Last updated: 07/03/2019

Tim Warburton

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Research Interests

Discontinuous Galerkin Methods:, I work with numerous collaborators to develop practical numerical methods for time-dependent electromagnetics, acoustics, computational seismology, and fluid dynamics. I am particularly interested in developing efficient and robust methods with local time-stepping, artificial viscosity for shock capturing, preconditioning, and convergent adaptive schemes. I co-authored a textbook on these methods..

High Performance Computing:, I worked with David Medina to develop an Open Concurrent Computing Abstraction (OCCA) that allows compute kernels to be cross compiled to OpenCL, CUDA, and OpenMP. I also worked with Jesse Chan to exploit Bernstein-Bezier basis functions to reduce the computational complexity of DG methods. I developed performance models for DG methods on GPUs. My research team collaborates with teams at Argonne and Livermore National Labs to develop next generation, exascale ready simulation tools..

Complete Radiation Boundary Conditions:, I collaborated with Thomas Hagstrom in the development of a new family of high-order boundary conditions for time-dependent, predominantly hyperbolic partial differential equations. The Complete Radiation Boundary Conditions are more transparent to both plane waves and evanescent fields than previous absorbing boundary conditions.

Applications:, I collaborated with the Shell Computational and Modeling group to develop a world class seismic inversion simulation platform based on the GPU accelerated discontinuous Galerkin methods that my research team developed. I also worked with researchers at the MD Anderson Cancer Center to develop a prototype therapy modeling tool for the Magnetic Resonance Guided Laser Instertitial Thermal Therapy (MRgLITT) that can provide predictive capabilities.

Academic Positions

2015– **Professor of Mathematics**, *Virginia Tech.*
2015– **Faculty affiliate in Computational Modeling and Data Analytics**, *Virginia Tech.*
2015–2018 **Adjunct Professor of Computational and Applied Math**, *Rice University.*
2014–2015 **Professor of Computational and Applied Math**, *Rice University.*
2008–2014 **Associate Professor of Computational and Applied Math**, *Rice University.*
2004–2008 **Assistant Professor of Computational and Applied Math**, *Rice University.*
2001–2004 **Assistant Professor of Mathematics**, *University of New Mexico.*
1999–2001 **Visiting Research Associate in Applied Mathematics**, *Brown University.*
1998–1999 **Research Officer in Computing**, *Oxford University.*
1996–1997 **Teaching Assistant in Applied Mathematics**, *Brown University.*
1993–1998 **Research Assistant in Applied Mathematics**, *Brown University.*

Education

1994–1999 **Ph.D. in Applied Mathematics**, *Brown University*, Providence, RI.
1993–1994 **Sc.M. in Applied Mathematics**, *Brown University*, Providence, RI.
1990–1993 **B.A. & M.A. in Mathematics**, *University of Oxford*, Oxford, UK.

Awards

2015– **John K. Costain Faculty Chair**, *College of Science*, Virginia Tech.
2011 **Michael Pearlman Memorial Award**, *Rice University.*
1991 **Scholar**, *Hertford College*, Oxford University.
1990 **Victoria Scholarship**, *Lancaster Royal Grammar School.*

Extended Research Visits & Consulting Positions

2013 **Visiting Researcher**, *Shell Technology Center*, Houston.

2009–2011 **Consultant**, *Hypercomp Inc.*.

2001–2010 **Consultant**, *Division of Applied Mathematics*, Brown University.

2000 **Summer visitor**, *ICASE*, NASA Langley Research Center..

Current Funded Projects

2017-2018 **Center for Efficient Exascale Discretizations: accelerating finite elements with the Open Concurrent Compute Abstraction**, *VT PI: Tim Warburton*, sponsor: CEED center at Lawrence Livermore National Lab funded through the DOE Exascale Computing Project led by Misun Min, Paul Fischer & Tzanio Kolev, (web).

2016-2017 **Combining Big Compute & Big Data Technologies with the ICTAS Nanoscale Imaging Capabilities for Undergraduate Research**, *PI: Cheng Chen, co-PI: Tim Warburton*, sponsor: Institute for Critical Technology and Applied Science (ICTAS) Research Experiences for Undergraduates (REU) Grant.

Completed Funded Projects

2016-2017 **Discontinuous Galerkin Methods for Full Waveform Inversion**, *PI: Tim Warburton*, Sponsor: industrial project.

2012–2016 **Collaborative Research: Adaptive Hybridization DG Methods for Acoustic and Electromagnetic Scattering**, *PI: Tim Warburton. Joint project with Ronald Hoppe (University of Houston) and Peter Monk (University of Delaware)*, sponsor: NSF DMS-1216674, (web).

2014–2016 **NPS-NRL-Rice-UIUC Collaboration on Navy Atmosphere-Ocean Coupled Models on Many-Core Computer Architectures**, *PI: Lucas Wilcox (Naval Postgraduate School), Rice/VT PI: Tim Warburton*, sponsor: ONR N00014-13-1-0873, (web), (related slides).

2015-2016 **Hybrid Mesh Discontinuous Galerkin Methods for Seismic Imaging**, *PI: Tim Warburton*, Sponsor: industrial project.

2015-2016 **Discontinuous Galerkin Methods with Sub-element Scale Heterogeneity for Seismic Imaging**, *PI: Tim Warburton*, sponsor: industrial project.

2011–2015 **CESAR: Co-Design for Exascale in Nuclear Engineering for Small Modular Reactors**, *Rice/VT PI: Tim Warburton*, sponsor: sub-contract to Argonne National Laboratory, (web).

2012–2015 **Computational Geophysics**, *PI: Tim Warburton*, sponsor: industrial project.

2013–2014 **AIR Option 1: Technology Translation - A Portable Treatment Planning System for MR-Guided Thermal Therapy**, *Rice PI: T. Warburton*, Sponsor: sub-contract to University of Texas, M.D. Anderson Cancer Center under grant NSF-IIP 1312048, (web).

2013 **Optimization of Lattice Boltzmann Simulations on Multi-core CPU and Many-core GPU Processors**, *Rice PI: Vivek Sarkar, co-PI: Tim Warburton*, sponsor: Halliburton Corp.

2012 **Donation**, *Sponsor: equipment and funds from AMD.*

2010 **Fast, High-Order algorithms for Many-Core and GPU-based Computer Architectures**, *Sponsor: sub-contract to MathSys AFOSR STTR.*

2008–2012 **Collaborative Research: Tuning-Free Adaptive Multilevel Discontinuous Galerkin Methods for Maxwell's Equations**, *PI: Tim Warburton. Joint project with Ronald Hoppe (University of Houston) and Guido Kanschat (Texas A&M)*, sponsor: NSF DMS-0810187, (web).

2005-2008 **Compatible and Nearly Compatible Finite Element Discretizations: Algorithms, Analysis and Applications**, *PI: Tim Warburton*, sponsor: NSF DMS-Computational Mathematics DMS-0512673, (web).

2005-2007 **Towards High Resolution Numerical Algorithms for Wave Dominated Physical Phenomena**, *PI: Tim Warburton*, sponsor: AFOSR.

2003-2007 **Collaborative Research ITR: An Integrated Simulation Environment for High-Resolution Computational Methods in Electromagnetics with Biomedical Applications**, *PI: Tim Warburton, CO-PI's, Thomas Hagstrom (UNM), Moysey Brio (U. Arizona), Anne Gelb (Arizona State), Jan Hesthaven (Brown U.), Henry Tufo (U. Colorado at Boulder)*, sponsor: NSF CNS-0514002, (web).

2003-2006 **Adaptive, High-Resolution Simulation Methods for Wave Propagation in Heterogenous Media**, *PI: Thomas Hagstrom, CO-PI: Tim Warburton*, Sponsor: Army Research Office.

2002-2004 **High-Order Finite Element Methods for Solution of Partial Differential Equations**, *PI: Tim Warburton*, sponsor: Sandia University Research Program.

Publications: (scholar.google summary and arXiv summary)

Book

2008 J.S. Hesthaven and T. Warburton, Nodal Discontinuous Galerkin Methods: Algorithms, Analysis, and Applications, Volume 54, Springer Texts in Applied Mathematics, Springer Verlag, New York, (web)

2011 Chinese edition of book: 交点间断Galerkin方法:算法、分析和应用 , translated by Jichun Li and Tao Tang, Science Press, Beijing (available at amazon.cn).

Book Chapters

2013 Andreas Klöckner, Timothy Warburton and Jan S Hesthaven, High-Order Discontinuous Galerkin Methods by GPU Metaprogramming, GPU Solutions to Multi-scale Problems in Science and Engineering, Series: Springer Lecture Notes in Earth System Sciences 2013, pp 353-374, (web), (arXiv.org).

2011 A. Klöckner, T. Warburton and J.S. Hesthaven, *Solving Wave Equations on Unstructured Geometries*, GPU Computing Gems Jade Edition, Editor Wen-mei Hwu, Morgan Kaufmann Publishers, August 2011, (web), (arXiv.org).

Journal Articles in Progress

2018 Paul Fischer, Thilina Rathnayake, Som Dutta, Veselin Dobrev, Tzanio Kolev, Martin Kronbichler, Tim Warburton, Jed Brown, and Misun Min, *Running Faster in HPC Applications*.

Articles in Press

2019 Ali Karakus, Noel Chalmers, Kasia Swirydowicz, Timothy Warburton, *GPU Acceleration of a High-Order Discontinuous Galerkin Incompressible Flow Solver*, submitted (arXiv.org).

Arturo Vargas, Thomas Hagstrom, Jesse Chan, T. Warburton, *A Hermite-leapfrog method for wave propagation*, (arXiv.org).

Published Journal Articles

2019 A. Karakus, N. Chalmers, J.S. Hesthaven, and T. Warburton, *Discontinuous Galerkin Discretizations of the Boltzmann Equations in 2D: semi-analytic time stepping and absorbing boundary layers*, Journal of Computational Physics, published online: (web), (arXiv.org).

Kasia Swirydowicz, Noel Chalmers, Ali Karakus, and T. Warburton, *Acceleration of tensor-product operations for high-order finite element methods*, The International Journal of High Performance Computing Applications, (web), (arXiv.org).

2018 Noel Chalmers and T. Warburton, *Low-Order Preconditioning of High-Order Triangular Finite Elements*, SIAM Journal on Scientific Computing, Volume 40, Issue 6, Pages A4040-A4059, (web).

