

## PADMA RAGHAVAN

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Vice Provost for Research Bio: [https://www.vanderbilt.edu/provost/areas/vice-provost-for-research/Engineering Faculty Bio: <https://engineering.vanderbilt.edu/bio/padma-raghavan>](https://www.vanderbilt.edu/provost/areas/vice-provost-for-research/Engineering%20Faculty%20Bio/padma-raghavan)

### LIST OF PUBLICATIONS, PRESENTATIONS and STUDENT SUPERVISION

Raghavan specializes in computational and data science and high-performance computing, also known as supercomputing. She has led the development of “sparse algorithms” that derive from and operate on compact yet accurate representation of high-dimensional data, complex models, and computed results. She has developed parallel sparse solvers that limit the growth of computational costs and utilize the more than million-way concurrent computing capability of advanced hardware to enable the solution of large-scale modeling and simulation problems that are otherwise beyond reach. She has also developed algorithms and software for predictive computational modeling of materials and mechanical systems, and advanced sparse matrix and graph methods to increase the efficiency and quality of solutions produced by data mining schemes. Raghavan was among the first to propose the design of energy-efficient supercomputing systems by combining results from sparse scientific computing with hardware features for embedded mobile processors. Raghavan’s recent research focuses on resilient algorithms in the face of transient hardware errors and scheduling schemes for the efficient processing of data-intensive workflows when resource requirements are unpredictable.

**Total publications: 6 edited volumes/book chapters/position papers, and 118 refereed publications.**

#### Edited Volumes/Book Chapters/Position Papers

1. F. Berman, R. Rutenbar, B. Hailpern, H. Christensen, S. Davidson, D. Estrin, M. J. Franklin, M. Martonosi, P. Raghavan, V. Stodden and A. S. Szalay. 2018. Realizing the Potential of Data Science. *Communications of the ACM* 61, 4 (2018), 67–72.
2. B. Mohr and P. Raghavan, Editors. 2017. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis (SC '17)*, November 12 - 17, 2017, Denver, CO, USA, ACM.
3. A. Chatterjee\*, S. Bhowmick\* and P. Raghavan. 2013. Improving Classification through Graph Embeddings. *Graph Embedding for Pattern Analysis*, Editors, Y. Fu and Y. Ma, Springer, New York, (2013), 119 – 138.
4. J. S. Vetter, P. Raghavan. 2013. Special Issue: Selected Papers from Super Computing 2012. *Scientific Programming* 21, 3-4 (2013), 63-64.
5. M. H. Heroux, P. Raghavan and H. D. Simon. 2006. Parallel Processing for Scientific Computing. *SIAM book series on Software, Tools, and Environments including introductory and concluding chapters, Parallel Processing for Scientific Computing: An Overview, and Opportunities and Challenges for Parallel Computing in Science and Engineering*, November 2006. A reviewer in InsideHPC on 06/23/2010 says “Parallel is organized around the themes and problems presented at the Eleventh SIAM Conference on Parallel Processing for Scientific Computing, held in San Francisco in 2004... even though 2004 seems like a long time ago, the editors and contributors took care in the creation of this book, and it remains timely today.” (see <http://insidehpc.com/2010/06/review-parallel-processing-for-scientific-computing/>)
6. M. W. Berry, P. Raghavan and X. Zhang\*. 2001. Symbolic Preprocessing Techniques for

Information Retrieval Using Vector Space Models. *Computational Information Retrieval, SIAM Proceedings in Applied Mathematics*, 2001, SIAM, Editor M. W. Berry, Philadelphia, PA, USA, 75–86.

