

ROBERT M. KIRBY II

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Citizenship:

United States of America

Education:

- Brown University, Ph.D. candidate in Applied Mathematics, Expected Spring/Summer 2002. Dissertation Title: “Dynamic Spectral/hp Refinement: Algorithms and Applications to Flow-Structure Interactions”
Advisor: Professor George Em Karniadakis
- Brown University, Master of Science degree in Computer Science, May 2001.
Project Title: “Visualizing Fluid Flow Data: From the Canvas to the Cave”
Advisor: Professor Andries van Dam
- Brown University, Master of Science degree in Applied Mathematics, May 1999.
Advisor: Professor George Em Karniadakis
- The Florida State University, Bachelor of Science degree; Majors: Applied Mathematics and Computer and Information Sciences; Graduated *Summa Cum Laude*.

Research Interests:

Large-scale scientific computation and visualization, with an emphasis on the scientific cycle of mathematical modeling, computation, visualization, evaluation, and understanding. Incorporation of scientific visualization into different disciplines of computational science, with emphasis on the use of emerging scientific visualization tools such as virtual reality and multi-valued data painterly methods. Interdisciplinary projects (e.g. computational MEMS) requiring synergistic combination of skills from many scientific concentrations. Design and analysis of finite-element and spectral methods on complex-geometry domains. Development of associated efficient algorithms for parallel computing.

Work Experience:

- September 1997 - present: Graduate Research Assistant
Center for Fluid Mechanics, Brown University
- April 1997 - August 1997: Computer Systems Manager
The Geophysical Fluid Dynamics Institute at The Florida State University
- June 1992 - April 1997: Computer Programmer/ Research Assistant
The Geophysical Fluid Dynamics Institute at The Florida State University

Teaching Experience:

- Co-taught with advisor the undergraduate/graduate course “Introduction to Numerical Analysis”, Fall 2001.
- Co-taught with advisor the undergraduate course “Introduction to Scientific Computing”, Spring 2000.
- Organized and presented a C++ programming tutorial series for both undergraduate and graduate students in the Division of Applied Mathematics, Spring 1999.
- Provided mentoring for graduate students in the Center for Fluid Mechanics, 1998 to 2001.
- Teaching assistant in charge of computing assistance for *all* Brown University, Applied Mathematics courses with computational content, Fall 1998 and Spring 1999.

Publications and Presentations

1 Book

1. George Em Karniadakis and Robert M. Kirby, *Parallel Scientific Computing in C++ and MPI*, Cambridge University Press, June 2002.

2 Book Chapters:

1. R.M. Kirby, G.E. Karniadakis, O. Mikulchenko and K. Mayaram, “Integrated Simulation for MEMS: Coupling Flow-Structure-Thermal-Electrical Domains”, *The CRC Handbook of MEMS*, CRC Press, Boca Raton, FL, 2001. Editor: M. Gad-el-Hak
2. Robert M. Kirby and George Em Karniadakis, “Under-Resolution and Diagnostics in Spectral Simulations of Complex-Geometry Flows”, *Turbulent Flow Computation*, Kluwer Academic Publishers, The Netherlands, 2001. Editors: D. Drikakis and B. Geurts

3 Peer-Reviewed Journal Publications:

1. I. Lomtev, R.M. Kirby, and G.E. Karniadakis, “A Discontinuous Galerkin ALE Method for Compressible Viscous Flows in Moving Domains”, *Journal of Computational Physics*, Vol. 155, 128-159, 1999.
2. 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.
3. R.M. Kirby, G.E. Karniadakis, O. Mikulchenko, and K. Mayaram, “An Integrated Simulator for Coupled Domain Problems in MEMS”, *Journal of Microelectromechanical Systems*, Vol. 10, 3:379-399, 2001.

4 Peer-Reviewed Conference Publications:

1. R.M. Kirby, H. Marmanis and D.H. Laidlaw, “Visualizing Multivalued Data from 2D Incompressible Flows Using Concepts from Painting”, Proceedings of IEEE Visualization 1999, San Francisco, CA, October 1999.
2. G-S Karamanos, C. Evangelinos, R.C. Boes, R.M. Kirby and G.E. Karniadakis, “Direct Numerical Simulation of Turbulence with a PC/Linux Cluster: Fact or Fiction?”, Proceedings of SuperComputing 1999, Portland, OR, November 1999.
3. A. Forsberg, R.M. Kirby, D.H. Laidlaw, G.E. Karniadakis, A. van Dam, and J. Elion, “Immersive Virtual Reality for Visualizing Flow Through an Artery”, Proceedings of IEEE Visualization 2000, Salt Lake City, UT, October 2000.
4. D.H. Laidlaw, R.M. Kirby, J.S. Davidson, T.S. Miller, M. da Silva, W.H. Warren, and M. Tarr, “Quantitative Comparative Evaluation of 2D Vector Field Visualization Methods”, Proceedings of IEEE Visualization 2001, San Diego, CA, October 2001.

