Tim Warburton

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Education

1994-1999 **Brown University**
Ph.D. in Applied Mathematics
"Spectral/hp Methods on Polymorphic Multi-Domains: Algorithms and Applications"

1993-1994 **Brown University**
Sc.M. in Applied Mathematics.

1990-1993 **Oxford University, UK**
B.A./M.A. in Mathematics.

Research Interests

Analysis of modern, high-order, unstructured, finite-element methods. Development of associated efficient algorithms, including parallel computational techniques, adaptivity, and advanced preconditioning methods for solving linear systems. Scientific computing applications for these methods including electromagnetics, acoustics and computational fluid dynamics in complex geometries. Simplification and introduction of these techniques to academic, defense and industrial environments. Development of artificial radiation boundary conditions for the time-domain Maxwell's equations.

Academic Positions

1. July 2008 - present: Associate Professor
   Department of Computational and Applied Mathematics, Rice University.
2. July 2004 - June 2008: Assistant Professor
   Department of Computational and Applied Mathematics, Rice University.
3. August 2001 - December 2004: Assistant Professor
   Department of Mathematics and Statistics, University of New Mexico.
4. June 2000 - August 2000: Visitor
   ICASE, NASA Langley Research Center.
5. October 1999 - August 2001: Visiting Research Associate
   Division of Applied Mathematics, Brown University.
6. November 1998 - October 1999: Research Officer
   Oxford University Computing Laboratory.

7. August 1993 - November 1998: Research Assistant
   Division of Applied Mathematics, Brown University.

8. September 1996 - June 1997: Teaching Assistant
   Division of Applied Mathematics, Brown University.

Consulting

- October 2009 - present: Hypercomp Inc.
- October 2001 - present: Division of Applied Mathematics, Brown University.

Recent Presentations (* invited)

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

2. *A Low Storage High-Order Discontinuous Galerkin Method for Curvilinear Domains**, Applied and Computational Mathematics Seminar, University of North Carolina at Charlotte, NC, 2009.

3. *Advanced Numeric Computing Techniques**, Key Session, NVIDIA Research Summit, part of the NVIDIA GPU Technology Conference, San Jose, CA, 2009.

4. *A Low Storage High-Order Discontinuous Galerkin Method for Curvilinear Domains**, Frontiers of Geophysical Simulation Workshop, National Center for Atmospheric Research, Boulder, CO, 2009.

5. *Accelerating Discontinuous Galerkin Finite Element Methods**, ExxonMobil Upstream Technical Training Center, Houston, TX, 2009.

6. *Towards High Resolution Numerical Algorithms for Wave Dominated Physical Phenomena*, AFOSR Computational Program Review, Washington, DC, 2009.

7. *Discontinuous Galerkin Methods for Electromagnetics**, International Conference on Spectral and High Order Methods, Norges Teknisk-Naturvitenskapelige Universitet, Trondheim, Norway, 2009.

8. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, Workshop on Computational Methods for Hyperbolic Problems, University of Waterloo, Canada, 2009.

9. *Accelerating the DG Time-Domain Method*, SIAM Conference on Computational Science and Engineering, Miami, FL, 2009.

10. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, Numerical Analysis Seminar, Texas A&M, TX, 2009.

11. *Accelerating the Time-Domain Discontinuous Galerkin Method for Wave Propagation*, FEMTEC09, NV, 2009.

12. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, Math Departent, Southern Methodist University, TX, 2008.

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

14. *Accelerating Time-Domain Discontinuous Galerkin Methods for Electromagnetics**, Oberwolfach Conference on Non-traditional Finite Element Methods, Mathematisches Forschungsinstitut Oberwolfach, Germany, 2008

15. *Advances in Wave Propagation with Discontinuous Galerkin Methods**, Center for Computation and Technology Colloquium, Louisiana State University, LA, 2008.

16. *Advances in Wave Propagation with Discontinuous Galerkin Methods**, Discontinuous Galerkin Methods for Partial Differential Equations, Banff International Research Station, Canada, 2007.

17. *Advances in Wave Propagation with Discontinuous Galerkin Methods**, Mathematics and Computer Science Division, Argonne National Laboratory, Chicago, USA, 2007.

18. *Improving the CFL Condition for Discontinuous Galerkin Methods**, The 8th International Conference on Mathematical and Numerical Aspects of Waves, Reading, UK, 2007.

19. *Improving the CFL Condition for Discontinuous Galerkin Methods*, 6th International Congress on Industrial and Applied Mathematics, Zurich, Switzerland, 2007.