### Refereed Publications (\* indicates student/postdoctoral supervision by P. Raghavan)

#### Computational and Data Science:

Parallel matrix and graph algorithms, computational modeling and data analytics

7. H. Sun, Q. Yue, J. L. Sy, D. Godwin, H. P. Eaton, P. Raghavan, R. Marois. 2020. Increase in Inter-Network Functional Connectivity in the Human Brain with Attention Capture. *Journal of Neurophysiology* 124, 6 (2020), 1885–1899.
8. S. Kirmani\*, H. Sun\* and P. Raghavan. 2018. A Scalability and Sensitivity Study of Parallel Geometric Algorithms for Graph Partitioning. In *Proceedings of the 9th Workshop on Applications for Multi-Core Architectures (WAMCA '18)*, 2018, Lyon, France.
9. P. Raghavan, S. Kirmani\* and J. Park\*. 2017. An Embedded Sectioning Scheme for Multiprocessor Topology-Aware Mapping of Irregular Applications. *The International Journal of High Performance Computing Applications (IJHPCA '17)* 31, 1 (2017), 91-103.
10. G. Aupy\*, J.H. Park\* and P. Raghavan. 2016. Locality-Aware Laplacian Mesh Smoothing. In *Proceedings of the 45th International Conference on Parallel Processing (ICPP '16)*, August 16-19, 2016, Philadelphia, PA, USA, 588-597.
11. H. Kabir\*, J. Booth\*, G. Aupy, A. Benoit, Y. Robert and P. Raghavan. 2015. STS-k: A Multilevel Sparse Triangular Solution Scheme for NUMA Multicores. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis (SC '15)*, November 2015, Austin, TX, USA, 55, 1-11.
12. H. Kabir\*, J. Booth\*, P. Raghavan. 2014. A Multilevel Compressed Sparse Row Format for Efficient Sparse Computations on Multicore Processors. In *Proceedings of the 21<sup>st</sup> IEEE International Conference on High Performance Computing (HiPC '14)*, December 2014, Goa, India, 1-10.
13. J. Booth\* and P. Raghavan. 2014. Hybrid Sparse Linear Solutions with Substituted Factorization. In *Proceedings of the International Meeting High Performance Computing for Computational Science (VECPAR '14), Lecture Notes in Computer Science 8969, (2015)*, June 2014, Eugene, OR, USA, 145-155.
14. S. Kirmani\*, P. Raghavan. 2013. Scalable Parallel Graph Partitioning. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis (SC '13)*, November 2013, Denver, CO, USA, 51:1-10. **Finalist for Best Student Paper Award.**
15. M.R. Frasca\*, K. Madduri, P. Raghavan. 2012. NUMA-aware Graph Mining Techniques for Performance and Energy Efficiency. In *Proceedings of the SC Conference on High Performance Computing Networking, Storage and Analysis (SC '12)*, November 2012, Salt Lake City, UT, USA.
16. B. Suchoski\*, C. Severn\*, M. Shantharam\*, P. Raghavan. 2012. Adapting Sparse Triangular Solution to GPUs. In *Proceedings of the 41st International Conference on Parallel Processing Workshops*, September 2012, Pittsburgh, PA, USA, 140–148.
17. M. Shantharam\*, S. Srinivasmurthy\*, P. Raghavan. 2012. Fault Tolerant Preconditioned Conjugate Gradient for Sparse Linear System Solution. In *Proceedings of the International Conference on Supercomputing (ICS '12)*, June 2012, Venice, Italy, 69–78.
18. A. Chatterjee\*, P. Raghavan. 2012. Similarity Graph Neighborhoods for Enhanced Supervised Classification. *Procedia Computer Science* 9, (2012), 577-586.
19. J. Booth\*, A. Chatterjee\*, P. Raghavan, M. Frasca\*. 2011. A Multilevel Cholesky Conjugate Gradients Hybrid Solver for Linear Systems with Multiple Right-hand Sides. *Procedia Computer Science* 4, (2011), 2307-2316.
20. M. Shantharam\*, A. Chatterjee\*, P. Raghavan. 2011. Exploiting dense substructures for fast sparse