5 Other Conference Publications (Extended Abstracts Refereed):

1. T.C. Warburton, I. Lomtev, R.M. Kirby and G.E. Karniadakis, “A Discontinuous Galerkin Method for the Compressible Navier-Stokes Equations on Hybrid Grids”, Proceedings of the Tenth International Conference on Finite Elements in Fluids, January 1997.
2. I. Lomtev, R.M. Kirby, and G.E. Karniadakis, “A Discontinuous Galerkin Method in Moving Domains”, In *Discontinuous Galerkin Methods: Theory, Computation and Applications*, Eds. B. Cockburn, G.E. Karniadakis, and C.-W. Shu, Springer-Verlag, NY, 1999.
3. R.M. Kirby, I. Lomtev, C. Evangelinos, G-S Karamanos and G.E. Karniadakis, “Parallel DNS of Flow-Structure Interactions”, Proceedings of the DoD HPCMP Users Group Conference, June 7-10, 1999.
4. I. Lomtev, R.M. Kirby, and G.E. Karniadakis, “A Discontinuous Galerkin Arbitrary Lagrangian Eulerian Formulation for Viscous Compressible Flows”, Proceedings of the 2nd International Conference on DNS/LES, June 7-9, 1999.
5. R.M. Kirby, T.C. Warburton, S.J. Sherwin, A. Beskok and G.E. Karniadakis, “The Nektar Code: Dynamic Simulations without Remeshing”, Proceedings of the 2nd International Conference on Computational Technologies for Fluid/Thermal/Chemical Systems with Industrial Applications, August 1-5, 1999.
6. R.M. Kirby, Y. Du, D. Lucor, X. Ma, G-S Karamanos and G.E. Karniadakis, “Parallel DNS and LES of Turbulence and Flow-Structure Interactions”, Proceedings of the DoD HPCMP Users Group Conference, June 5-8, 2000.
7. J. Boyan, A. Greenwald, R.M. Kirby and J. Reiter, “Bidding Algorithms for Simultaneous Auctions”, Proceedings of IJCAI Workshop on Economic Agents, Models, and Mechanisms, pages 1-11, 2001.
8. I. Pivkin, R.M. Kirby, and G.E. Karniadakis, “High-order Discontinuous Galerkin Method: Simulation of Coil Flows”, *DNS/LES: Progress and Challenges*, Third AFOSR International Conference, Arlington, TX, August 5-9 2001.

9. Robert M. Kirby and George Em Karniadakis, "A Dynamic Spectral Vanishing Viscosity Method for LES", AIAA 40th Aerospace Sciences Meeting and Exhibit, Reno, Nevada, January 14-17, 2002.

6 Conference Abstracts:

1. R.M. Kirby, T.C. Warburton, I. Lomtev, and G.E. Karniadakis, "A Discontinuous Galerkin Spectral/hp Method on Hybrid Grids", Presented at the International Conference on Spectral and High Order Methods, June 1998.
2. R.M. Kirby, A. Beskok, T. Warburton and G.E. Karniadakis, "Flow Past a Cylinder with a Flexible Splitter Plate", Presented at the 51st Annual Meeting of the American Physical Society's (APS) Division of Fluid Dynamics, November 1998.
3. I. Lomtev, R.M. Kirby, and G.E. Karniadakis, "A Discontinuous Galerkin Formulation for Compressible Flows Past a 3D Flexible Wing", Presented at the Fifth Official Congress of the U.S. Association for Computational Mechanics (USACM), August 4-6, 1999.
4. J. Allen, G.E. Karniadakis, R.M. Kirby and A. Smits, "Piezo-electric Eels as Power Generators," Presented at the 52nd Annual Meeting of the American Physical Society's (APS) Division of Fluid Dynamics, November 21-23, 1999.
5. G. Karamanos, R.M. Kirby, and G.E. Karniadakis, "A Spectral Vanishing Viscosity Method for LES-FEM", Presented at Finite Elements in Flow Problems , Austin, TX, April 30 - May 4, 2000.
6. D. Xiu, R. M. Kirby, and G. E. Karniadakis, "A Semi-Lagrangian Spectral/hp Element Method for Advection-Diffusion", Presented at Finite Elements in Flow Problems, Austin, TX, April 30 - May 4, 2000.
7. A. Forsberg, A. van Dam, R.M. Kirby and G.E. Karniadakis, "Simulation Steering in CFD." Presented at the Undersea Weapon Simulation Based Design Workshop, June 7-9, 2000.
8. R. M. Kirby and G. E. Karniadakis, "Flow Past a Bluff Body with a Rigid and a Flexible Splitter Plate", Presented at IUTAM Symposium on Bluff Body Wakes and Vortex-Induced Vibrations, June 13 - 16, 2000.

7 Presentations:

1. "Simulation Science with the Nektar Code". Presentation given at IBM T.J. Watson Research Center, Yorktown Heights, NY, August 10, 1998.
2. Presenter: November, 1998. See Section 6.2.
3. Presenter: June, 1999. See Section 5.3.
4. Presenter: August, 1999. See Section 6.3.
5. Presenter: October, 1999. See Section 4.1.
6. "Simulation of Incompressible Fluid Flow". Presentation given at the IBM Booth, Super-Computing 1999, Portland, OR, November 13-19, 1999.

7. "Simulation of Compressible Fluid Flow". Presentation given at the IBM Booth, SuperComputing 1999, Portland, OR, November 13-19, 1999.
8. Presenter: April, 2000. See Section 6.5.
9. Presenter: June, 2000. See Section 5.6.
10. Presenter: June, 2000. See Section 6.8.
11. "Flow Past an Energy-Harvesting Eel". Presentation given at DARPA Workshop for Energy-Harvesting Eel Project, Pennington, NJ, June 26, 2000.
12. Presenter: October, 2000. See Section 4.3.
13. "Simulation of an Energy-Harvesting Eel - Optimizing through Simulation". Presentation given at DARPA Workshop for Energy-Harvesting Eel Project Design Review, Pennington, NJ, March 2, 2001.
14. Co-Presenter with D.H. Laidlaw: See Section 4.4.
15. Presenter: January, 2002. See Section 5.9.