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Department of Mathematics  
Southern Methodist University  
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## Education

- Ph.D. in Applied Mathematics, California Institute of Technology, Pasadena, CA, June 1983
- Thesis Title: Reduction of Unbounded Domains to Bounded Domains for Partial Differential Equation Problems
- Thesis Advisor: Professor H.B. Keller
- A.B. summa cum laude in Mathematics, Dartmouth College, Hanover, NH, June 1979

## Positions

- 2008-: Professor, Department of Mathematics, Southern Methodist University, Dallas, TX
- 1996-: Professor, Department of Mathematics and Statistics, University of New Mexico, Albuquerque, NM
- Spring 2005: Visiting Researcher, Center for Applied Scientific Computing, Lawrence Livermore National Laboratory, Livermore, CA
- Fall 2004: Visiting Professor, Division of Applied Mathematics, Brown University, Providence, RI
- 1987-2004: Consultant, Institute for Computational Mechanics in Propulsion, NASA Glenn Research Center, Cleveland, OH
- 1997-98: Visiting Researcher, Courant Institute of Mathematical Sciences, New York University, New York, NY

- Fall 1997: Visiting Researcher, Mittag-Leffler Institute, Djursholm, Sweden
- 1996-2000: Consultant, Fast Mathematical Algorithms and Hardware Corporation, Hamden, CT
- 1990-96: Associate Professor, Department of Mathematics and Statistics, University of New Mexico, Albuquerque, NM
- 1992-94: Consultant, Los Alamos National Laboratory, Los Alamos, NM
- 1992-94: Consultant, Ecodynamics Research Associates, Albuquerque, NM
- 1984-90: Assistant Professor, Department of Applied Mathematics, SUNY at Stony Brook, Stony Brook, NY
- 1983-84: Research Associate, Mathematics Research Center, University of Wisconsin-Madison, Madison, WI
- Fall 1983: Lecturer, Computer Sciences Department, University of Wisconsin-Madison, Madison, WI
- Summer 1983: Research Associate, Applied Mathematics Department, California Institute of Technology, Pasadena, CA
- Summer 1982: Research Staff Member, Magnetic Recording Devices Group, IBM-Watson Research Center, Yorktown Heights, NY
- Summer 1980: Engineer, Automated Systems Section, NASA Jet Propulsion Laboratory, Pasadena, CA

## Publications

### Invited

1. Boundary conditions for models of slightly compressible flows, (with J. Lorenz), *Applications of Boundary and Interior Layers*, J.J.H. Miller, ed., (1993), 53-93.
2. On high-order radiation boundary conditions, *IMA Volume on Computational Wave Propagation*, B. Engquist and G. Kriegsmann, eds., Springer-Verlag (1996), 1-22.

3. On progressive wave expansions and asymptotic boundary conditions for hyperbolic systems, (with S.I. Hariharan), *IMA Volume on Computational Wave Propagation*, B. Engquist and G. Kriegsmann, eds., Springer-Verlag (1996), 23-44.
4. Experiments with approximate radiation boundary conditions for computational aeroacoustics, (with J. Goodrich), *Appl. Num. Math.*, 27, (1998), 385-402.
5. A formulation of asymptotic and exact boundary conditions using local operators, (with S.I. Hariharan), *Appl. Num. Math.*, 27, (1998), 403-416.
6. Radiation boundary conditions for the numerical simulation of waves, *Acta Numerica*, (1999), 47-106.
7. On the theory of exact and approximate boundary conditions for linearized compressible flow problems, (with J. Goodrich and L. Xu), in *Artificial Boundaries and Layers, Domain Decomposition Methods. Applications to Large Scale Computation*, L. Tourette and L. Halpern, eds., NOVA Science, (2001) 201-216.
8. New results on absorbing layers and radiation boundary conditions, *Topics in Computational Wave Propagation*, M. Ainsworth, P. Davies, D. Duncan, P. Martin, and B. Rynne, eds., Springer-Verlag, (2003), 1-42.
9. Local high order absorbing boundary conditions for time-dependent waves in guides, (with D. Givoli, M. deCastro, and D. Tzemach), *J. Comput. Acoust.*, 15, (2007), 1-22.
10. Radiation boundary conditions for Maxwell's equations: A review of accurate time-domain formulations, (with S. Lau), *J. Comput. Math.*, 25, (2007), 305-336.

