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Research Interests

Parallel and distributed computing, numerical scientific components, compiler technology, automatic differentiation, performance modeling, interactive supercomputing.

Education

University of Illinois at Urbana-Champaign, Urbana, IL
Sept. 1995–Nov, 1999: Ph.D. in Computer Science, Jan. 2000
Thesis Title: An Environment for Interactive Parallel Numerical Computing
Doctoral Advisor: Dr. Michael Heath

Wake Forest University, Winston-Salem, NC, Aug. 1993–May 1995.
B.S. in Computer Science, May 1995, 3.95/4.0 GPA, Summa Cum Laude.

University of Illinois at Urbana-Champaign, Urbana, IL
Jan. 1993–May 1993: Research Experience for Undergraduates, 5.0/5.0 GPA.

Southwest State University, Marshall, MN, Sep. 1991–Jan. 1993, 4.0/4.0 GPA.

Employment

Assistant Computer Scientist, Argonne National Laboratory, October 2001–present. Design and development of numerical components and related infrastructure; compiler-based tools for automatic differentiation; performance modeling and prediction; methods and software for nanophotonics simulation.

Postdoctoral Research Staff, Argonne National Laboratory, November 1999–October 2001. Development of tools for automatic differentiation and AD integration into numerical software.

Teaching Assistant, University of Illinois at Urbana-Champaign, January–May, 1999. Teaching discussion sections in an introductory computer science course, exam and homework preparation and grading.

Wallace Givens Research Associate, Argonne National Laboratory, Summer 1998. Development of a differentiated version of PETSc using automatic differentiation tools and high-level algorithmic templates.

Graduate Research Assistant to Dr. Michael Heath, National Center for Supercomputing Applications, University of Illinois, June 1996–January 1999, August–November 1999. Design and implementation of a Matlab-based high-performance parallel computing environment.

Consultant/Senior Programmer, Liberty Data Systems, Kernersville, NC, summer 1995. Network application development and consulting.

Consultant/Programmer, self-employed, Apr. 1994–May 1995. Business application development and consulting.

Computer Center Consultant, Wake Forest University, Aug. 1994–May 1995. Applications support for university software.

Software Developer, AMP, Inc., Winston-Salem, NC, summer 1994. MS Windows business application development.

Consultant/Programmer, Information Technology Professionals, Winston-Salem, NC, Aug. 1993–May 1994. Business application development, mainly relational databases.

Undergraduate research assistant to Dr. Michael Heath, National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign, Jan. 1993–May 1993. Developed and implemented a generalized parallel matrix multiplication algorithm using 2D data partitioning.

Honors

Fellowship receipt at the Second MIT CFD Conference, June 2003

SURGE Graduate Fellowship, University of Illinois at Urbana-Champaign, Sep. 1995–present.

Carswell Distinguished Scholarship, Wake Forest University, Sep. 1994–May 1995.

Presidential Scholarship, Southwest State University, Sep. 1991–Dec. 1993.

Member of the National Honor Society since Jan., 1991; Phi Beta Kappa since Apr., 1995.

Professional Activities

Member: ACM (1998), IEEE Computer Society (1999), National Honor Society (1991), SIAM (1998).

Member of the Common Component Architecture Forum since 1999.

Co-PI in “Performance Engineering Research Center” (DOE, funded 2001) and “Computational Nanophotonics: Modeling Optical Interactions and Transport in Tailored Nanosystem Architectures” (DOE, funded 2003).

Reviewer, IPDPS’2001, AD Workshop at ICCSA’03, SAC’03, HICSS (2003, 2004), DOE Early Career Grants (2003, 2004), IEEE Proceedings (2004), AD’2004.

Organizer of a minisymposium on High Performance Components at the Eleventh SIAM Conference on Parallel Processing for Scientific Computing (PP04) conference.

Organizing committee member for AD’2004.

Organizing committee member for Workshop on Domain-Specific Languages for Optimization, Argonne National Laboratory, August 18-20, 2004.

Served on the organizing committee for the High Performance Computing Workshop at the Computer Science Department, University of Illinois at Urbana-Champaign, 1999.

