2007
Biomedical Flows Workshop, Simula Research, Oslo, Norway, June 2007
Seminar, Supercomputing Institute, University of Minnesota, Minneapolis, MN, December 2006
Seminar, Simula Research, Oslo, Norway, November 2006
FEniCS 06, TU Delft, Delft, Netherlands, November 2006
Multiphysics Simulation, INL, Idaho Falls, ID, September 2006
Magma Dynamics Workshop, Columbia University, New York, NY, August 2006
SIAM Annual Meeting, Boston, MA, July 2006
Fault Systems Workshop, Colorado School of Mines, Golden, CO, June 2006
Compressible Convection Workshop, Purdue University, West Lafayette, IN, March 2006
CIG Science Steering Committee Meeting, Pasadena, CA, November 2005
FEniCS 05, TTI, Chicago, IL, October 2005
CIG Meeting, Monash University, Melbourne, Australia, October 2005
Seminar, Indiana University, Bloomington, IN, September 2005
Short-Term Crustal Dynamics Workshop, LANL, Los Alamos, NM, July 2005
Mantle Convection Workshop, UC Boulder, Boulder, CO, June 2005
CIG Executive Committee Meeting, Berkeley, CA, May 2005
Parallel Computing Workshop, University of Houston, Houston, TX, April 2005
CIG Meeting, Caltech, Pasadena, CA, March 2005
SIAM CS&E, Orlando, FL, February 2005
MCS Seminar, ANL, Lemont, IL, October 2004
CIG Meeting, Monash University, Melbourne, Australia, October 2004
CRI Seminar, Purdue University, West Lafayette, IN, October 2004
Domain Specific Languages for PDE Constrained Optimization, ANL, Lemont, IL, August 2004
Seminar, CMU, Pittsburgh, PA, July 2004
Climate Simulation Colloquium, University of Chicago, Chicago, IL, June 2004
Parallel CFD 2004, Gran Canaria, May 2004
Lecture, Columbia University, New York, NY, February 2004
CIG Kickoff Meeting, LAX, Los Angeles, CA, January 2004
CRI Seminar, Purdue University, West Lafayette, IN, February 2003
Seminar, LBL, Berkeley, CA, August 1999
Parallel CFD, Williamsburg, VA, May 1999
Seminar, Lucent, Murray Hill, NJ, May 1999

SIAM Workshop on OO Meth. for InterOp. Sci. & Eng. Comp., IBM T.J. Watson, NY October 1998

Conference on Capability Computing, NCSA, Urbana-Champaign, IL, September 1998

Solving Irregularly Structured Problems in Parallel, LBL, Berkeley, CA August 1998

Seminar, CERFACS, Toulouse, France, June, 1996

Contributed Presentations

Biophysical Society Annual Meeting, Boston, MA, March 2009

Parallel CFD 08, Lyon, France, May 2008

SIAM PP, Atlanta, GA, March 2008

USNCCM 10, San Francsico, CA, July 2007

Workshop on Scientific Computing, UT Austin, Austin, TX, October 2006

SIAM PP, San Francisco, CA, February 2006

SciPy 2005, Caltech, Pasadena, CA, September 2005

USNCCM 8, Austin, TX, July 2005

SciPy 2004, Caltech, Pasadena, CA, September 2004

Parallel CFD, Gran Canaria, Spain, May 2004

SIAM PP, San Francisco, CA, February 2004

Geoframeworks Workshop, Caltech, Pasadena, CA, October 2003

SciPy 2003, Caltech, Pasadena, CA, September 2003

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