## Refereed Journals

1. Electrostatic disturbance forces on a 3-axis drag-free sensor (with A. Vijayaraghavan and D. Sonnabend), *J. of Guidance, Control and Dynamics*, 7, (1984), 286-294.
2. Exact boundary conditions at an artificial boundary for partial differential equations in cylinders (with H. B. Keller), *SIAM J. Math. Anal.*, 17, (1986), 322-341.
3. The numerical calculation of traveling wave solutions of nonlinear parabolic equations (with H. B. Keller), *SIAM J. of Sci. Stat. Comp.*, 7 (1986), 978-988.
4. Asymptotic expansions and boundary conditions for time dependent problems, *SIAM J. Numer. Anal.*, 23 (1986), 948-958.

5. Boundary conditions at outflow for a problem with transport and diffusion, *J. Comp. Phy.*, 69 (1987), 69-80.
6. Asymptotic boundary conditions and numerical methods for nonlinear elliptic problems on unbounded domains (with H. B. Keller), *Math. Comp.*, 48 (1987), 449-470.
7. Accurate boundary conditions for exterior problems in gas dynamics, (with S. I. Hariharan), *Math. Comp.*, 51, (1988) 581-597.
8. Multidimensional traveling wave solutions to reaction-diffusion equations, (with S. Buonincontri), *IMA J. Appl. Math.*, 43 (1989) 261-271.
9. Numerical experiments with a domain decomposition algorithm for nonlinear elliptic boundary value problems, (with R. P. Tewarson and A. Jazcilevich), *Appl. Math. Lett.*, 1, (1988), 299-302.
10. Asymptotic boundary conditions for dissipative waves: General theory, *Math. Comp.*, 56, (1991), 589-606.
11. Conditions at the downstream boundary for simulations of viscous incompressible flow, *SIAM J. Sci. Stat. Comp.*, 12, (1991), 843-858.
12. On the accurate long-time solution of the wave equation in exterior domains, (with S.I. Hariharan and R.C. MacCamy), *Math. Comp.*, 63 (1994), 507-539.
13. Open boundary conditions for a parabolic system, *Math. Comp. Mod.*, 20 (1994), 55-68.
14. All-time existence of smooth solutions to PDEs of mixed type and the invariant subspace of uniform states, (with J. Lorenz), *Adv. Appl. Math.*, 16 (1995), 219-257.
15. An efficient spectral method for ordinary differential equations with rational function coefficients, (with E. Coutsias and D. Torres), *Math. Comp.*, 65, 214 (1996), 611-635.
16. Integration preconditioners for differential operators in spectral  $\tau$ -methods, (with E. Coutsias, J. Hesthaven and D. Torres), *Houston J. Math*, (1996).
17. All-time existence of smooth solutions for slightly compressible flows, (with J. Lorenz), *SIAM J. Math. Anal.*, 27, (1998) 652-672.
18. Locating the discontinuities of a bounded function by the partial sums of its Fourier series, (with G. Kvernadze and H. Shapiro), *J. Sci. Comp.*, 14, (1999).

19. Rapid evaluation of nonreflecting boundary kernels for time-domain wave propagation, (with B. Alpert and L. Greengard), *SIAM J. Num. Anal.*, 37, (2000), 1138-1164.
20. An integral evolution formula for the wave equation (with B. Alpert and L. Greengard), *J. Comput. Phys.*, 163, (2000), 536-543.
21. Detecting the discontinuities of a function of  $V_p$  class by its integrated Fourier series, (with G. Kvernadze and H. Shapiro), *Comp. Math. Appl.*, 39, (2000), 25-43.
22. On the stability of approximate solutions of hyperbolic-parabolic systems and the all-time existence of smooth, slightly compressible flows, (with J. Lorenz), *Indiana Univ. Math. J.*, 51, (2002), 1339-1387.
23. Nonreflecting boundary conditions for the time-dependent wave equation, (with B. Alpert and L. Greengard), *J. Comput. Phys.*, 180, (2002), 270-296.
24. Analysis of extrapolation boundary conditions for the linearized Euler equations (with J. Nordström), *Appl. Num. Math.*, 44, (2002), 95-108.
25. Accurate radiation boundary conditions for the linearized Euler equations in Cartesian domains, (with J. Goodrich), *SIAM J. Sci. Comp.*, 24, (2002), 770-795.
26. Decay in time of incompressible flows (with H.-O. Kreiss, J. Lorenz and P. Zingano), *J. Math. Fluid Mech.*, 5, (2003), 231-244.
27. High-order radiation boundary conditions for the convective wave equation in exterior domains, (with S.I. Hariharan and D. Thompson), *SIAM J. Sci. Comp.*, 25, (2003), 1088-1101.
28. A new auxiliary variable formulation of high-order local radiation boundary conditions: Corner compatibility conditions and extensions to first order systems, (with T. Warburton), *Wave Motion*, 39, (2004), 327-338.
29. Hermite methods for hyperbolic initial-boundary value problems, (with J. Goodrich and J. Lorenz), *Math. Comp.*, 75, (2006), 595-630.
30. Finite element formulation with high order absorbing boundary conditions for time-dependent waves, (with D. Givoli and I. Patlashenko), *Computer Meth. Appl. Mech. Engrg.*, 195, (2006), 3666-3690.
31. On the spectral deferred correction of splitting methods for initial value problems (with R. Zhou), *Comm. Appl. Math. Comp. Sci.*, 1, (2006), 169-205.

