

Sanjukta Bhowmick: Curriculum Vitae

Assistant Professor, Department of Computer Science and Engineering, Pennsylvania State University.

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Education

- Ph.D., Department of Computer Science and Engineering with Minor in High Performance Computing, Pennsylvania State University, University Park, 2004.
Thesis Advisor: Dr. Padma Raghavan.
Thesis: *Multimethod Solvers: Algorithms, Applications and Software*.
- Bachelor of Technology (Honors), Computer Science and Engineering, Haldia Institute of Technology, West Bengal, India, 2000.

Employment

- **Assistant Professor** (Fixed-Term Appointment), August 2007-present, Department of Computer Science and Engineering, Pennsylvania State University.
- **Postdoctoral Research Associate**, October 2004-August 2007, Joint Appointment:
 - Department of Applied Physics and Applied Mathematics, Columbia University. Supervisor: Dr. David Keyes.
 - The Mathematics and Computer Science Department, Argonne National Laboratory. Supervisor: Dr. Paul Hovland.
- **Research Assistant**, Supervisor: Dr. Padma Raghavan, Summer 2001-Summer 2004.
- **Wallace Givens Research Associate**, Supervisor: Dr. Lois Curfman McInnes and Dr. Boyana Norris, MCS Division, Argonne National Laboratory, May-August 2003.
- **Teaching Assistant**, Fall 2000 and Spring 2001, Department of Computer Science and Engineering, Pennsylvania State University.

Teaching Experience

- **Assistant Professor** (Fixed-Term Appointment), Department of Computer Science and Engineering, Pennsylvania State University.
Introduction to Parallel Programming, Fall 2007.
Introduction to Numerical Analysis, Spring 2008.
Introduction to Matlab, Spring 2008.
- **Teaching Assistant**, Department of Computer Science and Engineering, Pennsylvania State University.
Principles of Programming with Business Applications, Fall 2000 and Spring 2001.

Recent Awards

- SIAM Travel Award to attend the SIAM Workshop on Combinatorial Scientific Computing (CSC07), February 2007.
- The CSE Best Research Assistant Award (Honorable Mention) awarded by the Department of Computer Science and Engineering, The Pennsylvania State University, 2004.
- The Wallace Givens Research Associate appointment in the MCS division at Argonne National Laboratory, May-August 2003.
- SIAM Student Travel Award to attend the SIAM 50th Anniversary Annual Meeting, Philadelphia, July 2002.
- Gold Medal for securing highest scores in B.Tech. (Hons.), Vidyasagar University, West Bengal, India.
- National Scholarship for achievement in Higher Secondary Examination, West Bengal Higher Secondary Education Board, India.

Research Interests

My interests are in high performance computing, specifically in areas that involve a liaison between non-numerical (graph theory, machine learning) and numerical (large scale sparse linear solvers) algorithms. My research includes algorithm development, software design, and their evaluation in context of large scale parallel applications. Current projects involve use of machine learning tools for predicting efficient sparse linear solvers, optimization of Hessian computation in automatic differentiation, combinatorial techniques for optimizing data layout for scientific codes, and graph algorithms for data clustering.

Publications

Refereed Conference Proceedings

1. *FAST: Force-direct Approximate Subspace Transformation for Improved Unsupervised Document Classification*, A. Chatterjee, S. Bhowmick, and P. Raghavan, TextMining Workshop at SIAM Conference on Data Mining 2008, Atlanta, Georgia, April 26 2008.
2. *Improving the Performance of Graph Coloring Algorithms through Backtracking*, S. Bhowmick and P. Hovland (submitted to Fifth International Conference on Computer Science ICCS 2008).
3. *A Polynomial-Time Algorithm for Detecting Directed Axial Symmetry in Hessian Computational Graphs*, S. Bhowmick and P. Hovland, The Fifth International Conference on Automatic Differentiation (AD), Bonn, Germany, August 11-15 2008.
4. *Middleware for Dynamic Adaptation of Component Applications*, B. Norris, S. Bhowmick, D. Kaushik and L. C. McInnes, Proceedings of the IFIP WoCo9 Conference, Prescott, AZ, July, 2006. Also ANL Preprint ANL/MCS-P1365-0806, 2006.
5. *Parallel Adaptive Solvers in Compressible PETSc-FUN3D Simulations*, S. Bhowmick, D. Kaushik, L. McInnes, B. Norris and P. Raghavan, Parallel Computational Fluid Dynamics 2005: Theory and Applications, pp. 277-284, Editors A. Deane, Gunther Brenner, A. Ecer, David R. Emerson, James McDonough, J. Periaux, N. Satofuka, Damien Tromeur-Dervout, 2006.