20. *Improving the CFL Condition for Discontinuous Galerkin Methods**, International Workshop on High-Order Finite Element Methods, Herrsching, Germany, 2007.

21. *Advances in Numerical Wave Propagation: Hanging Nodes, Spurious Modes, & Simulation Codes**, Computer and Information Technology Institute (CITI) Luncheon, Rice University, Houston, TX, 2007.

22. *Survey of Discontinuous Galerkin Methods for Time-Domain Electromagnetics**, Oberwolfach Conference on Computational Electromagnetism and Acoustics, Mathematisches Forschungsinstitut Oberwolfach, Germany, 2007

23. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, Department of Mathematics, Rice University, Houston, TX, 2006

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

25. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, 7'th World Congress on Computational Mechanics, Los Angeles, CA, USA, 2006

26. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, SIAM Annual Meeting, Boston, MA, 2006

27. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, ICES, U. Texas at Austin, TX, USA 2006

28. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, Computational Methods for Electromagnetism, Southeastern Section MAA & SIAM Southeast Atlantic Section, Auburn, AL, USA, 2006

29. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, Advances in Computational Scattering, BIRS, Banff, Canada, 2006

30. *Advances in Wave Propagation with the Discontinuous Galerkin Method**, Scientific Computing Seminar, University of Houston, Houston, TX, USA, 2006

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

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

33. *Spurious Solutions and the Discontinuous Galerkin Method on Nonconforming Meshes*, Waves'05, Providence, RI, USA, 2005

34. *Solving Scattering Problems for Maxwell's Equations Using Polygonal Artificial Boundaries*, Waves'05, Providence, RI, USA, 2005

35. *Comparing Continuous and Discontinuous Galerkin Methods for Maxwell's Equations*, USNCCM8, Austin, TX, USA, 2005

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

37. *Bridging the Divide Between Compatible and Weakly Compatible Finite Element Methods**, CAAM, Rice University, Houston, TX, USA, 2004

38. *, PDE's and Applications, Notre Dame University, South Bend, IN, USA, 2003

39. *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, 2003

40. *High Order Nodal DG-FEM for the Maxwell Eigenvalue Problem*, USNCCM7, Albuquerque, NM, USA, 2003

41. *The Unstructured Spectral Element Method and USEMe Computer Code**, Math Department, Notre Dame University, South Bend, IN, USA, 2003

42. *, Math Department & Geophysics Department, University of Chicago, Chicago, IL, USA, 2003

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

44. *, Math Department, University of Arizona, AZ, USA, 2002

45. *, NCAR (National Center for Atmospheric Research), CO, USA, 2002

46. *, Math Department, University of New Mexico, Albuquerque, NM, USA, 2001

47. *Nodal Unstructured Spectral Elements for Conservation Laws **, Math Department, Texas A&M University, College Station, TX, USA, 2001
48. *High Order Finite Element Methods in Matlab and Beyond*, Division of Applied Math, Brown University, Providence, RI, USA, 2001
49. *, CASC, Lawrence Livermore National Laboratory, Livermore, CA, USA, 2001
50. Finite Elements in Fluids 2000, Austin, TX, USA, 2000
51. *Application of Nodal unstructured spectral elements to Maxwell's equations*, p-FEM 2000, St. Louis, MO, USA, 2000
52. *, Electromagnetics Research Branch, NASA Langley Research Center, Hampton, VA, USA, 2000
53. CERFACS, Toulouse, France, 1999
54. DGM99, Newport, RI, USA, 1999
55. *Overlapping Schwarz preconditioners for solving elliptic problems on polymorphic/hp elements*, ICIAM99, Edinburgh, UK, 1999

Teaching Experience

1. Taught Introduction to Computational Engineering, CAAM, Rice University, Spring 2008.
2. Taught Computational Science II, CAAM, Rice University, Spring 2008.
3. Taught Numerical Methods For Partial Differential Equations, CAAM, Rice University, Spring 2005 & 2006.
4. Taught Computational Science I, CAAM, Rice University, Fall 2004, 2005, 2006, 2008, & 2009.
5. Created and taught an innovative course in numerical solution of partial differential equations using the discontinuous Galerkin method, University of New Mexico, Spring 2003.
6. Developed and taught an innovative course in introductory numerical computing, University of New Mexico, Spring 2002, Fall 2002, & Fall 2003.
7. 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).
8. 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.
9. Organized and presented a seminar series: *hp Finite Elements* for the graduate students and faculty of the Oxford University Computing Laboratory, Spring 1999.