32. Perfectly matched layers for hyperbolic systems: general formulation, well-posedness and stability, (with D. Appelö and G. Kreiss), *SIAM J. Appl. Math.*, 67, (2006), 1-23.
33. Grid stabilization of high-order one-sided differencing. I. First-order hyperbolic systems, (with G. Hagstrom), *J. Comput. Phys.*, 223, (2007), 316-340.
34. On symmetrization and energy estimates using local operators for partial differential equations, (with D. Appelö), *Comm. Part. Diff. Eq.*, 32, (2007), 1129-1145.
35. Perfectly matched layers in photonics computations: 1D and 2D nonlinear coupled mode equations, (with T. Dohnal), *J. Comput. Phys.*, 223, (2007), 690-710.
36. Regularization strategies for hyperplane classifiers: Application to cancer classification with gene expression data, (with E. Andries, S. Atlas, and C. Willman), *J. Bioinformatics and Comput. Biol.*, 5, (2007), 79-104.
37. High-order local absorbing boundary conditions for the wave equation: extensions and improvements, (with A. Mar-Or and D. Givoli), *J. Comput. Phys.*, (2008), 227, 3322-3357.
38. Taming the CFL number for discontinuous Galerkin methods on structured meshes, (with T. Warburton), *SIAM J. Num. Anal.*, (2008), 46, 3151-3180.
39. A general perfectly matched layer model for hyperbolic-parabolic systems, (with D. Appelö), *SIAM J. Sci. Comput.*, (2008), to appear.
40. Radiation boundary conditions for time-dependent waves based on complete plane wave expansions, (with T. Warburton and D. Givoli), *J. Comput. Math.*, (2008), to appear.

## Conference Proceedings

1. Domain reduction and asymptotic boundary conditions (with H.B. Keller), appearing in *Computational Methods in Applied Science and Engineering VII*, North-Holland (1986), 173-179.
2. Partitioning and parallel algorithms for kidney models (with R. P. Tewarson), *Math. Comp. Modelling*, 11, (1988), 847-849.
3. Far field expansion for anisotropic wave equations (with S.I. Hariharan), *Computational Acoustics: Scattering, Gaussian Beams and Aeroacoustics*, D. Lee, A. Cakmak, R. Vichnevetsky, eds., (1990), 283-294.

4. Asymptotic analysis of dissipative waves with applications to their numerical simulation, *Asymptotic Analysis and the Numerical Solution of Partial Differential Equations*, Lecture Notes in Pure and Applied Mathematics, vol. 130, H. Kaper, M. Garbey. eds., (1991), 99-112.
5. Consistency and convergence for numerical radiation conditions, *Mathematical and Numerical Aspects of Wave Propagation Phenomena*, G. Cohen, L. Halpern, P. Joly, eds., SIAM, (1991), 283-292.
6. Boundary conditions and the simulation of low Mach number flows, (with J. Lorenz), *Proceedings of the First International Conference on Theoretical and Computational Acoustics*, D. Lee and M. Schultz, eds., 2 (1994), 657-668.
7. On the convergence of local approximations to pseudodifferential operators with applications, *Proceedings of the Third International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, E. Bécache, G. Cohen, P. Joly and J. Roberts, eds., SIAM (1995), 474-482.
8. An outflow boundary condition for aeroacoustic computations, (with E. Hayder), *Computational Aeroacoustics*, FED-vol 219, ASME, (1995).
9. Accurate algorithms and radiation boundary conditions for linearized Euler equations, (with J. Goodrich), *2nd AIAA/CEAS Aeroacoustics Conference*, (1996).
10. A comparison of two accurate boundary treatments for computational aeroacoustics, (with J. Goodrich), *3rd AIAA/CEAS Aeroacoustics Conference*, (1997).
11. Accurate boundary treatments for Maxwell's equations and their computational complexity, (with B. Alpert, L. Greengard and S.I. Hariharan), *13th Annual Review in Applied Computational Electromagnetics*, II, (1998), 600-606.
12. Computation of steady and unsteady laminar flames: Theory, (with K. Radhakrishnan and R. Zhou), *34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, (1998).
13. Exact and high-order boundary conditions in the time domain, *IUTAM Symposium on Computational Methods for Unbounded Domains*, T. Geers, ed., Kluwer Acad. Pub., (1998), 179-186.
14. A systematic approach for constructing asymptotic boundary conditions for wave-like equations, (with S.I. Hariharan), *IUTAM Symposium on Computational Methods for Unbounded Domains*, T. Geers, ed., Kluwer Acad. Pub., (1998), 197-206.