6. *Robust Algorithms and Software for Parallel PDE-Based Simulations*, S. Bhowmick, L. McInnes, B. Norris, and P. Raghavan, Proceedings of HPC 2004, the Twelfth Special Symposium on High Performance Computing at the 2004 Advanced Simulation Technologies Conference, Arlington, VA, April 18-22, 2004.
7. *Adaptive Sparse Linear Solvers for Implicit CFD Using Newton-Krylov Algorithms*, L. McInnes, B. Norris, S. Bhowmick and P. Raghavan, Proceedings of the Second MIT Conference on Computational Fluid and Solid Mechanics, Massachusetts Institute of Technology, Boston, USA, June 17-20 2003, pp.1024-1028, Volume 2, Editor K. J. Bathe.
8. *The Role of Multi-Method Solvers in PDE-Based Simulations*, S. Bhowmick, L. C. McInnes, B. Norris and P. Raghavan, Proceedings of the 2003 International Conference on Computational Science and its Applications, ICCSA 2003, Montreal, Canada May18-21, 2003. Lecture Notes in Computer Science, Number 2677, Springer Verlag, Editors V. Kumar, M. L. Gavrilova, C. J. K. Tan, and P. L'Ecuyer pp.828-839, 2003.
9. *A Combinatorial Scheme for Developing Efficient Composite Solvers*, S. Bhowmick, P. Raghavan and K. Teranishi, Lecture Notes in Computer Science, Eds. P. M. A. Sloot, C. J. K. Tan, J. J. Dongarra, A. G. Hoekstra, Number 2330, Springer Verlag, Computational Science-ICCS 2002, pp.325-334, 2002.

Refereed Journal Publications

1. *Application of Machine Learning to the Selection of Sparse Linear Solvers*, S. Bhowmick, V. Eijkhout, Y. Freund, E. Fuentes and D. Keyes (submitted to International Journal of High Performance Computing Applications).
2. *Sensitivity Analysis and Design Optimization through Automatic Differentiation*, P. Hovland, B. Norris, M. Strout, S. Bhowmick and J. Utke. SciDac 2005, Vol 16, pp.466-470. Institute of Physics Publishing, Journal of Physics: Conference Series, 2005.
3. *Faster PDE-based Simulations using Robust Composite Linear Solvers*, S. Bhowmick, P. Raghavan, L. C. McInnes and B. Norris, Future Generation Computer Systems, pp.373-387, Volume 20, Number 3 April 2004.

Invited Papers

1. *Combinatorial Algorithms Enabling Computational Science: Tales From the Front*, S. Bhowmick, E. Boman, K. Devine, A. Gebremedhin, B. Hendrickson, P. Hovland, T. Munson and A. Pothen, Journal of Physics: Conference Series, Vol 46, 2006.

Technical Reports

1. *A Polynomial Time Algorithm for Detection of Axial Symmetry in Directed Acyclic Graphs*, S. Bhowmick and P. Hovland, Preprint ANL/MCS-P1314-0106.

Presentations

Refereed Conference Presentations

1. *A Backtracking Heuristic for Graph Coloring*, S. Bhowmick and P. Hovland, SIAM Conference on Optimization, at the Boston Park Plaza Hotel and Towers, Boston, Massachusetts, May 10 - 13, 2008, (to be presented by S. Bhowmick).
2. *Issues in Exploiting the Power of Multiple Methods*, S. Bhowmick, SIAM Parallel Processing for Scientific Computing (PP08), Atlanta, Georgia, March 12-14, 2008 (to be presented by S. Bhowmick)