10. Provided mentoring for graduate students in the Center for Fluid Mechanics, Brown University, 1996 to 1998.
11. Teaching assistant in charge of computing assistance for *all* Brown University, Applied Mathematics courses with computational content, Fall 1996 and Spring 1997.

Professional Service

1. Instructor: High Performance Computing Summer Institute organized by the Ken Kennedy Institute for Information Technology, 2009.
2. Co-organizer of two minisymposium at SIAM Computational Science and Engineering, 2009.
3. Member of the scientific commmittee for FEMTEC 2009.
4. Instructor: Parallel Numerical Methods for Partial Differential Equations , Rocky Mountain Mathematics Consortium Summer School, University of Wyoming, WY, 2008.
5. Co-organizer of minisymposium at ICIAM 2007.
6. Chair for miniminisymposium session on Discontinuous Galerkin Methods at WCCM07.
7. Co-organizer of two minisymposia at ICOSAHOM, 2004.
8. Reviewer for SIAM Journal on Numerical Analysis, 2005 & 2008..
9. Reviewer for Monthly Weather Review, 2005 & 2007.
10. Reviewer for Journal of Scientific Computing, 2007 & 2008.
11. Reviewer for Computing in Science and Engineering.
12. Reviewer for Journal of Computational and Applied Mathematics, 2007 & 2008.
13. Reviewer for Computational Methods in Applied Mechanical Engineering, 2005, & 2007
14. Reviewer for Microfluidics and Nanofluidics, 2005.
15. Reviewer for International Journal for Numerical Methods in Fluids, 2005.
16. Reviewer for SIAM Computational Science and Engineering Book Series, 2005.
17. Reviewer for Applied Numerical Analysis and Computational Mathematics, 2005.
18. Reviewer for SIAM Journal on Scientific Computing, 2005 & 2007.
19. Reviewer for Applied Numerical Mathematics, 2005.
20. Reviewer for Journal of Fluids Engineering (ASME), 2006.
21. Reviewer for Theoretical and Computational Fluid Dynamics, 2006.
22. Reviewer for Journal of Computational Physics, 2006, & 2007.
23. Reviewer for Journal of Engineering Mathematics, 2006.

24. Reviewer for IMA Journal of Numerical Analysis, 2007.
25. Panel reviewer for DOE applied mathematics, 2004 & 2005.
26. Panel reviewer for NSF DMS, 2005, 2006, 2007 & 2009.

Departmental and University Service

1. Huifang Li, graduate student in the Mathematics department, University of Houston (PhD Thesis committee), 2009.
2. Xin Wang, graduate student in CAAM (Co-advised with Bill Symes), 2009-.
3. Toni Tulius, graduate student in CAAM (Co-advised with Beatrice Riviere), 2009-.
4. Rice University Research Subcommittee, 2009.
5. Served on Solar Physics Faculty Search Committee (department of Physics, Rice University), 2009.
6. Josef Sifuentes, graduate student in CAAM (Ph.D. Thesis Proposal Committee), 2009.
7. Prince Chidyagwai, graduate student in CAAM (Ph.D. Thesis Proposal Committee), 2009.
8. Sean Hardesty, graduate student in CAAM (Ph.D. Thesis Proposal Committee), 2009.
9. Igor Terentyev, graduate student in CAAM (Masters Thesis Committee), 2009.
10. Hosted visiting graduate students: Nicolas Jeannequin (Oxford U.), Andreas Klöckner (Brown U.), Nico Gödel (Hamburg University), Steffen Schomann (Hamburg University).
11. Co-organizing seminar series in Scientific Computing and Numerical Analysis with Beatrice Riviere, CAAM, Fall 2008, Spring 2009, Fall 2009.
12. Jeffrey Bridge, undergraduate research assistant (Directed summer 2008-).
13. Tetyana Vdovina, post-doctoral associate in CAAM (Co-sponsored with Bill Symes, 2007-).
14. Russell Carden, graduate student in CAAM (Summer co-mentor with Mark Embree, 2007).
15. Tobin Isaac, undergraduate research assistant (Directed spring & summer 2007).
16. Tommy Binford, graduate student in CAAM. Masters Thesis: A Survey of Discontinuous Galerkin Methods for Solving the Time Domain Maxwell's Equations, 2006.
17. Josef Sifuentes, graduate student in CAAM (Master's Thesis Committee).
18. Patricia Howard, graduate student in CAAM (Master's Thesis Committee).
19. Leila Issa, graduate student in CAAM (Master's Thesis Committee).
20. Edward Castillo, graduate student in CAAM (Ph.D. Thesis Proposal and Ph.D. Committee, 2007).