15. Simulation of unsteady combustion phenomena using complex models, (with K. Radhakrishnan, S. Steinberg and R. Zhou), *35th AIAA/ASME/SAE/ASEE Joint Propulsion Conference*, (1999).
16. High order implementations of accurate boundary conditions, (with John Goodrich), *5th AIAA/CEAS Aeroacoustics Conference*, (1999).
17. Experiments with stable, high-order difference approximations to hyperbolic initial-boundary value problems, A. Bermudez, D. Gomez, C. Hazard, P. Joly and J. Roberts, eds., *Proceedings of the Fifth International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, SIAM, 2000, 827-831.
18. Absorbing layers and radiation boundary conditions for jet flow simulation (with I. Nazarov), *8th AIAA/CEAS Aeroacoustics Conference*, AIAA 2002-2606, 2002.
19. A new construction of perfectly matched layers for hyperbolic systems with applications to the linearized Euler equations, G. Cohen, E. Heikkola, P. Joly and P. Neittaanmäki, eds., *Proceedings of the Sixth International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, Springer-Verlag, 2003, 125-129.
20. High-order radiation boundary conditions for time-domain electromagnetics using an unstructured discontinuous Galerkin method, (with T. Warburton), K.J. Bathe, ed., *Computational Fluid and Solid Mechanics 2003*, Elsevier, 2003, 1358-1363.
21. Perfectly matched layers and radiation boundary conditions for shear flow calculations (with I. Nazarov), *9th AIAA/CEAS Aeroacoustics Conference*, AIAA 2003-3298, 2003.
22. Exact solutions to category 1, problem 3 (with I. Nazarov), *4th Computational Aeroacoustics Workshop on Benchmark Problems*, NASA/CP-2004-212954, 2004, 35-38.
23. Solution of category 1 benchmark problems using high-order difference methods and perfectly matched layers (with I. Nazarov), *4th Computational Aeroacoustics Workshop on Benchmark Problems*, NASA/CP-2004-212954, 2004, 355-370.
24. Construction of stable PML's for general  $2 \times 2$  symmetric hyperbolic systems (with D. Appelö), *10th International Conference on Hyperbolic Problems: Theory, Numerics, Applications*, 2004.
25. High-order methods and boundary conditions for simulating subsonic flows (with J. Goodrich, I. Nazarov and C. Dodson), *11th AIAA/CEAS Aeroacoustics Conference*, AIAA 2005-2869.



26. Solving scattering problems for Maxwell's equations using polygonal artificial boundaries (with D. Justo and T. Warburton), *7th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, 2005, 71-73.
27. Stability, convergence and parameter selection for high-order local radiation boundary conditions (with M. deCastro), *7th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, 2005, 85-87.
28. Adaptive finite-element implementation of arbitrary order radiation boundary conditions on rectangular domains (with D. Givoli and I. Patlashenko), *7th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, 2005, 88-90.
29. High-order single-step methods for simulating waves, *7th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, 2005, 390-392.
30. A Hermite-Taylor algorithm for simulating subsonic shear flows, (with J. Goodrich and G. Zhu), *12th AIAA/CEAS Aeroacoustics Conference*, 2006.
31. Optimal local radiation boundary condition sequences, optimal perfectly matched layers, and why they are the same, *Computational Electromagnetism and Acoustics*, Mathematisches Forschungsinstitut Oberwolfach, Report 5/2007, 39-41.
32. Experiments with Hermite methods for simulating compressible flows: Runge-Kutta time-stepping and absorbing layers, (with D. Appelö), *13th AIAA/CEAS Aeroacoustics Conference*, 2007.
33. On complete radiation boundary conditions and optimal absorbing layers, (with T. Warburton) *8th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, 2007, 12-17.
34. Taming the CFL condition for discontinuous Galerkin in two-dimensions, (with T. Warburton) *8th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena*, 2007, 273-275.