Niklas Wintermeyer, Andrew R. Winters, Gregor J. Gassner, Timothy Warburton, *An entropy stable discontinuous Galerkin method for the shallow water equations on curvilinear meshes with wet/dry fronts accelerated by GPUs*, Journal of Computational Physics, Volume 375, Pages 447-480, (web), (arXiv.org).

A. Karakus, T. Warburton, M.H. Aksel and C. Sert, *An adaptive fully discontinuous Galerkin level set method for incompressible multiphase flows*, International Journal of Numerical Methods for Heat and Fluid Flow, Vol. 28 Issue: 6, pp. 1256-1278, (web).

2017 Jesse Chan, Russell J. Hewett, and T. Warburton, *Weight-adjusted discontinuous Galerkin methods: wave propagation in heterogeneous media*, SIAM Journal on Scientific Computing Volume 39, Issue 6, pp. A293–A2961,(web),(arXiv.org).

Daniel S. Abdi, Francis X. Giraldo, Emil M. Constantinescu, Lester E. Carr III, Lucas C. Wilcox, Timothy Warburton, *Acceleration of the Implicit-Explicit Non-hydrostatic Unified Model of the Atmosphere (NUMA) on Manycore Processors*, International Journal of High Performance Computing, (web).

Jesse Chan, Russell J. Hewett, and T. Warburton, *Weight-adjusted discontinuous Galerkin methods: curvilinear meshes*, SIAM Journal on Scientific Computing Volume 39 (6), A2395-A2421, (web), (arXiv.org).

Jesse Chan, T. Warburton, *On the penalty stabilization mechanism for first order discontinuous Galerkin formulations*, Computers & Mathematics with Applications, Volume 74, Issue 12, pp. 3099–3110, (web), (arXiv.org).

Axel Modave, Andreas Atle, Jesse Chan, Tim Warburton, *High-order absorbing boundary conditions with corner/edge compatibility for GPU-accelerated discontinuous Galerkin wave simulations*, International Journal for Numerical Methods in Engineering, Volume 112, Issue 11, pp. 1659-1686, (web), (arXiv.org).

Arturo Vargas, Jesse Chan, Thomas Hagstrom, Tim Warburton, *Variations on Hermite methods for wave propagation*, Communications in Computational Physics, Volume 22, Number 2, pp. 303–337, (web), (arXiv.org).

Jesse Chan and T. Warburton, *GPU-Accelerated Bernstein-Bezier Discontinuous Galerkin Methods for Wave Problems*,SIAM Journal on Scientific Computing, Volume 39, Issue 2, pp. A628–A654, (web), (arXiv.org).

Jesse Chan, Russell J. Hewett, Zheng Wang, and T. Warburton, *Reduced storage nodal discontinuous Galerkin methods on semi-structured prismatic meshes*, Computers and Mathematics with Applications, Volume 73, pp. 775–793, (web), (arXiv.org).

D.S. Abdi, L. Wilcox, T. Warburton, F.X. Giraldo, *A GPU-accelerated continuous and discontinuous Galerkin non-hydrostatic atmospheric model*, International Journal for High-Performance Computing Applications, (web). Francis Giraldo's website for the OCCA accelerated NUMA code: (web).

2016 Jean-Francois Remacle, Rajesh Gandham, Timothy Warburton, *GPU accelerated spectral finite elements on all-hex meshes*, Journal of Computational Physics, Volume 324, pp. 246–257, (web), (arXiv.org).

A. Karakus, T. Warburton, M.H. Aksel, and C. Sert, *A GPU accelerated level set reinitialization for an adaptive discontinuous Galerkin method*, Computers & Mathematics with Applications, Volume 72, Issue 3, August 2016, Pages 755-767, (web).

Jesse Chan and T. Warburton *A short note on a Bernstein-Bezier basis for the pyramid*, SIAM Journal of Scientific Computing, Volume 38, Issue 4, pp. A2162-A2172, (web), (arXiv.org).

Jesse Chan, Zheng Wang, Axel Modave, Jean-Francois Remacle, and T. Warburton, *GPU-accelerated discontinuous Galerkin methods on hybrid meshes*, Journal of Computational Physics, Volume 318, Pages 142-168, (web), (arXiv.org), (slides).

Jesse Chan and T. Warburton, *Orthogonal Bases For Vertex-mapped Pyramids*, SIAM Journal of Scientific Computing, Volume 38, Issue 2, pp. A1146-A1170, (web), (arXiv.org), related SIAM CS&E talk by Jesse Chan: (web).

A. Karakus, T. Warburton, M.H. Aksel and C. Sert, *A GPU Accelerated Adaptive Discontinuous Galerkin Method for Level Set Equation*, International Journal of Computational Fluid Dynamics, Volume 30, Issue 1, pp. 56-68, (web).

Florian Kummer and T. Warburton, *Patch-recovery filters for curvature in discontinuous Galerkin-based level-set methods*, Communications in Computational Physics, Volume 19, Issue 2, pp. 329-353 (web), (arXiv.org).

Cheng Chen, Zheng Wang, Deepak Majeti, Nick Vrvilo, Timothy Warburton, Vivek Sarkar, and Gang Li, *Optimization of Lattice Boltzmann Simulation by GPU Parallel Computing and the Application in Reservoir Characterization*, Society of Petroleum Engineers Journal, Volume 21, Issue 4, pp. 1425âĂŞ1435. SPE-179733-PA, (web).

A. Modave, A. St-Cyr, T. Warburton, *GPU performance analysis of a nodal discontinuous Galerkin method for acoustic and elastic models*, Computers & Geosciences, Volume 91, pp. 64-76, (web), (arXiv.org).

2015 Axel Modave, Amik St-Cyr, Wim A. Mulder, Tim Warburton, *A nodal discontinuous Galerkin method for reverse-time migration on GPU clusters*, Geophysical Journal International, Volume 203, Issue 2, pp. 1419-1435, (web), (arXiv.org).

S. Fahrenholtz, T. Moon, M. Franco, D. Medina, J. D. Hazle, R. J. Stafford, F. Maier, S. Danish, A. Gowda, A. Shetty, T. Warburton, and D. Fuentes, *A Model Evaluation Study for Treatment Planning of Laser Induced Thermal Therapy*, International Journal of Hyperthermia, Volume 31, Issue 7, (web), (related slides)

Jesse Chan and T. Warburton, *A Comparison of High-Order Lagrange Interpolation Nodes for the Pyramid*, SIAM Journal on Scientific Computing, Volume 37, Issue 5, pp. A2151-2170, 2015, (web), (arXiv.org).

R. Gandham, D.S. Medina and T. Warburton, *GPU Accelerated Discontinuous Galerkin Methods for Shallow Water Equations*, Communications in Computational Physics, Volume 18, Issue 1, pp. 37-64, (web), (arXiv.org).

Shelvean Kapita, Peter Monk, and Timothy Warburton, *Residual based adaptivity and PWDG methods for the Helmholtz equation*, SIAM Journal on Scientific Computing, Volume 37 Issue 3, pp. A1525-A1553, (web), (arXiv.org).

Jesse Chan and T. Warburton, hp-*finite element trace inequalities for the pyramid*, Computers and Mathematics with Applications, Volume 69, Issue 6, pp. 510-517, (web).

2013 T. Warburton, *A Low Storage Curvilinear Discontinuous Galerkin Method for Wave Problems*, SIAM Journal on Scientific Computing, Volume 35, Number 4, pp. A1987-A2012, (web).

2011 A. Klöckner, T. Warburton, J.S. Hesthaven, *Viscous Shock Capturing in a Time-Explicit Discontinuous Galerkin Method*, Mathematical Modelling of Natural Phenomena, Volume 6, Issue 3, pp. 57-83, (web), (arXiv.org).

C. Carstensen, R.H.W. Hoppe , N. Sharma, and T. Warburton, *Adaptive Hybridized Discontinuous Galerkin Interior Penalty Methods for H(curl)-elliptic problem*, Numerical Mathematics: Theory, Methods and Applications, Volume 4, pp. 13-27, (web).

2010 Nico Gödel, Steffen Schomann, Tim Warburton, and Markus Clemens, *GPU Accelerated Adams-Bashforth Multirate Discontinuous Galerkin Simulation of High Frequency Electromagnetic Fields*, IEEE Transactions on Magnetics, Volume 46, No. 8, pp. 2735-2738, (web).

S. Schomann, N. Gödel, T. Warburton, and M. Clemens, *Local Time-stepping Techniques Using Taylor Expansion for Modeling Wave Propagation with Discontinuous Galerkin FEM*, IEEE Transactions on Magnetics, Volume 46, No. 8, pp. 3504-3507, (web).

N. Gödel, N. Nunn, T. Warburton, and M. Clemens, *Accelerating Multi GPU Based Discontinuous Galerkin FEM Computations for Electromagnetic Radio Frequency Problems*, Applied Computational Electromagnetic Society Journal, Volume 25, No. 4, pp. 331-338.

N. Gödel, N. Nunn, T. Warburton, and M. Clemens, *Scalability of Higher-Order Discontinuous Galerkin FEM Computations for Solving Electromagnetic Wave Propagation Problems on GPU Clusters*, IEEE Transactions on Magnetics, Volume 46, Number 8, (web).

Thomas Hagstrom, Timothy Warburton, and Dan Givoli, *Radiation Boundary Conditions for Time-dependent Waves Based on Complete Plane Wave Expansions*, Journal of Computational and Applied Mathematics, Volume 234, Issue 6, pp. 1988-1995,(web).

2009 A. Klöckner, T. Warburton, J. Bridge, and J.S.Hesthaven, *Nodal Discontinuous Galerkin Methods on Graphics Processors*, Journal of Computational Physics, Volume 228, Issue 21, pp. 7863-7882, (web), (arXiv.org).

T. Hagstrom and T. Warburton, *Complete Radiation Boundary Conditions: minimizing the long time error growth of local methods*, SIAM Journal on Numerical Analysis, Volume 47, Issue 5, pp. 3678-3704, (web).

Annalisa Buffa, Ilaria Perugia, and Tim Warburton, *The mortar-discontinuous Galerkin method for the 2D Maxwell eigenproblem*, Journal of Scientific Computing, Volume 40, pp. 86-114, (web).