21. Todd Watermann, Ph.D. CS Rice University (Ph.D. Thesis Committee, 2006).

22. Allan Engsig-Karup, Ph.D. Danish Technical University (Ph.D. Thesis Committee, 2006).

23. Jesper Grooss, Ph.D. Danish Technical University (Ph.D. Thesis Committee, 2005).

24. Miroslav Joler, Ph.D. in ECE, U. New Mexico (Ph.D. Thesis Committee).

25. Manuela Longoni de Castro, Ph.D. in Math& Stats, U. New Mexico (Ph.D. Thesis Committee & sponsor).

26. Dagoberto Justo, Ph.D. in Math & Stats, U. New Mexico (Ph.D. Thesis Committee & sponsor).

27. Served on CAAM Graduate Committee, Rice University 2005.

28. Served on the CAAM A-exam Committee, Rice University.

29. Served as chair of the CAAM Computing Committee, Rice University 2009

30. Served on the CAAM Computing Committee, Rice University 2004 & 2005

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

Recent and Current Funding

1. *High-Order Finite Element Methods for Solution of Partial Differential Equations*, PI: Tim Warburton, Sandia University Research Program, 10/01/02-09/30/03, $35,000.

2. *High-Order Finite Element Methods for Solution of Partial Differential Equations (supplement)*, PI: Tim Warburton, Sandia University Research Program, 6/01/02-09/30/03, $9,700.

3. *High-Order Finite Element Methods for Solution of Partial Differential Equations (renewal)*, PI: Tim Warburton, Sandia University Research Program, 10/01/03-09/30/04, $40,000.

4. *Adaptive, High-Resolution Simulation Methods for Wave Propagation in Heterogenous Media*, PI: Thomas Hagstrom, CO-PI: Tim Warburton, Army Research Office, 03/01/03-02/28/06, $270,000.

5. *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), NSF, 09/01/03-08/31/07, $317,503 (UNM), $1,000,000 (Total Project).

6. *Compatible and Nearly Compatible Finite Element Discretizations: Algorithms, Analysis and Applications*, PI: Tim Warburton, DMS-Computational Mathematics, NSF, 07/01/05 - 06/30/08, $186,195.

7. *Towards High Resolution Numerical Algorithms for Wave Dominated Physical Phenomena*, PI: Tim Warburton, AFOSR, 07/01/05 - 11/30/07, $ 242,259.

8. *Collaborative Research: Tuning-Free Adaptive Multilevel Discontinuous Galerkin Methods for Maxwell's Equations*, PI: Tim Warburton, NSF-DMS 07/09/08-.

Publications

Book:

1. 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, 2008.

Articles in Progress:

1. **T. Warburton** and T. Hagstrom, *Complete Radiation Boundary Conditions for Electromagnetic Scattering*.

2. **T. Warburton**, T. Hagstrom, and L. Wilcox, *Local Time Stepping for Discontinuous Galerkin Methods*.

Journal Articles in Press:

1. 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.,

Published Journal Articles:

1. A. Klöckner, **T. Warburton**, J. Bridge, and J.S.Hesthaven, *High-Order Discontinuous Galerkin Methods on Graphics Processors*, Journal of Computational Physics, Volume 228, Issue 21, Pages 7863-7882, 2009.

2. 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, 2009.

3. 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, 2009.

4. 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, 2009.

5. 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, 2008.

6. **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 2008.

7. 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, 2008.

8. F.X. Giraldo and **T. Warburton**, *A high-order Triangular Discontinuous Galerkin Oceanic Shallow Water Model*, accepted to International Journal of Numerical Methods in Fluids,Volume 56 Issue 7, Pages 899 - 925, 10 Jul 2007.

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

10. **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, 2006.

11. 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. (January 2007), pp. 39-58.

12. 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, 2005.

13. 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, 2004.

14. 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, 2004.

15. 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, 2004.

16. **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, 2003.

17. J. S. Hesthaven and **T. Warburton**, *High-Order Accurate Methods for Time Domain Electromagnetics*, Computer Modeling Engineering Science, 5(5), 395-408, 2004.

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

19. 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, 2002.