## Miscellaneous

1. Boundary conditions at artificial boundaries for singular perturbations, (with A. Baumert and J. Lorenz), Report RWTH-Aachen, (1995).
2. Much ado about nothing: Radiation boundary conditions at artificial boundaries for computational aeroacoustics, ICOMP News, (1997).

## Research Support

1. NSF Grant DMS-0610067, “Numerical Methods for Wave Propagation Problems: Efficient Resolution of Multiple Scales”, 8/06-7/09, \$150,000.
2. ARO Grant DAAD19-03-1-0146, “Adaptive, High-Resolution Simulation Methods for Wave Propagation in Heterogeneous Media”, 7/03-6/07, \$320,000.
3. NSF Grant DMS-0306285, “Numerical Methods for Multi-Scale Problems in Wave Propagation”, 6/03-5/06, \$128,190.
4. LLNL Subcontract, “High-order structured grid methods for wave propagation on complex unbounded domains”, 1/05-5/05, \$38,000.
5. NSF Grant ITR-0324911, “Collaborative Research ITR: An Integrated Simulation Environment for High-Resolution Computational Methods in Electromagnetics with Biomedical Applications”, 10/03-9/05, \$110,000. (T. Warburton co-PI).
6. BSF 2002019, “High-Order Absorbing Boundary Conditions”, 9/03-8/07, \$60,000, (with D. Givoli, Technion, Haifa).
7. NASA Grant NAG3-2692, “Computational Methods for Jet Noise Simulation”, 12/01-9/04, \$208,848.
8. NSF Grant DMS-9971772, “New Methods for the Simulation and Analysis of Waves”, 7/99-6/02, \$90,000.
9. NASA Grant NAG3-2322, “Accurate Boundary Conditions for Computational Aeroacoustics”, 1/00-1/01, \$86,532.
10. NSF Grant DMS-9977396, SCREMS (P.I.; Participants-Coutsias, Ellison, Lorenz, Sulsky), 9/99-8/00, \$30,000.
11. Sandia Contract BG-1442, “Data Visualization for Computational Electromagnetics”, (support for A. Yuen), 5/99-5/00, \$20,000.
12. NSF Grant DMS-9600146, “Computational Analysis of Multiple Scales Problems in Wave Propagation”, 6/96-12/99, \$60,000.
13. NASA NRA-96-LeRC-2, “Numerical Analysis of Complex Physical Processes in Reaction Dynamics”, 1/97-1/99, \$83,000.

14. NSF Grant DMS-9304406, “Computational Analysis of Wave Propagation in the Presence of Multiple Scales”, 7/93-6/96, \$56,500.
15. DOE, “Numerical and Asymptotic Studies of Complex Flow Dynamics”, 7/92-6/94, \$50,000, (with J. Lorenz and E. Coutsias).
16. NSF SCREMS Grant, 7/95-6/96, \$32,000. (D. Sulsky, J. Milgram co-PI’s.)
17. NSF - SCREMS Grant, 7/91-6/92, \$29,749, (PI with 6 participating faculty).
18. NSF Grant DMS-9108072, “Computation and Analysis of Waves and Their Dynamics”, 7/91-6/93, \$46,200.
19. NSF Grant DMS-8905314, “Computational Analysis of Fluid Flows: External Boundaries, Internal Layers and Nonlinear Waves”, 7/89-6/91, \$38,500.

## Honors and Awards

- Outstanding Graduate Instructor, UNM Dept. of Mathematics, 1995-96.
- Second, 1988 Leslie Fox Prize Competition, London
- Phi Beta Kappa, Rufus Choate Scholar, Robert Proctor Memorial Scholar (Dartmouth College)
- Special Institute, Earle C. Anthony and Northrop Corporation Fellowships (California Institute of Technology).

## Postdoctoral Fellows Supervised

1. Stephen Lau (2004-2005).

## Doctoral Dissertations Supervised

1. E. Andries, *Regularized Least Squares Classifiers: Applications to Leukemia Cancer Classification*, Dept. of Math. and Stat., U. of New Mexico, (2004).