Software Projects

CCA scientific components; CCA-compliant linear algebra and optimization components (this multi-institution collaborative project was named as one of the “Top 10 DOE Science Achievements in 2002”)

Performance modeling tools based on source code analysis

Structured AMR in FDTD methods for nanophotonics simulations; visualization

XAIF, an XML-based intermediate representation for automatic differentiation

ADIC, automatic differentiation of ANSI C and C++ code programs

ADIC and ADIFOR Web-based and command line remote application servers

Publications

B. Norris. “Software Architecture Approaches for Adaptive Scientific Computing,” to appear in *Proceedings of PARA’04 Workshop on State-of-the-art in Scientific Computing*, Lyngby, Denmark, June 20-23, 2004.

S. Bhowmick, L. McInnes, B. Norris, and P. Raghavan. “Robust Algorithms and Software for Parallel PDE-Based Simulations,” High Performance Computing Symposium, Arlington, Virginia, to appear in *Proceedings of the Advanced Simulation Technologies Conference, ASTC’04*, April 18 - 22, 2004.

D. E. Bernholdt, B. A. Allan, R. Armstrong, F. Bertrand, K. Chiu, T. L. Dahlgren, K. Damevski, W. R. Elwasif, T. G. W. Epperly, M. Govindaraju, D. S. Katz, J. A. Kohl, M. Krishnan, G. Kurfert, J. W. Larson, S. Lefantzi, M. J. Lewis, A. D. Malony, L. C. McInnes, J. Nieplocha, B. Norris, S. G. Parker, J. Ray, S. Shende, T. L. Windus, S. Zhou. “A Component Architecture for High-Performance Scientific Computing,” *Intl. J. High-Perf. Computing Appl.*, 2004, submitted to ACTS Collection special issue.

B. Norris, J. Ray, R. Armstrong, L. C. McInnes, D. E. Bernholdt, W. R. Elwasif, A. D. Malony, and S. Shende. “Computational Quality of Service for Scientific Components,” to appear in *Proceedings of the International Symposium on Component-Based Software Engineering (CBSE7)*, Edinburgh, Scotland, May 24–25, 2004. Argonne National Laboratory Preprint ANL/MCS-P1131-0204.

S. Bhowmick, L. McInnes, B. Norris, and P. Raghavan. “The Role of Multi-Method Linear Solvers in PDE-Based Simulations,” in *Proceedings of the 2003 International Conference on Computational Science and its Applications, ICCSA 2003*, Montreal, Canada May 18 - May 21, 2003. Lecture notes in Computer Science 2677, Editors V. Kumar, M. L. Gavrilova C. J. K. Tan, and P. L’Ecuyer, pp. 828–839, 2003. Argonne National Laboratory preprint ANL/MCS-P1027-0203.

P. Hovland, K. Keahey, L.C. McInnes, B. Norris, L.F. Diachin, and P. Raghavan, “A Quality-of-Service Architecture for High-Performance Numerical Components,” in *Proceedings of the Workshop on QoS in Component-Based Software Engineering*, Toulouse, France, June 20, 2003.

S. Bhowmick, P. Raghavan, L. McInnes, and B. Norris, “Faster PDE-based Simulations Using Robust Composite Linear Solvers,” Argonne National Laboratory preprint ANL/MCS-P993-0902, to appear in *Future Generation Computer Systems*, 2003.

L. McInnes, B. Norris, S. Bhowmick, and P. Raghavan, “Adaptive Sparse Linear Solvers for Implicit CFD Using Newton-Krylov Algorithms,” in *Proceedings of the Second MIT Conference on Computational Fluid and Solid Mechanics*, Massachusetts Institute of Technology, Boston, USA, June 17-20, 2003. Argonne National Laboratory preprint ANL/MCS-P998-0902, 2003.

C. H. Bischof, P. D. Hovland, and B. Norris. “Implementation of Automatic Differentiation Tools,” in *Proceedings of PEPM’02*. Revised version to appear in a special issue of Higher-Order and Symbolic Computation.