3. *A Polynomial Time Algorithm for Detection of Axial Symmetry in Hessian Computational Graphs*, S. Bhowmick and P. Hovland, SIAM Workshop on Combinatorial Scientific Computing (CSC07) Hilton Orange County/Costa Mesa, Costa Mesa, California, February 17-19, 2007 (presented by S. Bhowmick).
4. *The Synergy of Computer Science and Scientific Computing*, S. Bhowmick, SIAM Conference on Computational Science and Engineering (CSE07), Hilton Orange County/ Costa Mesa, Costa Mesa, California, February 19-23, 2007 (presented by S. Bhowmick).
5. *Application of Machine Learning to Selecting Solvers for Sparse Linear Systems*, S. Bhowmick, D. Keyes, Y. Freund, V. Eijkhout and E. Fuentes, SIAM Conference on Parallel Processing for Scientific Computing, San Francisco, California, February 22-24 2006. (presented by S. Bhowmick).
6. *A Backtracking Correction Heuristic for Improving Performance of Graph Coloring Algorithms*, S. Bhowmick and P. Hovland, Second International Workshop on Combinatorial Scientific Computing (CSC05) June 21-23, 2005, CERFACS, Toulouse, France (presented by S. Bhowmick).
7. *Parallel Adaptive Solvers in Compressible PETSc-FUN3D Simulations*, S. Bhowmick, D. Kaushik, L. McInnes, B. Norris and P. Raghavan, International Conference on Parallel Computational Fluid Dynamics, May 24-27, 2005 University of Maryland, College Park Campus (presented by L. McInnes).
8. *Combinatorial Schemes for Developing Composite and Adaptive Solvers*, S. Bhowmick, L. C. McInnes, B. Norris and P. Raghavan, Eleventh SIAM Conference on Parallel Processing for Scientific Computing (PP04), San Francisco, February 25-27, 2004 (presented by S. Bhowmick).
9. *Robust Algorithms and Software for Parallel PDE-Based Simulations*, S. Bhowmick, L. McInnes, B. Norris, and P. Raghavan, Proceedings of HPC 2004, the Twelfth Special Symposium on High Performance Computing at the 2004 Advanced Simulation Technologies Conference, Arlington, VA, April 18-22, 2004 (presented by S. Bhowmick).
10. *Adaptive Sparse Linear Solvers for Implicit CFD Using Newton-Krylov Algorithms*, B. Norris, L. C. McInnes, S. Bhowmick and P. Raghavan, The Second MIT Conference on Computational Fluid and Solid Mechanics, Massachusetts Institute of Technology, Boston, June 17-20, 2003 (presented by B. Norris).
11. *The Role of Multi-Method Solvers in PDE-Based Simulations*, S. Bhowmick, L. C. McInnes, B. Norris and P. Raghavan, The 2003 International Conference on Computational Science and its Applications, ICCSA 2003, Montreal, Canada, May18-21, 2003 (presented by S. Bhowmick).
12. *A New Scheme for Developing Composite Solvers*, S. Bhowmick, P. Raghavan and K. Teranishi, SIAM 50th Anniversary and Annual Meeting, Philadelphia, July 6-14, 2002 (presented by S. Bhowmick).
13. *A Combinatorial Scheme for Developing Efficient Composite Solvers*, S. Bhowmick, P. Raghavan and K. Teranishi, International Conference on Computational Science, Workshop on Modern Numerical Algorithms, Amsterdam, April 2002 (presented by P. Raghavan).

Invited Presentations

1. Fifth International Conference of Applied Mathematics and Computing, Plovdiv, Bulgaria, August 12-18, 2008 (invited lecture).
2. *Application of Machine Learning for Solver Selection*, S. Bhowmick, D. Keyes, Y. Freund, V. Eijkhout and E. Fuentes, CScADS Workshop on Libraries and Algorithms for Petascale Applications July 30-August 2 2007, Snowbird, Utah (presented by S. Bhowmick).
3. *Selecting and Combining Solvers—A Multimethod Approach to Solving Linear Systems*, CPPG Group Seminar, Princeton Plasma Physics Laboratory, March 2006 (presented by S. Bhowmick).

Posters

1. *Implementing Machine Learning for Solver Selection*, S. Bhowmick, D. Keyes, Y. Freund, V. Eijkhout and E. Fuentes, SIAM Conference on Computational Science and Engineering (CSE07), Hilton Orange County/Costa Mesa, Costa Mesa, California, February 19-23, 2007.
2. *Improving the Performance of PDE-Based Simulations by Using Multi-Method Solvers*, S. Bhowmick, P. Raghavan, L. C. McInnes, and B. Norris, SIAM Conference on Computational Science and Engineering(CSE03), San Diego, California, February 10-13, 2003.
3. *Robust Sparse Linear Solvers*, S. Bhowmick, P. Raghavan, L. C. McInnes, and B. Norris, The 2003 International Conference on Preconditioning Techniques for Large Scale Sparse Matrix Problems In Scientific and Industrial Applications, Napa, California, October 27-29, 2003.

Professional Activities

- Organizer, Minisymposium on *Multimethod Problems: Challenges and Implementations* at SIAM Parallel Processing for Scientific Computing (PP08), Atlanta, Georgia, March 12-14, 2008. (scheduled).
- Reviewer for Technical Papers in Super-Computing 2007, High Performance Networking and Computing Conference, Reno, November 10-16, 2007.
- Organizer, Minisymposium on *Trends in the Evolution of Scientific Computing Software* at SIAM Conference on Computational Science and Engineering (CSE07), Hilton Orange County/Costa Mesa, Costa Mesa, California, February 19-23, 2007.
- Reviewer for Computational Chemistry and its Applications Workshop in ICCS 2006.
- Reviewer for Proceedings of PARA'04, Workshop On State of the Art in Scientific Computing, June 20-23, 2004.
- Thesis Parts Appointment at Argonne National Laboratory, Fall 2003.
- Member of SIAM, SIAG/SP, IEEE Computer Society.
- Student Volunteer, Super-Computing 2002, High Performance Networking and Computing Conference, Baltimore, November 16-22, 2002.

References

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