2. I. Nazarov, *I. A Mathematical Analysis for Sustainable Management of Ecosystems, II. Perfectly Matched Layers for Linearized Euler's Equation*, Dept. of Math. and Stat., U. of New Mexico, (2004) (with A. Aceves and L. Li).
3. M. deCastro, *Stability of Parabolic System on a Half-Space and Theoretical Aspects of Absorbing Boundary Conditions*, Dept. of Math. and Stat., U. of New Mexico, (2004) (with J. Lorenz).
4. R. Zhou, *Numerical Methods for Reaction-Diffusion Equations with Complex Physical Models*, Dept. of Math. and Stat., U. of New Mexico, (2001) (with S. Steinberg).
5. L. Xu, *Applications of High-Order Radiation Boundary Conditions*, Dept. of Math. and Stat., U. of New Mexico, (2001) (with S. Steinberg).
6. T. Brown, *Multiple Time-Scale Numerical Solutions for Low Mach Number Flows Obeying the Navier-Stokes Equations*, Dept. of Math. and Stat., U. of New Mexico, (1998).
7. G. Kvernadze, *Locating Discontinuities of a Bounded Function by Spectral Methods*, Dept. of Math. and Stat., U. of New Mexico, (1998).
8. S. Buonincontri, *Multidimensional Traveling Wave Solutions to Reaction-Diffusion Equations*, Dept. of Appl. Math., SUNY at Stony Brook, (1989).
9. Supervised funded research of D. Justo, G. Zhu and O. Guba.
10. Hosted (at UNM and LLNL) and supervised research of D. Appelö, a Ph.D. student at KTH, Stockholm.
11. Current doctoral students: X. Chen, J. Hernandez.

## Master's Theses Supervised

1. A. Smith, *Numerical Shock Solutions of the Traditional and Modified Navier-Stokes Equations Using the Hermite-Taylor Method*, Dept. of Math. and Stat., U. of New Mexico, (2006).
2. C. Dodson, *A High-Order Hermite Compressible Navier-Stokes Solver*, Dept. of Math. and Stat., U. of New Mexico, (2003).
3. S. Rodriguez, *A Fourth Order AMR Method for Flame Simulation*, U. of New Mexico, (2003).

## Education and Service

- Co-developer of a graduate certificate program in computational science and engineering (CSE) at UNM.
- First College of Arts and Sciences coordinator for the CSE program, and current coordinator.
- Initiated, along with SOE coordinator Marc Ingber and the CSE Program Committee chaired by Deborah Sulsky, a post-degree certificate option. A number of Sandia scientists are currently enrolled in the program.
- Co-developer of a program to award grants for instructional computing at SUNY Stony Brook.
- Supervised six undergraduates in research projects, four of whom went on to Ph.D. programs in mathematics or engineering.
- Served on NSF review committees for ITR, SCREMS, CAREER, CSUMS, and fluid dynamics programs.
- Proposal review for NSF, Hong Kong Research Foundation (CERG), FSU Civilian Research and Development Fund, Israel-US Binational Science Foundation, Israel Science Foundation.
- Reviewer for dozens of scientific journals.
- Scientific committee for the 6th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena, Finland, 2003.
- Scientific committee for the 2003 Workshop on Benchmark Problems in Computational Aeroacoustics.
- Represented the College of Arts and Sciences on the Faculty Senate 1996-97.
- Opponent for the dissertation of J. Nordström, University of Uppsala, Sweden, 1993.
- Referee for the Habilitation of O. Vacus, Université Paris Dauphine, 2004.
- Opponent for the dissertation of M. Svärd, University of Uppsala, Sweden, 2004.
- Scientific committee for the 7th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena, Providence, 2005.