T. Binford, D.P. Nicholls, N. Nigam, and T. Warburton, *Exact Non-Reflecting Boundary Conditions on General Domains and hp-Finite Elements*. Journal of Scientific Computing, Volume 39, Number 2, pp. 265-292, (web).

2008 R.H.W. Hoppe, G. Kanschat, and T. Warburton, *Convergence Analysis of an Adaptive Interior Penalty Discontinuous Galerkin Method*. SIAM Journal on Numerical Analysis, Volume 47, Issue 1, pp. 534-550, (web).

T. Warburton and T. Hagstrom, *Taming the CFL Number for Discontinuous Galerkin Methods on Structured Meshes*, SIAM Journal on Numerical Analysis, Volume 46, Issue 6, pp. 3151-3180, (web).

Allan P. Engsig-Karup, Jan S. Hesthaven, Harry B. Bingham, and T. Warburton, *DG-FEM Solution for Nonlinear Wave-structure Interaction Using Boussinesq-type Equations*, Coastal Engineering, Volume 55, Issue 3, pp. 197-208, (web).

2007 F.X. Giraldo and T. Warburton, *A high-order Triangular Discontinuous Galerkin Oceanic Shallow Water Model*, International Journal of Numerical Methods in Fluids, Volume 56 Issue 7, pp. 899-925, (web).

Hayder Salman, Jan Hesthaven, Tim Warburton, and George Haller, *Predicting transport by Lagrangian coherent structures with a high-order method*, Theoretical and Computational Fluid Dynamics, Vol. 21, No. 1, pp. 39-58, (web).

2006 T. Warburton, *An Explicit Construction for Interpolation Nodes on the Simplex*, Journal of Engineering Mathematics, Volume 56, Number 3, pp. 247-262, (web).

T. Warburton and M. Embree, *On the Role of the Penalty in the Local Discontinuous Galerkin Method for Maxwell's Eigenvalue Problem*, Computer Methods Applied Mechanical Engineering, Vol 195, Issues 25-28, pp. 3205-3223, (web).

2005 F.X. Giraldo and T. Warburton, *A Nodal Triangle-based Spectral Element Method for the Shallow Water Equations on The Sphere*, Journal of Computational Physics, Vol 207, Issue 1, pp. 129-150, (web).

2004 J.S. Hesthaven and T. Warburton, *Discontinuous Galerkin Methods for the Time-Domain Maxwell's Equations*, Applied Computational Electromagnetics Society Newsletter, Vol. 19, No. 1.

Thomas Hagstrom and Tim Warburton, *A New Auxiliary Variable Formulation of High-Order Local Radiation Boundary Conditions: Corner Compatibility Conditions and Extensions to First Order Systems*, Wave Motion, Vol. 39, 327-338, (web).

J.S. Hesthaven and T. Warburton, *High-Order Nodal Discontinuous Galerkin Methods for the Maxwell's Eigenvalue Problem*, Phil. Trans. R. Soc. Lond. A, Vol 362, pp.493-524, (web).

J.S. Hesthaven and T. Warburton, *High-Order Accurate Methods for Time Domain Electromagnetics*, Computer Modeling Engineering Science, 5(5), 395-408, (web).

2003 T. Warburton and J.S. Hesthaven, *On the Constants in hp-Finite Element Trace Inverse Inequalities*, Computer Methods Applied Mechanical Engineering, Vol. 192, No. 25, pp. 2765-2774, (web).

2002 P. Dutta, T.C. Warburton and A. Beskok, *Electroosmotic Flow Control in Complex Micro-Geometries*, Journal of Microelectromechanical Systems, 11:36-44, (web).

P. Dutta, T.C. Warburton and A. Beskok, *Numerical Simulation of Mixed Electroosmotic/Pressure Driven Flows in Complex Micro-Geometries*, Journal of Numerical Heat Transfer, Vol 41, 2:131-148.

J.S. Hesthaven and T. Warburton, *Nodal High-Order Methods on Unstructured Grids, I. Time-Domain Solution of Maxwell's Equations*, Journal of Computational Physics, Vol. 181, No. 1, pp. 186-221, (web).

F.X. Giraldo, J.S. Hesthaven, and T. Warburton, *Nodal High-Order Discontinuous Galerkin Method for the Spherical Shallow Water Equations*, Journal of Computational Physics, Vol. 181, No. 2, pp. 499-525, (web).

2001 A. Beskok and T.C. Warburton, *An Unstructured hp Finite Element Scheme for Fluid Flow and Heat Transfer in Moving Domains*, Journal of Computational Physics, Vol. 174, 2:492-509, (web).

A. Beskok and T.C. Warburton, *Arbitrary Lagrangian Eulerian Analysis of a Bidirectional Micro-Pump Using Spectral Elements*, International Journal of Computational Engineering Science, Volume 2, (web).

2000 T. Warburton, L. Pavarino and J.S. Hesthaven, *A Pseudo-Spectral Scheme for the Incompressible Navier-Stokes Equations Using Unstructured Nodal Elements*, Journal of Computational Physics, 164:1-21, (web).

L.F. Pavarino and T. Warburton, *Overlapping Schwarz Methods for Unstructured Spectral Elements*, Journal of Computational Physics, 160:298-317, (web).

1999 R.M. Kirby, T.C. Warburton, I. Lomtev, and G.E. Karniadakis, *A Discontinuous Galerkin Spectral/hp Method on Hybrid Grids*, Journal of Applied Numerical Mathematics, 33:393-405, (web).

T. Warburton and G. Karniadakis, *A Discontinuous Galerkin Method for the Viscous MHD Equations*, Journal of Computational Physics, 152:608-641, (web).

T.C. Warburton, S.J. Sherwin, and G.E. Karniadakis, *Spectral Basis Functions for 2D Hybrid hp Elements*, SIAM Journal on Scientific Computation, Volume 20, 5:1671-1695.

T. Warburton, I. Lomtev, Y. Du, S. Sherwin and G. Karniadakis, *Galerkin and Discontinuous Galerkin Spectral/hp Methods*, Special edition of *Spectral, Spectral Element, and hp Methods in CFD* in Computer Methods in Applied Mechanics and Engineering, 175:343-359, (web).

Articles in Conference Proceedings

2017 Arturo Vargas, Jesse Chan, Thomas Hagstrom, Timothy Warburton, *GPU Acceleration of Hermite Methods for the Simulation of Wave Propagation*, Spectral and High Order Methods for Partial Differential Equations ICOSAHOM 2016, pp. 357–368, (web), (arXiv.org).

Axel Modave, Andreas Atle, Jesse Chan, and Tim Warburton, *A nodal discontinuous Galerkin method with high-order absorbing boundary conditions and corner/edge compatibility*, Proceedings of WAVES 2017, the 13th International Conference on Mathematical and Numerical Aspects of Wave Propagation, May 2017, (web).

2016 Andreas Klöckner, Lucas Wilcox, and Tim Warburton, *Array Program Transformation with Loo.py by Example: High-Order Finite Elements*, Proceedings of the 3rd ACM SIGPLAN International Workshop on Libraries, Languages, and Compilers for Array Programming (ARRAY 2016), pp. 9-16, (arXiv.org), (web).

2015 R. Rahaman, D. Medina, A. Lund, J. Tramm, T. Warburton, and A. Siegel, *Portability and Performance of Nuclear Reactor Simulations on Many-Core Architectures.* Proceedings of the 3rd International Conference on Exascale Applications and Software. University of Edinburgh, (web).

Jesse Chan, Zheng Wang, Axel Modave, J.F. Remacle, and T. Warburton, *Low-memory discontinuous Galerkin methods for wave propagation on hybrid meshes*, Computational Engineering, MFO Technical Report 43/2015, pp. 20-21, (web).

David S. Medina, Amik St-Cyr, and Timothy Warburton, *High-order finite differences on multi-threaded architectures using OCCA*, Spectral and High Order Methods for Partial Differential Equations, ICOSAHOM 2014, Lecture Notes in Computational Science and Engineering, (web), (arXiv.org)

A. Modave, A. St-Cyr, T. Warburton, W. A. Mulder, *Accelerated Discontinuous Galerkin Time-Domain Simulations for Seismic Wave Propagation*, extended abstract accepted to EAGE 2015, (web).

2012 Andreas Klöckner (joint with Timothy Warburton & Jan S. Hesthaven), *Tools and Methods for Discontinuous Galerkin Solvers on Modern Computer Architectures*, On The Theory and Applications of Discontinuous Galerkin Methods, MFO Technical Report 10/2012, (web).

T. Warburton, *Aspects of the a priori convergence analysis for the low storage curvilinear discontinuous Galerkin method*, On the Theory and Applications of Discontinuous Galerkin Methods, MFO Technical Report 10/2012, 2012, (web).

2011 N. Gödel, T. Warburton and M. Clemens, *Modeling Effects of Electromagnetic Waves on Thin Wires with a High-Order Discontinuous Galerkin Method*, Spectral and High Order Methods for Partial Differential Equations, Lecture Notes in Computational Science and Engineering, Volume 76, pages 209-218, (web).

2010 T. Warburton, *A low storage curvilinear discontinuous galerkin time-domain method for electromagnetics*, Electromagnetic Theory (EMTS), 2010 URSI International Symposium on, pp. 996–999, IEEE, (web).

Xin Wang, William W. Symes and Tim Warburton, *Comparison of discontinuous Galerkin and finite difference methods for time domain acoustics*, SEG Technical Program Expanded Abstracts, Volume 29, Number 1, 3060–3065.

Carsten Burstedde, Omar Ghattas, Michael Gurnis, Tobin Isaac, Andreas Klöckner, Georg Stadler, Tim Warburton, and Lucas C. Wilcox, *Extreme-Scale AMR*. ACM IEEE SC Conference Series. Finalist paper for the Gordon Bell Prize 2010, (web).

2009 S. Chun, H. Haddar, J.S. Hesthaven, A. Klöckner, T. Warburton, and L. Wilcox, *Overcoming Performance Bottlenecks in DG-FEM for EM Problems*. Proceedings of 9th International Conference on Mathematical and Numerical Aspects of Wave Propagation, Pau, France, pp. 80-81.

N. Gödel, S. Schomann, T. Warburton, and M. Clemens, *GPU Accelerated Adams-Bashforth Multirate Discontinuous Galerkin Simulation of High Frequency Electromagnetic Fields*, 17th Conference on the Computation of Electromagnetics Fields (COMPUMAG 2009), Florianopolis, Brazil, Two page abstract.