20. 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, Sep 2002, pp. 186-221

21. 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, Sep 2002, pp. 499-525.

22. **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, 2000.

23. L.F. Pavarino and **T. Warburton**, *Overlapping Schwarz Methods for Unstructured Spectral Elements*, Journal of Computational Physics, 160:298-317, 2000.

24. 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, 2001.

25. 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, March 2001.

26. 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, 1999.

27. **T. Warburton** and G. Karniadakis, *A Discontinuous Galerkin Method for the Viscous MHD Equations*, Journal of Computational Physics, 152:608-641, 1999.

28. **T.C. Warburton**, S.J. Sherwin, and G.E. Karniadakis, *Spectral Basis Functions for 2D Hybrid hp Elements*, SIAM Journal of Scientific Computation, Volume 20, 5:1671-1695, 1999.

29. **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, 1999.

Articles in Conference Proceedings:

1. 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, Barsilien, Two page abstract, 2009.

2. 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, Barsilien, Two page abstract, 2009.

3. 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, Barsilien, Two page abstract, 2009.

4. 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.

5. N. Gödel, **T. Warburton**, M. Clemens, *Modelling Effects of Electromagnetic Waves on Thin Wires with a High-Order Discontinuous Galerkin Method*, International Conference on Spectral and High Order Methods (ICOSAHOM 09), Trondheim, Norway, Two page abstract submitted, 2009.

6. N. Gödel, S. Schomann, **T. Warburton**, and M. Clemens, *Discontinuous Galerkin Methods for High Frequency Electromagnetic Computations*, 3rd European Conference on Antennas and Propagation, 2009.

7. 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), Hensinki University of Technology, Hensinki, Finland, 2008.

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

9. **Timothy Warburton**, *Accelerating the Discontinuous Galerkin Time-Domain Method*, MFO Report Nonstandard Finite Element Methods, No. 36/2008.

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

11. **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.

12. **T. Warburton**, *A Survey of Discontinuous Galerkion Methods for Time-Domain Electromagnetics*, Oberwolfach Conference on Computational Electromagnetism and Acoustics, 2007.

13. **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, June 20-24, 2005.

14. 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, June 20-24, 2005.

15. 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 Flbuid and Solid Mechanics, June 17-20, 2003, Cambridge, Massachusetts.

16. 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, June 17-20, 2003, Cambridge, Massachusetts.

17. J.S. Hesthaven and **T. Warburton**, *High-Order Unstructured Grid Methods for Time-Domain Electromagnetics*, Proceedings of 40th AIAA Aerospace Sciences Meeting and Exhibit, January 14-17, 2002, Reno, Nevada.

18. 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, 2001.

19. 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, 1999.

20. **T. Warburton**, *Application of the Discontinuous Galerkin Method to Maxwell's Equations Using Unstructured Polymorphic hp-Finite Elements.* International Symposium on Discontinuous Galerkin Methods, 1999.

21. R.M. Kirby, **T.C. Warburton**, S.J. Sherwin, A. Beskok and G.E. Karniadakis, *The Nektar Code: Dynamic Simulations without Remeshing.* The 2nd International Conference on Computational Technologies for Fluid/Thermal/Chemical Systems with Industrial Applications.

22. R.M. Kirby, **T.C. Warburton**, I. Lomtev, and G.E. Karniadakis, *A Discontinuous Galerkin Spectral/hp Method on Hybrid Grids.* International Conference on Spectral and High Order Methods, June 1998.

23. A. Beskok and **T.C. Warburton**, *Micro-fluidic design and fluid-structure interaction analysis of a micro-pump*, IMECE 98, Proceedings of the ASME Dynamic Systems and Control Division, 1998.

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Software

1. Co-developer of Nektar from 1994 to 1998 *http://www.nektar.info*, (hp-FEM solver for compressible & incompressible Navier-Stokes and MHD)
2. Lead developer of USEMe, 1999 to present, *http://www.useme.org*, (unstructured discontinuous Galerkin spectral element solver for electromagnetics)
3. Lead developer of Sledge++, 2003 to present, (object oriented C++ computational library for adaptive, high-order, finite element, edge element and discontinuous Galerkin on conforming, non-conforming & overlapping meshes).
4. Co-developer of nudg++, 2007 to present, *http://www.nudg.org*, (nodal unstructured discontinuous Galerkin solvers)
5. Developer of MIDG, 2008, *http://www.caam.rice.edu/~timwar/RMMC*, (GPU discontinuous Garlerkin PDE solvers)