## Recent Lectures

- Asymptotic analysis of dissipative waves with applications to their numerical simulation, Workshop on Asymptotic Analysis and Numerical Solution of PDE's, Argonne National Lab., 1990.
- The numerical analysis of boundary conditions at inflow and outflow for viscous flows, Advances in Computational Methods in Transport Phenomena, University of Kentucky, 1991.
- Consistency and convergence for numerical radiation conditions, First International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena, Strasbourg, France, 1991.
- Multidimensional traveling waves and bifurcation from the essential spectrum, ICIAM, Washington, DC 1991.
- Benchmark tests of asymptotic boundary conditions for incompressible flows, Workshop on Outflow Boundary Conditions, Stanford University, 1991.
- Chairman and organizer of a minisymposium on boundary conditions for the simulation of unsteady flows, SIAM Annual Meeting, Los Angeles, 1992.
- Boundary conditions at artificial boundaries with applications to fluid flow simulations, Workshop on Theory and Numerical Methods for Initial-Boundary Value Problems, Oberwolfach, Germany, 1992.
- Numerical and asymptotic studies of complex flow dynamics Applied Mathematics Workshop, Albuquerque, NM, 1993.
- Boundary conditions and the simulation of low Mach number flows, First International Conference on Theoretical and Computational Acoustics, Connecticut, 1993.
- Experimental and theoretical studies of iterative methods for nonlinear, nonsymmetric problems arising in combustion, Colorado Conference on Iterative Methods, Colorado 1994.
- All time existence of smooth solutions to PDEs of mixed type, SIAM Annual Meeting, San Diego 1994.
- On high-order radiation boundary conditions, IMA Workshop on Computational Wave Propagation, University of Minnesota 1995.

- On the convergence of local approximations to pseudodifferential operators with applications, Third International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena, France, 1995.
- Integral Operators and the numerical solution of differential equations, H.B. Keller 70th Birthday Symposium, Cal. Tech. 1995.
- On the convergence of local approximations to convolutions with applications, SIAM Annual Meeting, Charlotte 1995.
- Special Session on Boundary Conditions at Artificial Boundaries, SIAM Annual Meeting, Kansas City 1996.
- Special Session on Mathematical Wave Propagation, AMS Meeting, Chattanooga 1996.
- A high-order numerical method for flame simulations with complex models, Sixth International Conference on Numerical Combustion, New Orleans 1996.
- Exact and high order boundary conditions in the time domain, IUTAM Symposium on Computational Methods for Unbounded Domains, Boulder 1997.
- All-time existence of smooth solutions to the slightly compressible Navier-Stokes equations, Mittag-Leffler Institute, Sweden 1997.
- Traveling wave solutions to stiff systems arising from complex models of combustion, Workshop on Dynamics of Fronts and Pulses, Germany, 1998.
- Computation of steady and unsteady laminar flames: Theory, 34th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Cleveland, (1998).
- High-order simulation of complex reaction-diffusion models, NASA Glenn HBC/OMU Conference, 1999.
- An integral evolution formula for the wave equation, ICIAM, Edinburgh, 1999.
- Experiments with stable, high-order discretizations of hyperbolic initial-boundary value problems, 5th International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena, Spain, 2000.
- High-order single-step methods for initial-boundary value problems, SIAM Annual Meeting, San Diego, 2001.

- High-order single-step methods for hyperbolic initial-boundary value problems, 9th Int. Conf. on Hyperbolic Problems, Pasadena, 2002.
- New results on absorbing layers and radiation boundary conditions, Short Course at the LMS-Durham Symposium on Computational Methods in Direct Scattering, Durham, UK 2002.
- Absorbing layers and radiation boundary conditions for jet flow simulation, 8th AIAA/CEAS Aeroacoustics Conference, Breckinridge, 2002.
- A new construction of perfectly matched layers for hyperbolic systems with applications to the linearized Euler equations, Sixth International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena, Finland 2003.
- Perfectly matched layers and radiation boundary conditions for shear flow calculations, 9th AIAA/CEAS Aeroacoustics Conference, Hilton Head 2003.
- Domain truncation methods for simulating waves: Successes and challenges, keynote address, US National Congress on Computational Mechanics, Albuquerque, 2003.
- Solution of benchmark problems in computational aeroacoustics using high-order difference methods and perfectly matched layers, 4th Computational Aeroacoustics Workshop on Benchmark Problems, NASA Glenn Research Center, 2003.
- Advances in radiation boundary conditions for simulating waves, Foundations of Computational and Applied Mathematics, New Jersey Institute of
- Co-chairman and co-organizer of a minisymposium on accurate domain truncation methods, International Conference on Spectral and High-Order Methods, Providence, 2004.
- Accurate domain truncation for fluid dynamics, International Conference on Spectral and High-Order Methods, Providence, 2004.
- Chairman and organizer of a symposium on high-order structured grid methods for simulating waves, 2004 SIAM Annual Meeting, Portland.
- Grid-stabilization of one-sided, wide-stencil discretizations, 2004 SIAM Annual Meeting, Portland.
- High-order methods and boundary conditions for simulating subsonic flows, 11th AIAA/CEAS Aeroacoustics Meeting, Monterey, 2005.