N. Gödel, N. Nunn, T. Warburton, and M. Clemens, *Scalability of Higher-Order Discontinuous Galerkin FEM Computations for Solving Electromagnetic Wave Propagation Problems on GPU Clusters*, 17th Conference on the Computation of Electromagnetics Fields (COMPUMAG 2009), Florianopolis, Brazil, Two page abstract.

S. Schomann, N. Gödel, T. Warburton, and M. Clemens, *Local Time-stepping Techniques Using Taylor Expansion for Modeling Wave Propagation with Discontinuous Galerkin FEM*, 17th Conference on the Computation of Electromagnetics Fields (COMPUMAG 2009), Florianopolis, Brazil, Two page abstract.

N. Gödel, T. Warburton, M. Clemens, *GPU Accelerated Discontinuous Galerkin Methods for Electromagnetic Radio-Frequency Problems*, IEEE International Symposium on Antennas & Propagation and USNC/URSI National Radio Science Meeting (IEEE APS-URSI 2009), Charleston, USA, Full paper accepted for presentation.

N. Gödel, S. Schomann, T. Warburton, and M. Clemens, *Local Timestepping Discontinuous Galerkin Methods for Electromagnetic RF Field Problems*, 3rd European Conference on Antennas and Propagation, pages 2149-2153, (web).

2008 J.S. Hesthaven, T. Warburton, C. Chauviere and L. Wilcox. *High-order discontinuous Galerkin methods for computational electromagnetics and uncertainty quantification.* In Proceedings of 7th International Conference on Scientific Computing in Electrical Engineering (SCEE 2008), Helsinki University of Technology, Helsinki, Finland, (web).

Ronald H. W. Hoppe (joint with Guido Kanschat & Tim Warburton), *Convergence Analysis of an Adaptive Interior Penalty Discontinuous Galerkin Method*, MFO Report Non-standard Finite Element Methods, No. 36/2008 (web).

Timothy Warburton, *Accelerating the Discontinuous Galerkin Time-Domain Method*, MFO Report Non-standard Finite Element Methods, No. 36/2008 (web).

2007 T. Hagstrom, and T. Warburton, *On Complete Radiation Boundary Conditions and Optimal Absorbing Layers*, 8th International Conference on Mathematical and Numerical Aspects of Waves, (web).

T. Warburton, and Thomas Hagstrom, *Taming the CFL Condition for Discontinuous Galerkin in Two-Dimensions*, 8th International Conference on Mathematical and Numerical Aspects of Waves, (preprint).

T. Warburton, *A Survey of Discontinuous Galerkin Methods for Time-Domain Electromagnetics*, Oberwolfach Conference on Computational Electromagnetism and Acoustics, (web).

2005 T. Warburton, *Spurious Solutions and the Discontinuous Galerkin Methods on Nonconforming Meshes*, Proceedings of the 7th International Conference on Mathematical and Numerical Aspects of Wave Propagation, WAVES 2005, Providence, RI.

T. Hagstrom, D. Justo, and T. Warburton, *Solving scattering problems for Maxwell's equations using polygonal artificial boundaries*, Proceedings of the 7th International Conference on Mathematical and Numerical Aspects of Wave Propagation, WAVES 2005, pp. 71-73, Providence, RI

2003 T. Hagstrom and T. Warburton, *High-Order Radiation Boundary Conditions for Time-Domain Electromagnetics Using An Unstructured Discontinuous Galerkin Method*, Accepted to the Second M.I.T. Conference on Computational Fluid and Solid Mechanics, Cambridge, Massachusetts.

C. Chauviere, J.S. Hesthaven, A. Kanevsky, and T. Warburton, *High-Order Localized Time Integration for Grid-Induced Stiffness*, Accepted to the Second M.I.T. Conference on Computational Fluid and Solid Mechanics, Cambridge, Massachusetts.

2002 J.S. Hesthaven and T. Warburton, *High-Order Unstructured Grid Methods for Time-Domain Electromagnetics*, Proceedings of 40th AIAA Aerospace Sciences Meeting and Exhibit, Reno, Nevada.

2001 J.S. Hesthaven and T. Warburton, *High-Order/Spectral Unstructured Grid Methods for the Time-Domain Solution of Maxwell's Equations*, Fourth International Workshop on Computational Electromagnetics in the Time-Domain: TLM/FDTD and Related Techniques, Nottingham, UK, C. Christopoulos (Eds), 47-53.

2000 T. Warburton, *Application of the Discontinuous Galerkin Method to Maxwell's Equations Using Unstructured Polymorphic hp-Finite Elements.*, Lecture notes in computational science and engineering, Volume 11, pages 451–458, Springer.

1999 P. Dutta and T.C. Warburton, and A. Beskok, *Numerical Modeling of Electrokinetically Driven Micro Flows*, Proceedings of ASME IMECE meeting, MEMS Vol 1, pp-467-474

Ph.D. Thesis & Technical Reports

2019 DOE ECP Milestone Report CEED-MS25, *Public release of CEED 2.0.*, J. Brown, A. Abdelfattah, V. Barra, V. Dobrev, Y. Dudouit, P. Fischer, T. Kolev, D. Medina, M. Min, T. Ratnayaka, C. Smith, J. Thompson, S. Tomov, V. Tomov, T. Warburton, (web), dxdoi.

DOE ECP Milestone Report CEED-MS23, *Engage second wave ECP/CEED applications WBS*, J.-S. Camier, P. Fischer, A. Karakus, S. Kerkemeier, T. Kolev, Y.-H. Lan, D. Medina, E. Merzari, M. Min, A. Obabko, T. Ratnayaka, D. Shaver, A. Tomboulides, V. Tomov, T. Warburton, (web), (dxdoi).

2018 DOE ECP Milestone Report CEED-MS20, *Performance tuning of CEED software and first wave apps*, S. Tomov, P. Bello-Maldonado. J. Brown. J.-S. Camier, V. Dobrev, J. Dongarra P.F. Fischer, A. Haidar, T. Kolev, E. Merzari, M. Min, A. Obabko, S. Parker, T. Ratnayaka, J. Thompson, A. Abdelfattah, V. Tomov, T. Warburton, (web), (dxdoi).

DOE ECP Milestone Report CEED-MS13, *Public release of CEED 1.0*, J. Brown, A. Abdelfata, J.-S. Camier, V. Dobrev, J. Dongarra, P. Fischer, A. Fisher, Y. Dudouit, A. Haidar, K. Kamran, T. Kolev, M. Min, T. Ratnayaka, M. Shephard, C. Smith, S. Tomov, V. Tomov, T. Warburton, (web), (dxdoi).

DOE ECP Milestone Report CEED-MS8, M. Min, J. Brown, V. Dobrev, P.F. Fischer, T. Kolev, D.S. Medina, E. Merzari, A. Obabko, S. Parker, R. Rahaman, S. Tomov, V. Tomov, and T. Warburton, *Initial Integration of CEED Software in ECP Applications*, (web), (dxdoi).

2014 D.S. Medina, A. St-Cyr, and T. Warburton, *OCCA: a unified approach to multi-threading languages*, (arXiv.org)

2004 David M. Day, Ranjeet S. Patil, and T. Warburton, *Discontinuous Galerkin Discretizations Applied to Eigenvalue Problems on Non-Conforming Meshes*, CSRI Technical Report, Sandia National Laboratory.

1999 Ph.D Thesis *Spectral/hp Methods on Polymorphic Multi-Domains: Algorithms and Applications*, Brown University.

Presentations

2019 Minisymposium talk: *libParanumal: portable highly optimized high-order finite element implementations for GPU computing*, North American High-Order Methods Conference, San Diego, California. (web), (abstracts).

2018 Keynote talk: *On building an exascale-ready high-order finite element flow solver*, Mid-Atlantic Numerical Analysis Day at Temple University, Philadelphia, Pennsylvania, (web)

Invited seminar talk: *GPU Accelerated High-order Discontinuous Galerkin Methods for Flow on a Sphere*, Nanjing University, Nanjing, China, (web) .

Invited workshop talk: *GPU Accelerated High-order Discontinuous Galerkin Methods for Flow on a Sphere*, Workshop of Applied Mathematics and Computation in Atmosphere 2018, Shanghai, China, (web) .

Workshop talk: *libParanumal: capabilities and performance analysis*, CEED Annual Meeting, University of Colorado at Boulder, Boulder, CO.

Invited minisymposium talk: *Low-order Preconditioning of High-order Triangular Finite Element Methods*, International Conference on Spectral and High-Order Methods, Imperial College, London, UK.

2017 Invited seminar talk: *GPU Accelerated Incompressible Flow Solvers*, UC Berkeley/Lawrence Berkeley National Lab Applied Mathematics Seminar, Berkeley, CA.

Invited workshop talk: *Holmes: High-Order Lightweight Mini-apps for Exploring Scalability*, Center for Efficient Exascale Discretization Annual Meeting, Lawrence Livermore National Lab., CA.

Invited workshop talk: *Holmes: High-Order Laboratory for Multi-threading @ Extreme Scale*, Center for Efficient Exascale Discretization Kick-off Meeting, Argonne National Lab, IL.

2016 Invited workshop keynote talk: *Portable Many-core Programming withâĂĺthe Open Concurrent Compute Abstraction (OCCA)*, Society of Exploration Geophysics High Performance Computing Workshop, Beijing (by telecon)

Invited industrial workshop talk: *Accelerated DG Time-domain Methods: sparse operators & radiation boundary conditions*, TOTAL Depth Imaging Project Workshop, Houston, TX.

Invited minisymposium talk: *Accelerating Discontinuous Galerkin Methods for Elastic Wave Propagation*, European Congress on Computational Methods in Applied Sciences and Engineering, Crete.

Short talk: *Numerical PDE Modeling with the Open Concurrent Compute Abstraction*, Advanced Research Computing High Performance Computing Day, Virginia Tech., Blacksburg, VA.

Seminar: *Open Concurrent Computing Abstraction: hands on*, Synergistic Environments for Experimental Computing Seminar, Virginia Tech., Blacksburg, VA.

Seminar: *Open Concurrent Computing Architecture: a hands on OCCA tutorial*, Matrix Analysis Seminar, Department of Mathematics, Virginia Tech., Blacksburg, VA.