P. D. Hovland, U. Naumann, and B. Norris, “An XML-Based Platform for Semantic Transformation of Numerical Programs,” in *Proceedings of Software Engineering and Applications*, November 4-6, 2002 Cambridge, MA, ACTA Press, Anaheim, CA, pp. 530–538. Argonne National Laboratory preprint ANL/MCS-P950-0402.

B. Norris, S. Benson, L. Freitag, P. Hovland, L. McInnes, M. Singer, and B. Smith. “Parallel Components for PDEs and Optimization: Some Issues and Experiences,” *Parallel Computing* 28 (12) (2002) 1811-1831.

Paul Hovland and Boyana Norris and Barry Smith, "Making Automatic Differentiation Truly Automatic: Coupling PETSc with ADIC," in *Proceedings of ICCS*, Springer, New York, 2002. Argonne National Laboratory preprint ANL/MCS-P922-0102.

J. Abate, S. Benson, L. Grignon, P. Hovland, L. McInnes, and B. Norris, "Integrating Automatic Differentiation with Object-Oriented Toolkits for High-Performance Scientific Computing," in George Corliss, Christèle Faure, Andreas Griewank, Laurent Hascoët, and Uwe Naumann, editors, *Automatic Differentiation of Algorithms: From Simulation to Optimization*. Springer, New York, 2002.

P. D. Hovland and B. Norris, "Users' Guide to ADIC 1.1," Technical Memorandum ANL/MCS-TM-225, July 2002.

E. Dolan, P. Hovland, J. Moré, B. Norris, and B. Smith, "Remote Access to Mathematical Software," *Internet Accessible Mathematical Computation Workshop 2001 at ISSAC'2001*, University of Western Ontario, Canada, 22 July, 2001.

J. Abate, P. D. Hovland, B. Norris, and L. Roh, "A Component-Based Software Architecture for Semantic Transformation of Scientific Software," Technical Report ANL/MCS-P930-0202, 2001.

B. Norris and P. Hovland, "A Distributed Application Server for Automatic Differentiation," Technical Report ANL/MCS-P856-1100, Mathematics and Computer Science Division, Argonne National Laboratory, 2000. Also in *Proceedings of IPDPS2001 (CDROM)*.

A. Radenski, B. Norris, and W. Chenn, "A Generic All-Pairs Cluster Computing Pipeline and Its Applications," in *Parallel Computing: Fundamentals & Applications*, Proceedings of the International Conference ParCo99, TU Delft, The Netherlands, Imperial College Press, 2000, pp. 367-374.

A. Radenski, A. Vann, and B. Norris, "Development and Utilization of Parallel Generic Algorithms for Scientific Cluster Computations," in *Object Oriented Methods for Interoperable Scientific and Engineering Computing: Proceedings of the 1998 SIAM Workshop*, SIAM, Philadelphia, 1999.

P. Hovland, B. Norris, L. Roh, and B. Smith, "Developing a Derivative-Enhanced Object-Oriented Toolkit for Scientific Computations," in *Object Oriented Methods for Interoperable Scientific and Engineering Computing: Proceedings of the 1998 SIAM Workshop*, SIAM, Philadelphia, 1999.

A. Radenski, A. Vann, and B. Norris, "Parallel Probabilistic Computations on a Cluster of Workstations," in *Parallel Computing: Fundamentals, Applications, and New Directions*, Elsevier, New York, 1998.

A. Radenski, A. Vann, B. Norris, "Development and Utilization of Generic Algorithms for Scientific Computations," *ECOOP 98, Workshop on Parallel Object Oriented Scientific Computing*, Brussels, Belgium, July 20-24, 1998. 2-page summary in *Object Oriented Technology*, Volume 1543 of *Lecture Notes in Computer Science*, Springer, New York, 1998, pp. 464-465.

A. Radenski, A. Vann, and B. Norris, "Parallel Probabilistic Computations on a Cluster of Workstations," in *Proceedings of the International Conference on Parallel Computing*, Bonn, Germany, September 16-19, 1997.