- High-order single-step methods for simulating waves, 7th International Conference on Mathematical and Numerical Aspects of Wave Propagation, Providence, 2005.
- High order local radiation boundary conditions: adaptivity, interface conditions, and applications to multiple media, 2005 SIAM Annual Meeting, New Orleans.
- Fast and accurate methods for simulating waves on unbounded domains, 2005 SIAM Annual Meeting, New Orleans.
- Adaptive finite element implementation of arbitrary order radiation boundary conditions on rectangular domains, 7th International Conference on Mathematical and Numerical Aspects of Wave Propagation, Providence, 2005.
- Radiation boundary conditions for time-domain simulations, Workshop on Computational Scattering, Banff International Research Station, Banff, Alberta, Canada, 2006.
- Chairman and coorganizer of a minisymposium on simulating waves, World Congress on Computational Mechanics, Los Angeles, 2006.
- Local, adaptive, high-order radiation boundary conditions, World Congress on Computational Mechanics, Los Angeles, 2006.
- Towards the ultimate time-domain solver for Maxwell's equations, Workshop on Computational Challenges of Maxwell's Equations, Weihai, China, 2006.
- A Hermite-Taylor algorithm for simulating subsonic shear flows, 12th AIAA/CEAS Aeroacoustics Conference, Boston, 2006.
- Optimal local radiation boundary condition sequences, optimal perfectly matched layers, and why they are the same, Workshop on Computational Electromagnetism and Acoustics, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany, 2007.
- Optimal local radiation boundary conditions and potential applications to multiscale-multiphysics problems, SIAM Conference on Computational Science and Engineering, Costa Mesa, 2007 (invited).
- Absorbing boundary conditions and layers for subsonic flows, Finite Elements in Fluids 07, Santa Fe, 2007 (invited).
- Complete plane wave representations, optimal local radiation boundary conditions, and optimal perfectly matched layers, Frontiers in Applied and Computational Mathematics, NJIT, 2007 (invited).

- Experiments with Hermite methods for simulating compressible flows: Runge-Kutta time stepping and absorbing layers, 13th AIAA/CEAS Aeroacoustics Conference, Rome, 2007.
- Improving the time step stability constraints of spectral element methods for wave propagation problems, Workshop on Spectral Methods, Xiamen, China, 2007 (invited).
- High-resolution discretizations and complete radiation boundary conditions for wave propagation problems with applications to aeroacoustics, International Conference on Spectral and High-Order Methods, Beijing, China, 2007 (invited).
- Stabilizing high-resolution one-sided difference operators, International Conference on Industrial and Applied Mathematics, Zurich, Switzerland, 2007 (invited).
- Complete plane wave representations and applications to interface problems, International Conference on Industrial and Applied Mathematics, Zurich, Switzerland, 2007 (invited).
- On complete radiation boundary conditions and optimal absorbing layers, International Conference on Mathematical and Numerical Aspects of Wave Propagation Phenomena, Reading, England, 2007 (plenary).
- Towards efficient volume-based time-domain solvers for scattering problems, American Institute of Mathematics Workshop on High Order Methods for Computational Wave Propagation and Scattering, Palo Alto, 2007 (invited).
- Accurate numerical methods for time-domain scattering problems: efficient representations of wavefields, Frontiers in Applied and Computational Mathematics, NJIT, 2008 (invited).
- Complete plane wave expansion and optimal radiation boundary conditions, SIAM Annual Meeting, San Diego, 2008 (invited).
- Studies of compressible flows using arbitrary-order Hermite discretizations, SIAM Annual Meeting, San Diego, 2008 (invited).
- Boundary conditions and the simulation of problems with multiple scales, H.B. Keller Memorial Workshop, Caltech, 2008 (invited).
- Colloquia given: North Carolina State University, Rice University, California Institute of Technology, University of Delaware.
- Colloquia and seminars (since 1988); FFA (Stockholm), Swedish Defence Research Agency, Royal Institute of Technology, University of Uppsala, University of Delaware, Mississippi State University, Rensselaer Polytechnic Institute, California Institute of Technology, UCLA,

Northwestern University, University of Akron, NASA Glenn Research Center, Sandia National Lab., Los Alamos National Lab., Courant Institute of Mathematical Sciences, New Jersey Institute of Technology, Brown University, Lawrence Livermore National Lab, Oxford University, Florida State University, University of North Carolina, North Carolina State University, Schlumberger-Doll Research, College de France, Rice University, Stanford University, Penn State University, University of Texas at Arlington, University of Texas at Austin.