Short talk: *Overview of Warburton Research Program*, Research Days, Department of Mathematics, Virginia Tech., Blacksburg, VA.

2015 Invited workshop talk: *ESPC-NUMA Research Project Update*, Annual Meeting, National Oceanographic Partnership Program, Arlington, VA. project web page.

Inaugural lecture: *Accelerating Computational Geophysics*, Inaugural John K. Costain Chair Lecture, College of Science Fall Roundtable, Virginia Tech., Blacksburg, VA, article.

Seminar: Accelerating Computational Geophysics, TOTAL E&P, Houston, TX.

Workshop tutorial: *OCCA: Portability Layer for Many-core Thread Programming*, co-presented with David Medina, Rice Oil & Gas Workshop, Houston, TX, slides.

Invited workshop talk: *OCCA: Unified Approach to Multi-threaded Languages*, ASCR Exascale Co-Design Program Meeting, Livermore, CA.

Invited colloquium: *Accelerating Computational Geophysics*, Math Department, Virginia Tech, Blacksburg, VA, (web).

2014 Invited workshop talk: *Accelerating Shallow Water Modeling*, IMA Hot Topics Workshop: Impact of Waves Along Coastlines, Institute for Mathematics and its Applications, University of Minnesota, MN, October 2014, (web).

Invited workshop talk: *OCCA: An Extensible Portability Layer for Many-Core Programming*, 43rd SPEEDUP Workshop on High-Performance Computing, University of Geneva, Switzerland, (web).

Tutorial: OCCA2, Hess Corporation, Houston, TX.

Contributed minisymposium talk: *Accelerating High-order Methods*, International Conference on Spectral and High-order Methods (ICOSAHOM), Utah, (web).

Invited minisymposium talk: *Low Storage Curvilinear Discontinuous Galerkin Methods*, International Conference on Spectral and High-order Methods (ICOSAHOM), Utah, (web).

Invited workshop talk: *OCCA: A Unified Approach to Multi-Threading Languages*, CESAR Hands-on Workshop, Argonne National Laboratory, IL.

Invited industrial seminar: *OCCA: A Unified Approach to Multi-Threading Languages*, High Performance Computing Seminar, BP, Houston, TX.

Invited workshop mini-talk: *OCCA: A Unified Approach to Multi-Threading Languages*, Algorithms and Abstractions for Assembly in PDE Codes, CSRI, Sandia National Lab, Albuquerque, NM, (web).

Pre-workshop Tutorial: *OCCA: portability layer for many-core thread programming*, 2014 Oil & Gas HPC Workshop, Rice University, (web).

Invited workshop talk: *Many-core Algorithms for High-order Finite Element Methods: when time to solution matters*, Advances in Numerical Algorithms and High Performance Computing, University College London, (web).

Invited workshop plenary: *Many-core Algorithms for High-order Finite Element Methods: when time to solution matters*, Scientific Computing Around Louisiana (SCALA 2014), Louisiana State University, Baton Rouge, Louisiana, (web).

2013 Invited workshop talk: *Portability Layer for GPUs: OCCA and GNek*, Annual Review, Center for Exascale Simulation of Advanced Reactors, Argonne National Lab, IL, (web).

Invited seminar: *Many-core Algorithms for High-order Finite Element Methods: when time to solution matters*, Scientific Computing Group Seminar, Division of Applied Mathematics, Brown University, Providence, RI, (web).

Workshop talk: *Portable many-core programming model and high-order finite element methods*, Kick-off workshop for Advanced Air-Ocean-Land-Ice Global Coupled Prediction on Emerging Computational Architectures, Florida State University, Tallahassee, FL.

Invited colloquium: *Many-core Algorithms for High-order Finite Element Methods: when time to solution matters*, Mathematics Colloquium, Department of Mathematics, Florida State University, Tallahassee, FL, (web).

Invited seminar: *Many-core Algorithms for High-order Finite Element Methods: when time to solution matters*, SCAIM Seminar, Pacific Institute for the Mathematical Sciences, University of British Columbia, (web).

Invited seminar: *Many-core Algorithms for High-order Finite Element Methods: when time to solution matters*, CSC Seminar, Mathematics Department, Simon Fraser University.

Invited minisymposium talk: *High-Order High-Throughput Numerical Methods for High-Contrast Seismic Imaging*, SIAM Conference on Mathematical & Computational Issues in the Geosciences, Padova, Italy, (web).

Invited minisymposium talk: *The Low-storage Curvilinear Discontinuous Galerkin Method*, Conference on the Mathematics of Finite Elements and Applications, Brunel University, Uxbridge, UK, (web).

Invited industrial seminar: $DG \mid !(DG)$?, Hess corporation, Houston, TX.

Invited workshop talk: *Discontinuous Galerkin Methods on Many-core Architectures*, Rice 2013 Oil & Gas High Performance Computing Workshop, Rice University, Houston, TX.

Invited minisymposium talk: *Discontinuous Galerkin Methods on Many-core Architectures*, Finite Elements in Flow Problems, special track of Advances in Computational Mechanics, (web).

2012 Invited seminar: *The Rice Advanced SCALable Simulation Project*, Rice Space Physics Seminar, Physics Department, Rice University, Houston.

Invited keynote talk: *Evaluating Discontinuous Galerkin Methods on Many-core Architectures*, CADMOS Workshop on Large Scale Computing, EPFL, Lausanne, Switzerland, (web).

Invited workshop talk: *Evaluating Discontinuous Galerkin Methods on Many-core Architectures*, Workshop on PDE Software Frameworks, Münster, Germany, (web).

Invited industrial seminar: *An Overview of Discontinuous Galerkin Methods*, Shell Technology Center, Houston, TX.

Invited seminar: *Evaluating Discontinuous Galerkin Methods on Many-core Architectures*, NASC Seminar, Courant Institute of Mathematical Sciences, New York University, New York, (web).

Invited workshop talk: *GPU Accelerated Discontinuous Galerkin Methods*, Workshop on Theory and Applications of Discontinuous Galerkin Methods, Mathematisches Forschungsinstitut Oberwolfach, Germany, (web).

Invited workshop talk: *CESAR: Nek and Many-core*, Mathematics and Computer Science Division, Argonne National Laboratory, Chicago, USA.

2011 Invited seminar: *GPU Accelerated Discontinuous Galerkin Methods*, Scientific Computing Seminar, Division of Applied Mathematics, Brown University, Providence, RI, (web).

Invited industrial seminar: *GPU Accelerated Discontinuous Galerkin Methods*, Shell Technology Center, Houston, TX.

Invited workshop talk: *GPU Accelerated Discontinuous Galerkin Methods*, Advances in Numerical Analysis and Scientific Computing, University of Houston, TX, (web).

Invited workshop talk: *CESAR: Nek and Many-core*, Mathematics and Computer Science Division, Argonne National Laboratory, Chicago, USA.

Invited talk: *GPU Accelerated Discontinuous Galerkin Methods*, Toward petaflop numerical simulation on parallel hybrid architectures, CEA-EDF-INRIA Summer School, INRIA Sophia Antipolis, France, (web).

Invited extended minisymposium talk: *GPU Accelerated Discontinuous Galerkin Methods*, Finite Element Methods in Flow Problems, Munich, Germany.

Contributed minisymposium talk: *GPU Accelerated Discontinuous Galerkin Methods*, SIAM Conference on Computational Science and Engineering, Reno, NV, (web).

2010 Invited speaker: *GPU Accelerated Discontinuous Galerkin Methods*, 6th International Workshop on Parallel Matrix Algorithms and Applications (PMAA10) University of Basel, Switzerland, (web).

Invited seminar: *The Rice University GPU-DG Project*, Mathematics and Computer Science Division, Argonne National Laboratory, Chicago, USA.

Invited talk: *Shockingly Fast and Accurate CFD Simulations*, NVIDIA Research Summit, part of the NVIDIA GPU Technology Conference, San Jose, CA, (video stream).

Invited minisymposium talk: *GPU Accelerated Low Storage Curvilinear Discontinuous Galerkin Methods*, 2010 International Symposium on Electromagnetic Theory, Berlin, Germany (web).

Invited plenary talk: *GPU Accelerated Low Storage Curvilinear Discontinuous Galerkin Methods*, Congrès CANUM, 40e Congrès National d'Analyse Numérique, Nr Bordeaux, France, (web).

Invited speaker: *GPU Accelerated Low Storage Curvilinear Discontinuous Galerkin Methods*, 10th ICFD Conference on Numerical Methods for Fluid Dynamics, Reading University, UK, (web).

Invited seminar: *GPU Accelerated Low Storage Curvilinear Discontinuous Galerkin Methods*, Computational Science & Engineering Seminar, Georgia Tech, Atlanta, GA.

Contributed minisymposium talk: *GPU Accelerated Low Storage Curvilinear Discontinuous Galerkin Methods*, SIAM Annual Meeting, Pittsburgh, PA, (web).

2009 Invited seminar talk: *GPU Accelerated Low Storage Curvilinear Discontinuous Galerkin Methods*, Applied and Computational Mathematics Seminar, University of North Carolina at Charlotte, NC.

Invited talk: *GPU Accelerated Low Storage Curvilinear Discontinuous Galerkin Methods*, Frontiers of Geophysical Simulation Workshop, National Center for Atmospheric Research, Boulder, CO, (web).

Invited talk: *Advanced Numeric Computing Techniques*, Key Session, NVIDIA Research Summit, part of the NVIDIA GPU Technology Conference, San Jose, CA, (video stream).

Invited industrial seminar talk: *Accelerating Discontinuous Galerkin Finite Element Methods*, ExxonMobil Upstream Technical Training Center, Houston, TX.

Contributed minisymposium talk: *Accelerating Discontinuous Galerkin Finite Element Methods*, SIAM Conference on Computational Science and Engineering, Miami, FL, (web).

Contributed talk: *Accelerating Discontinuous Galerkin Finite Element Methods*, FEMTEC09, NV, (web).

Invited workshop talk: *Towards High Resolution Numerical Algorithms for Wave Dominated Physical Phenomena*, AFOSR Computational Program Review, Washington, DC.

Invited plenary talk: *Discontinuous Galerkin Methods for Electromagnetics* †, International Conference on Spectral and High Order Methods, Norges Teknisk-Naturvitenskapelige Universitet, Trondheim, Norway.

Invited workshop talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Workshop on Computational Methods for Hyperbolic Problems, University of Waterloo, Canada.

Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Numerical Analysis Seminar, Texas A&M, TX.

2008 Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Math Department, Southern Methodist University, TX.

Invited workshop talk: *Accelerating Discontinuous Galerkin Finite Element Methods*, Oberwolfach Conference on Non-standard Finite Element Methods, Mathematisches Forschungsinstitut Oberwolfach, Germany, (web).

Invited colloquium talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Center for Computation and Technology Colloquium, Louisiana State University, LA, (web).

2007 Invited workshop talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Discontinuous Galerkin Methods for Partial Differential Equations, Banff International Research Station, Canada.

Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Mathematics and Computer Science Division, Argonne National Laboratory, Chicago, USA.

Invited minisymposium talk: *Improving the CFL Condition for Discontinuous Galerkin Methods*, The 8th International Conference on Mathematical and Numerical Aspects of Waves, Reading, UK.

Contributed minisyposium talk: *Improving the CFL Condition for Discontinuous Galerkin Methods*, 6th International Congress on Industrial and Applied Mathematics, Zurich, Switzerland.

Invited talk: *Improving the CFL Condition for Discontinuous Galerkin Methods*, International Workshop on High-Order Finite Element Methods, Herrsching, Germany.

Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Computer and Information Technology Institute (CITI) Luncheon, Rice University, Houston, TX.

Invited talk: *Survey of Discontinuous Galerkin Methods for Time-Domain Electromagnetics**, Oberwolfach Conference on Computational Electromagnetism and Acoustics, Mathematisches Forschungsinstitut Oberwolfach, Germany, (web).

2006 Invited workshop talk: *Towards High Resolution Numerical Algorithms For Wave Dominated Physical Phenomena*, AFOSR Program Review, Atlanta, GA, USA.

Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Department of Mathematics, Rice University, Houston, TX.

Invited minisymposium talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, 7'th World Congress on Computational Mechanics, Los Angeles, CA, USA.

Invited minisymposium talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, SIAM Annual Meeting, Boston, MA.

Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, ICES, U. Texas at Austin, TX, USA.

Invited minisymposium talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Computational Methods for Electromagnetism, Southeastern Section MAA & SIAM Southeast Atlantic Section, Auburn, AL, USA.

Invited workshop talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Advances in Computational Scattering, BIRS, Banff, Canada.

Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Scientific Computing Seminar, University of Houston, Houston, TX, USA.

2005 Invited seminar talk: *Advances in Wave Propagation with the Discontinuous Galerkin Method*, Math Department, Texas A&M University, College Station, TX, USA.

Contributed minisymposium talk: *Spurious Solutions and the Discontinuous Galerkin Method on Nonconforming Meshes*, Waves 2005, Providence, RI, USA.

Contributed minisymposium talk: *Solving Scattering Problems for Maxwell's Equations Using Polygonal Artificial Boundaries*, Waves'05, Providence, RI, USA.

Contributed minisymposium talk: *Comparing Continuous and Discontinuous Galerkin Methods for Maxwell's Equations*, USNCCM8, Austin, TX, USA.

2004 Contributed minisymposium talk: *Spectrally accurate radiation boundary conditions on polygonal artificial boundaries with discontinuous Galerkin implementation*, ICOSAHOM04, Brown University, Providence, RI, USA.

Invited seminar talk: *Bridging the Divide Between Compatible and Weakly Compatible Finite Element Methods*, CAAM, Rice University, Houston, TX, USA.

2003 Invited workshop talk: PDE's and Applications, Notre Dame University, South Bend, IN, USA.

d Invited minisymposium talk: *High-order radiation boundary conditions for time-domain electromagnetics using an unstructured discontinuous Galerkin method*, Second MIT Conference on Computational Fluid and Solid Mechanics, Boston, MA, USA.

Contributed minisymposium talk: *High Order Nodal DG-FEM for the Maxwell Eigenvalue Problem*, USNCCM7, Albuquerque, NM, USA.

Invited seminar talk: *The Unstructured Spectral Element Method and USEMe Computer Code*, Math Department, Notre Dame University, South Bend, IN, USA.

Invited seminar talk: Math Department & Geophysics Department, University of Chicago, Chicago, IL, USA.

2002 Invited seminar talk: *High-Order Unstructured Grid Methods for Time-Domain Electromagnetics*, Computer Science Research Institute, Sandia National Laboratories, NM, USA.

Invited seminar talk: Math Department, University of Arizona, AZ, USA.

Invited workshop talk: NCAR (National Center for Atmospheric Research), CO, USA.

2001 Invited seminar talk: Math Department, University of New Mexico, Albuquerque, NM, USA.

Invited seminar talk: *Nodal Unstructured Spectral Elements for Conservation Laws*, Math Department, Texas A&M University, College Station, TX, USA.

Invited seminar talk: *High Order Finite Element Methods in Matlab and Beyond*, Division of Applied Math, Brown University, Providence, RI, USA.

Invited seminar talk: CASC, Lawrence Livermore National Laboratory, Livermore, CA, USA.

2000 Contributed talk: Finite Elements in Fluids 2000, Austin, TX, USA.

Contributed minisympsoium talk: *Application of Nodal unstructured spectral elements to Maxwell's equations*, p-FEM 2000, St. Louis, MO, USA.

Invited seminar talk: Electromagnetics Research Branch, NASA Langley Research Center, Hampton, VA, USA.

1999 Invited seminar talk: CERFACS, Toulouse, France.

Contributed minisymposium talk: DGM99, Newport, RI, USA.

Contributed minisymposium talk: *Overlapping Schwarz preconditioners for solving elliptic problems on polymorphic/hp elements*, ICIAM99, Edinburgh, UK.

Posters (* presenters)

2016 *GPU Accelerated Discontinuous Galerkin Method on Hybrid Meshes: Applications in Seismic Imaging*, joint with Zheng Wang*, Jesse Chan, and Axel Modave, Rice Oil & Gas Workshop, Houston, TX, (web).

GPU Accelerated Hermite Methods for the Simulation of Waves, joint with Arturo Vargas*, and Jesse Chan, Rice Oil & Gas Workshop, Houston, TX, (web).

2015 *Adaptive Plane Wave Discontinuous Galerkin Methods for the Helmholtz Equation*, joint with Shelvean Kapita and Peter Monk, Franco-German Summer School Inverse Problems for Waves, Ecole Polytechnique, Palaiseau, France, poster.

GPU Accelerated Spectral Element Methods: 3D Euler equations, joint with Daniel S. Abdi*, Lucas Wilcox, and Francis X. Giraldo, American Geophysical Union Fall meeting. San Francisco, CA, poster on research gate.

Efficient DG methods on hybrid meshes, joint with Jesse Chan*, Zheng Wang, Axel Modave, J.F. Remacle, Polytopal Element Methods in Mathematics and Engineering, Atlanta, GA, poster.

OCCA: A Unified Approach to Multi-Threading Languages, joint with David Medina* and Amik St-Cyr, SIAM CS&E 2015, Salt Lake City, UT, poster, (web).

OCCA Accelerated Lattice Boltzmann Method in Core Sample Analysis, presented by Zheng (Frank) Wang*, Rice Oil & Gas Workshop, Houston, TX, (web).

2014 *High Performance Discontinuous Galerkin Methods For Tsunami Modeling*, joint with Rajesh Gandham*, David Medina. IMA Hot Topics Workshop: Impact of Waves Along Coastlines, Institute for Mathematics and its Applications, University of Minnesota, MN, (web).

OCCA: A Unified Approach to Multi-Threading Languages, joint with David Medina, Rajesh Gandham, and Amik St-Cyr, Algorithms and Abstractions for Assembly in PDE Codes, Sandia National Lab, Albuquerque, NM, (web).

Simulating Brain Cancer Laser Therapy with Spectral Elements on GPUs, joint with Tim Moon, Michael Franco*, David Medina, and David Fuentes, OEDK Engineering Design Showcase, Rice University, TX.

GPU Accelerated Numerical Methods for Tsunami Modeling, joint with Rajesh Gandham*, David Medina, GPU Technology Conference, San Jose, CA, (web).

GPU Accelerated Lattice Boltzmann Method in Core Sample Analysis, joint with Frank Wang*, Rice Oil & Gas HPC Worksop, Rice University, Houston, TX, (web).

OCCA: A Unified Approach to Multi-Threading Languages, joint with David Medina* and Amik St. Cyr, Rice Oil & Gas HPC Worksop, Rice University, Houston, TX, (web)

ALMOND: Algrebraic Multigrid on Numerous Devices, joint with Rajesh Gandham*, Rice Oil & Gas HPC Worksop, Rice University, Houston, TX, (web).

2013 *GPU Accelerated Numerical Methods for Tsunami Modeling*, joint with Rajesh Gandham* and David Medina, High-Performance Computing, Bengaluru, India.

High-order Numerical Methods for High-contrast Seismic Imaging, joint with Rajesh Gandham, David Medina*, and Amik St-Cyr, Rice 2013 Oil & Gas High Performance Computing Workshop, Rice University, Houston, TX.

2010 *GPGPU Accelerated Discontinuous Galerkin Methods*, IMA Workshop on Numerical Solutions of Partial Differential Equations: Novel Discretization Techniques, IMA, Minneapolis, MN.

2009 *High Performance High Order Simulations on a Workstation*, International Conference on Advances in Scientific Computing, Brown University, Providence, RI.

2008 *Teramite the Super-Computing Workstation*, HPC Users Workshop, Rice University, Houston, TX.

2005 AFOSR Program Review, Long Beach, CA, USA.

Summer Schools

2018 Instructor: Accelerator programming section of the Argonne Training Program on *Extreme-Scale Computing*, St Charles, IL, (video)

2017 Instructor: Accelerator programming section of the Argonne Training Program on *Extreme-Scale Computing*, St Charles, IL, (video)

2016 Instructor: Accelerator programming section of the Argonne Training Program on *Extreme-Scale Computing*, St Charles, IL, (part I: web, video, slides) (part II: web, video, slides).

2015 Instructor: Accelerator programming section of the Argonne Training Program on *Extreme-Scale Computing*, St Charles, IL, (web, slides, video part I, video part II).

2014 Instructor: Accelerator programming section of the Argonne Training Program on *Extreme-Scale Computing*, St Charles, IL, (web, slides, video part I, video part II).

2013 Instructor: Pan-American Advanced Engineering Institute advance-studies workshop on *The science of predicting and understanding tsunamis, storm surges and tidal phenomena*, Universidad Tecnica Federico Santa Maria, Valparaiso, Chile, (web).

2011 Instructor: Ph.D. School on Scientific Computing with Graphics Processing Units, (5 ECTS credits), Danish Technical University, Lyngby, Denmark, (web).

2009-2015 Instructor: High Performance Computing Summer Institute organized by the Ken Kennedy Institute for Information Technology, 2009, 2010, 2011, 2012, 2013, & 2015 (web).

2008 Instructor: Parallel Numerical Methods for Partial Differential Equations , Rocky Mountain Mathematics Consortium Summer School, University of Wyoming, WY.

Seminar Organization

Spring 2014 *Medical Imaging and Radiation Science Seminar Series*, co-organized with Dr David Fuentes and Dr Edward Castillo of the MD Anderson Cancer Center, Spring 2014. (web). Focus: leading researchers from the Departments of Radiation Physics, Imaging Physics, Interventional Radiology, and Neuroradiology at the MD Anderson Cancer Center invited to give presentations introducing their specialties.

Teaching

Teaching at Virginia Tech

MATH 5414 *Mathematics Topics in Applied Mathematics: Finite Elements & GPU Computing*, Focus: the goal of this course is for the students to develop a multi-GPU accelerated high-order discontinuous Galerkin solver from scratch. Fall 2016 (hyperbolic systems and Boltzmann gas dynamics), 2017 (elliptic equations), Fall 2018 (build your own GPU accelerate PDE solver).

CMDA 3634 *Computer Science Foundations for Computational Modeling and Data Analytics*. Focus: introduction to programming models and tools for parallel computing on modern architectures. Parallel programming survey includes introduction to: MPI, OpenMP, CUDA, OpenCL, and OpenACC. Also cross-listed as CS 3634. Spring 2016 and 2017, Fall 2017, Fall 2018.

CMDA 2984 *Discovering CMDA*. Focus: first year experience for CMDA majors. Fall 2015

CMDA 2984 *Software Tools and Applications for CMDA*. Focus: introducing first year CMDA students to key software tools like MATLAB, R, Python, SQL, LaTeX. Co-taught with Mark Embree with several guest speakers. Fall 2016.

Teaching at Rice University

CAAM 652 *Topics in Numerical Differential Equations.*
Focus: Discontinuous Galerkin methods, Spring 2011.

CAAM 600 *Thesis Writing.*
Co-instructors: Jan Hewitt and Matthias Heinkenschloss, Spring 2011 & 2012. With Jan Hewitt and Paul Hand, Spring 2015.

CAAM 499/699 *Numerical Analysis & Scientific Computing Seminar.*
Co-organized with Beatrice Riviere & Jennifer Young, Fall 2008 to Spring 2012.

CAAM 491 *Independent Study.*
Focus: project based course on building a parallel, GPU accelerated, discontinuous Galerkin solver, Spring 2013.

CAAM 453/553 *Numerical Analysis I*,
Focus: numerical methods, analysis and application, Fall 2010.

CAAM 452 *Numerical Methods For Partial Differential Equations*, (web)
Focus: survey of finite element, finite volume, finite difference and discontinuous Galerkin methods, Spring 2005 & 2006.

CAAM 520 *Computational Science II.* (web)
Focus: parallel computing chosen from MPI, GPGPU, CUDA, OpenCL, OpenMP, Spring 2008, 2010, 2012, 2014, & 2015.

CAAM 420 *Computational Science I.* (web)
Focus: introduction to scientific programming skills (C,C++,Fortran) and programming tools (unix, gdb, valgrind, LaTeX), Fall 2004, 2005, 2006, 2008, 2009, 2011, 2012, & 2014.

CAAM 210 *Introduction to Computational Engineering.* (web)
Focus: introduction to applied mathematical programming in MATLAB, Spring 2008.

Early Teaching Experience

Spring 2003 Created and taught an innovative course in numerical solution of partial differential equations using the discontinuous Galerkin method, University of New Mexico.

2002–2003 Developed and taught an innovative course in introductory numerical computing, University of New Mexico, Spring 2002, Fall 2002, & Fall 2003.

2001–2003 Co-created a pioneering course on high performance scientific computing using remote learning technology on the Access Grid network. I led the project at the University of New Mexico end, and collaborated with faculty at the University of Montana and the University of Alaska, Fall 2001, Fall 2002 & Fall 2003 (without Grid component).

2000-2001 Created and taught a new, graduate level, two semester long, Applied Mathematics topics course: *Elements of High Performance Scientific Computing* at Brown University, Fall 2000 and Spring 2001.

1999 Organized and presented a seminar series: *hp Finite Elements* for the graduate students and faculty of the University of Oxford Computing Laboratory, Spring 1999.

1996-1998 Provided mentoring for graduate students in the Center for Fluid Mechanics, Brown University.

1996-1997 Teaching assistant in charge of computing assistance for Brown University Applied Mathematics courses with computational content, Fall 1996 and Spring 1997.

Professional Activities

Activity Groups

2016–2017 Member of the Technical Committee of the Third EAGE Workshop on High Performance Computing for Upstream, Dubai, UAE.

2015–2017 Member of the Synergistic Environments for Experimental Computing at Virginia Tech (web).

Editorial Positions

2011–2013 Member of the editorial board for Applied Numerical Mathematics.

2012–2015 Member of the editorial board for Computers and Mathematics with Applications.

2012–2017 Associate Editor on the board of the SIAM Journal on Scientific Computing.

2012 Paper committee member for InPar '12: Innovative Parallel Computing: Foundations and Applications of GPU, Manycore, and Heterogeneous Systems

Other Professional Service

2019 Member of the Scientific Committee for the North American High-Order Methods Conference (NAHOMCON), San Diego.

2019 Chair of local organizing committee for the Center for Efficient Exascale Discretizations Third Annual Meeting, Virginia Tech.

2019 Chair of local organizing committee for the fall Finite Element Circus, Virginia Tech.

2004– Co-organizer of minisymposia at SIAM Annual Meeting (2010), SIAM Computational Science and Engineering (2009,2011), ICIAM (2007), ICOSAHOM (2014 (web),2004).

2009 Member of the scientific committee for FEMTEC 2009.

2007 Chair for minisymposium session on Discontinuous Galerkin Methods at WCCM07.

Reviewed for SIAM Journal on Numerical Analysis, Monthly Weather Review, Journal of Scientific Computing, Computing in Science and Engineering, Journal of Computational and Applied Mathematics, Computational Methods in Applied Mechanical Engineering, Microfluidics and Nanofluidics, International Journal for Numerical Methods in Fluids, SIAM Computational Science and Engineering Book Series, Applied Numerical Analysis and Computational Mathematics, SIAM Journal on Scientific Computing, Applied Numerical Mathematics, Journal of Fluids Engineering (ASME), Theoretical and Computational Fluid Dynamics, Journal of Computational Physics, Journal of Engineering Mathematics, IMA Journal of Numerical Analysis.

Reviewer for DOE applied mathematics, 2004, 2005, 2012, & 2017.

Panel reviewer for NSF 2005, 2006, 2007, 2009, 2010, 2012, 2013, 2014, 2016, 2017, & 2018.

Service @ VT

2019 Chair of the VT Class of 1950 Math Chair nomination committee.

2019 Member of the VT Academy of Integrated Science Hamlett evaluation committee.

2019-2020 Member of the Math department Executive Committee.

2019– Member of the Math department web page committee.

2018– Chair of the CMDA computing curriculum review working group.

2018– Member of the Advanced Research Computing Computational Scientist Search Committee.

2017– Chair VT Math Graduate Program Committee.

2017– Member of the Virginia Tech Advanced Research Computing Advisory Committee.

2017–2018 Chair High Performance Computational Mathematics Faculty Search Committee.

2015– Math department teaching observation.

2017– CMDA Scholarship Committee.

2016–2017 Chair Computational Mathematics Faculty Search Committee.

Service @ Rice University

2014–2015 Chair CAAM Graduate Committee, Rice University.

Chair CAAM Faculty Search Committee.

2009–2014 Rice University Research Computing Subcommittee.

2012–2014 CAAM Faculty Search Committee, 2012-2013, & 2013-2014.

2011–2014 CAAM Computational Methods Exam Committee, Rice University, 2011, 2012 (chair), & 2014.

2009-2013 Chair of the CAAM Computing Committee, Rice University.

2005 CAAM Graduate Committee, Rice University.

CAAM A-exam Committee, Rice University.

2004–2005 CAAM Computing Committee, Rice University 2004 & 2005

Service @ The University of New mexico

Computer Use Committee for the Math and Stats Department at UNM.

Mentoring

Post-doc Mentoring

2018- Anthony Austin, Postdoctoral Research Associate, VT.

2017- Kasia Swirydowicz, Research Associate, VT. Currently a post-doc at the National Renewable Energy Lab.

2017-2018 Noel Chalmers, Postdoctoral Research Associate, VT. Currently working at AMD Research.

2016-2018 Ali Karakus, Postdoctoral Research Associate, VT. Currently postdoc at Argonne National Lab.

2014-2016 Axel Modave, Postdoctoral Research Associate, Rice & VT. Currently a CNRS permanent researcher in the Applied Mathematics Department of ENSTA-ParisTech.

2014 Florian Kummer, Visiting Research Associate (funded by a German Research Foundation Fellowship).

2013-2016 Jesse Chan, Pfeiffer Postdoctoral Instructor, @Rice and Postdoctoral Researcher, @VT. Currently Assistant Professor of Computational and Applied Mathematics @ Rice University.

2007–2009 Tetyana Vdovina, Postdoctoral Research Associate (Co-sponsored with Bill Symes). Currently working at ExxonMobil Upstream Research Company, Houston.

Graduate Student Mentoring

2019- Joseph Weissman (Math@VT).

2018- Stephen Timmel (Math@VT).

2015-2017 Arturo Vargas (CAAM@Rice).
PhD: *Hermite Methods for the Simulation of Wave Propagation*, (pdf).
First position after PhD: Postdoctoral researcher at LLNL.

2012-2017 Zheng Wang (CAAM@Rice).
MA: *Modeling Laser-Induced Thermotherapy in Biological Tissue*, (pdf), 2015.
PhD: *GPU-accelerated discontinuous Galerkin methods on hybrid meshes: applications in seismic imaging*, (pdf).
First position after PhD: Software Engineer at Google.

2012–2015 David Medina (CAAM@Rice):
MA: *OCCA: A Unified Approach to Multi-Threading Languages*, 2014, (pdf).
PhD: *OKL: A Unified Language for Parallel Architectures*, 2015, (pdf).
First position after PhD: Quantitative Software Engineer at Two Sigma.

2011–2013 Nichole Stilwell (CAAM@Rice).
MA: *gNek: A GPU Accelerated Incompressible Navier Stokes Solver*, (web), 2013.
Currently a pilot with the USAF.

2011–2015 Rajesh Gandham (CAAM@Rice).
PhD: *High performance high-order numerical methods: applications in ocean modeling*, 2015, (web).
First position after PhD: Computational Scientist at Stone Ridge Technology.

2010–2015 Thomas Reid Atcheson (CAAM@Rice).
MA: *Explicit Discontinuous Galerkin Methods for Linear Hyperbolic Problems*, (web), 2013.
PhD: *Accelerated Plane-wave Discontinuous Galerkin for Heterogeneous Scattering Problems*, 2015, (web).
Current position: Accelerator Software Engineer at Numerical Algorithms Group.

Fall 2010 Yingpei Wang (CAAM@Rice).

2009–2012 A.J. Hergenroeder (CAAM@Rice) (Co-advised with Mark Embree).
MA thesis: *Moment Matching and Modal Truncation for Linear Systems*, (web), 2013.
Currently working at Charles River Associates, Washington DC.

2009–2010 Xin Wang (CAAM@Rice) (Co-advised with Bill Symes).
MA thesis: *Discontinuous Galerkin Time Domain Methods for Acoustics and Comparison with Finite Difference Time Domain Methods*, (web).
Currently working at BP.

2011 Toni Tullius (CAAM@Rice) (Co-advised with Beatrice Riviere), 2009-2011.
MA Thesis: *Accelerated Discontinuous Galerkin solvers with the Chebyshev Iterative Method on the Graphics Processing Unit*, (web).

Summer 2007 Russell Carden (CAAM@Rice) (Summer co-mentor with Mark Embree).

2002–2007 Tommy Binford (CAAM@Rice), 2002-2007.
MA Thesis: *A Survey of Discontinuous Galerkin Methods for Solving the Time Domain Maxwell's Equations.*
Currently working at Weatherford International.

Undergraduate Student Mentoring

2018 Dallas Viar, Nick Polidoro, Tulika Chaudhary, Weichen Li, Chris Jurgens, summer undergraduate research assistants.

2016 William Winter, summer undergraduate research assistant.

2013–2014 Tim Moon, summer undergraduate research assistant funded by the Rice VIGRE project, Physics senior thesis: *brainNek: Modeling Laser-Induced Thermal Therapy for Brain Cancer with Spectral Elements on GPUs*, 2014, (web)

2013 Michael Franco, summer undergraduate research assistant.

2013 Jake Bruggemann,
Physics senior thesis: *Computational Fluid Flow for Non-Newtonian Fluids Using Spectral Element Methods and GPUs.*

2008-2009 Jeffrey Bridge, summer undergraduate research assistant.

2007 Tobin Isaac, spring & summer undergraduate research assistant.

Other Student Related Activities

2007-2015 Faculty Advisor, SIAM Student Chapter at Rice University.

Ph.D. Thesis Committees

2018 Ruchi Guo (Math @ VT), Petr Cagas (Aero/Ocean @VT).

2017 Ross Glandon (Computer Science @ VT).

2016 Shelvean Kapita, (Mathematical Sciences) @ University of Delaware .

2015 Paolo Pacciarini (Mathematical Models and Methods in Engineering) @ Politecnico di Milano, Noel Chalmers (Math, University of Waterloo, link), Jizhou Li (CAAM, Rice University, link), Deepak Majeti (CS, Rice University, link)

2014 Jeffrey Reep (Physics, Rice University), Kamal Sharma (CS, Rice University, link)

2013 Kenneth Davis (MEMS , Rice University, link)

2012 Xin Wang (CAAM, Rice University, link), Hong Lu (Physics, Rice University, link)

2011 Natasha Sharma (Mathematics, University of Houston, link)

2010 Sean Hardesty (CAAM, Rice University, link), Andreas Klöckner (Division of Applied Mathematics, Brown University, link), Aycil Cesmelioglu (CAAM, Rice University, link), Leila Issa (CAAM, Rice University, link), Yang Zhang (CS, Rice University, link)

2009 Huifang Li (Mathematics, University of Houston, link)

2007 Edward Castillo (CAAM, Rice University), Todd Watermann (CS, Rice University, link)

2006 Allan Engsig-Karup (Scientific Computing, Danish Technical University link)

2005 Jesper Grooss (Applied Math, Danish Technical University link)

Earlier Miroslav Joler, (ECE, U. New Mexico), Manuela Longoni de Castro, (Math& Stats, U. New Mexico), Dagoberto Justo, (Math & Stats, U. New Mexico)

Ph.D. Thesis Proposal Committees

Yin Huang (2014), Xin Wang (2011), Josef Sifuentes (2009), Prince Chidyagwai (2009), Sean Hardesty (2009), Aycil Cesmelioglu (2009), Edward Castillo (2007).

MA Thesis Committees

Codi Wiersma (2018), Arturo Vargas (2015), Mario Bencomo (2015), Muhong Zhou (2014), Jizhou Li (2013), Yin Huang (2012), Shirin Sardar (2011),Kenneth Davis, (MEMS , Rice University, 2011), Xin Yang (2011), Nabor Reyna (2011), Klaus Wiegand (2010), Eelco Nederkoorn (2009), Igor Terentyev (2009), Josef Sifuentes (2006), Patricia Howard (2006), Leila Issa.

Visiting Graduate Students

2018 Thilina Rathnayake (University of Illinois Urbanna-Champaign), July 2018.

2017 Niklas Wintermeyer (University of Cologne), September 2017.

2013–2014 Ali Karakus (Middle East Technical University) funded by a grant by The Scientific and Technological Research Council of Turkey, Research project: *A Spectral/hp Discontinuous Finite Element Method for Incompressible Multi-Fluid Systems*, August 2013-July 2014.

2009 Steffen Schomann (Hamburg University), January-February 2009.

2008 Nico Gödel (Hamburg University), October 2008.

Andreas Klöckner (Brown U. and Post-doc, NYU), October 2008, May 2009, July 2011.

2006 Allan Engsig-Karup (Danish Technical University), January 2006.

Nicolas Jeannequin (University of Oxford), April-June 2006.

Visiting Post-docs

2014 Axel Modave (Université Catholique de Louvain), March 2014.

2013 Florian Kummer (Research associate, Stanford University, funded by a DFG Fellowship), October 2013.

Visiting Faculty

2014–2015 Jean-Francois Remacle (Université Catholique de Louvain), AY 2014-2015.

Computing

I have worked with undergraduates, graduate students, post-docs and visitors to build and maintain a group of workstations incorporating the latest graphics processing units, including GPUs donated by NVIDIA and equipment and funding donated by AMD. These machines are used for developing next generation parallel algorithms, student's research as well as hosting computational workshops and classes.

Mathematical and HPC Related Software Development

ARTSY Developer (2018-): Accelerated Ray Tracing SYstem: a Whitted style race tracer for visualization of high-order finite element data.

occaBench Developer (2018-): a portable microbenchmarking tool based on mixbench.

libParanumal Co-developer (2016-): a platform for developing high order, lightweight, miniapps for exploring scalability on parallel systems with emerging architectures.

BBDG Co-developer (2015-): Bernstein-Bezier based discontinuous Galerkin methods for solving conservation laws, (web).

nodes Co-developer (2014-): library of routines to calculate optimized interpolation nodes for high-order Lagrange finite elements in collaboration with Jesse Chan, (web).

vNek Co-developer (2014-): a GPU accelerated hybrid mesh, adaptive, high-order, finite-element solver in collaboration with Jean-Francois Remacle.

gNUMA Co-developer (2014-): a mini-app testbed for the numerical methods and many-core parallel algorithms developed as part of a project to port the Non-hydrostatic Unified Model of the Atmosphere framework to accelerators. To be released on Github.

Digital rock Co-developer (2013): a GPU accelerated lattice Boltzmann simulator for estimating rock permeability from CT images.

OCCA Co-developer (2013-2014): a single source threading language that can be compiled as OpenCL, CUDA, or OpenMP, (web) github, SIAM CSE 2015s slides.

brainNek Co-developer (2013-): a GPU accelerated spectral element based simulation tool for patient specific hyperthermia cancer treatment.

RiDG Co-developer (2013-): experimental platform for accelerated seismic forward wave modeling on GPU clusters.

gNek Co-developer (2012-): a GPU accelerated spectral element based incompressible flow solver in collaboration with Paul Fischer (ANL).

pasidg Co-developer (2012-): GPU-DG based shallow water equation solver developed for the Pan-American Advanced Studies Institute Workshop on Tsunamis, Storm Surges and Tidal Phenomena. Conference web-site: (web).

pydgeon Co-developer (2009-2010): python+OpenCL implementation of discontinuous Galerkin methods for acoustics to accompany *Jade edition of the GPU Computing Gems* edited by Wen-mei Hwu (web)book. Code page: (web).

MIDG Developer (2008): GPU discontinuous Garlerkin PDE solvers (web).

nudg++ Co-developer (2007-): nodal unstructured discontinuous Galerkin solvers (web).

Nodal DG Co-developer (2005-): MATLAB nodal unstructured discontinuous Galerkin codes to accompany textbook (web).

Sledge++ Lead developer (2003-2009): object oriented C++ computational library for adaptive, high-order, finite element, edge element and discontinuous Galerkin methods on conforming, non-conforming & overlapping meshes.

USEMe Lead developer (1999-2007): unstructured discontinuous Galerkin spectral element solver for electromagnetics.

Nektar Co-developer (1994-1998): hp-FEM solver for compressible & incompressible Navier-Stokes and MHD (web).

Computing Experience

1983– I have extensive programming experience. Since 1993 I have developed sophisticated computer codes using a combination of C, C++, F77, MPI, OpenMP, OpenCL, CUDA, and OpenGL.