- matrix vector multiplication. *International Journal of High Performance Computing Applications* 25, 3 (2011), 328-341.
21. M. Shantharam\*, S. Srinivasmurthy\*, P. Raghavan. 2011. Characterizing the Impact of Soft Errors on Iterative Methods in Scientific Computing. *ACM International Conference on Supercomputing* (2011), 152-161. **Short version awarded Best Poster at Supercomputing 2010.**
  22. A. Chatterjee\*, S. Bhowmick, P. Raghavan. 2010. Feature Subspace Transformations for Enhancing K-means Clustering. In *Proceedings of the 19th ACM Conference on Information and Knowledge Management (CIKM '10)*, October 2010, 1801-1804.
  23. A. Chatterjee\*, K. Fermoye\*, P. Raghavan. 2010. Characterizing sparse preconditioner performance for the support vector machine kernel. *Procedia Computer Science* 1, 1 (2010), 367-375.
  24. P. Raghavan and K. Teranishi\*. 2010. Parallel Hybrid Preconditioning: Incomplete Factorization with Selective Sparse Approximate Inversion. *SIAM J. Scientific Computing* 32, 3 (2010), 1323-1345.
  25. A. Shaffer\*, B. Einfalt, P. Raghavan. 2010. PFFTC: An improved fast Fourier transform for the IBM cell broadband engine. *Procedia Computer Science* 1, 1 (2010), 1045-1054.
  26. S. Bhowmick\*, B. Toth\* and P. Raghavan. 2009. Towards Low-Cost, High-Accuracy Classifiers for Linear Solver Selection. In *Proceedings of International Conference on Computational Science. Lecture Notes in Computer Science*, 2009, 5544, Springer, 463-472.
  27. K. Teranishi\*, P. Raghavan, J. Zhang, T. Wang, L. Q. Chen and Z. K. Liu. 2008. Readily Regenerable Reduced Microstructure Representations, *Computational Materials Science* (Mar. 2008), 18 pages, DOI: //dx.doi.org/10.1016/j.commatsci.2007.07.015
  28. K. Teranishi\*, P. Raghavan, J. Sun\* and P. Michaleris. 2007. An Evaluation of Limited Memory Sparse Linear Solvers for Thermo-Mechanical Applications. *International Journal of Numerical Methods for Engineering, Wiley InterScience, (www.interscience.wiley.com)*, (Nov. 2007), 1690-1715. DOI: 10.1002/nme.2239
  29. A. Sriraman\*, K. Butler, P. McDaniel and P. Raghavan. 2007. Analysis of the IPv4 Address Space Delegation Structure. *IEEE Symposium on Computers and Communications (ISCC'07)*, July 2007, 501-508, DOI: 10.1109/ISCC.2007.4381538
  30. M. Menon, E. Richter, I. Lee\* and P. Raghavan. 2007. Si Nanotrees: Structure and Electronic Properties. *Journal of Computational and Theoretical Nanoscience* 4, (2007), 250-256.
  31. J. Sun\*, P. Michaleris, A. Gupta and P. Raghavan. 2007. Applications of the FETI-DP-RBS-LNA algorithm on Coupled Linear-Nonlinear Large Scale Problems with Localized Nonlinearities, *Lecture Notes in Computational Science and Engineering, Domain Decomposition Methods in Science and Engineering XVI*, 55 (2007), 431-438.
  32. K. Teranishi\* and P. Raghavan. 2007. A Hybrid Parallel Preconditioner Using Incomplete Cholesky Factorization and Sparse Approximate Inversion. *Lecture Notes in Computational Science and Engineering, Domain Decomposition Methods in Science and Engineering XVI*, 55 (2007), 757-764.
  33. I. Lee\*, P. Raghavan and E. G. Ng. 2006. Effective Preconditioning through Ordering Interleaved with Incomplete Factorization. *SIAM Journal on Matrix Analysis and Applications* 27, 4 (2006), 1069-1088.
  34. P. Raghavan. 2006. Advanced Algorithms and Software Components for Scientific Computing. *Lecture Notes in Computer Science, Applied Parallel Computing 3732*, (2006), 590-592.
  35. K. Teranishi\* and P. Raghavan. 2006. Parallel Hybrid Sparse Solvers Through Flexible Incomplete Cholesky Preconditioning. *Lecture Notes in Computer Science, Applied Parallel Computing 3732*, (2006), 637-643.
  36. M. Menon, E. Richter, I. Lee\*, K. Teranishi\* and P. Raghavan. 2005. Large Scale Simulations of Branched Si-nanowires. In *Proceedings of the IEEE/ACM International Workshop on High Performance Computing for Nano-science and Technology (HPCNano '05)*, November 2005.
  37. S. Bhowmick\*, D. Kaushik, L. McInnes, B. Norris and P. Raghavan. 2005. Parallel Adaptive

- Solvers in Compressible PETSc-FUN3D Simulations. Argonne National Laboratory preprint ANL/MCS-P1279-0805, In *Proceedings of the 17th International Conference on Parallel Computational Fluid Dynamics*, August 2005.
38. K. Malkowski and P. Raghavan. 2005. Multi-Pass Mapping Schemes for Parallel Sparse Matrix Computations. *Lecture Notes in Computer Science, Computational Science-ICCS 2005* 3514, (May 2005), 245-255.
  39. J. Sun\*, P. Michaleris, A. Gupta and P. Raghavan. 2005. A Fast Implementation of the FETI-DP Method: FETI-DP-RBS-LNA and Applications on Large Scale Problems with Localized Nonlinearities. *International Journal for Numerical Methods in Engineering* 60, 4 (2005), 833-858.
  40. S. Bhowmick\*, L. McInnes, B. Norris and P. Raghavan. 2004. Robust Algorithms and Software for Parallel PDE-Based Simulations. In *Proceedings of The Twelfth Special Symposium on High Performance Computing at the 2004 Advanced Simulation Technologies Conference (HPC '04)*, April 2004. Arlington, VA, USA, 37-42.
  41. K. Teranishi\*, P. Raghavan and Z. K. Liu. 2004. Towards A Grid Enabled System for Multicomponent Materials Design. In *Proceedings of IEEE International Symposium on Cluster Computing and the Grid (CCGrid '04)*, April 2004, Chicago, Illinois, USA, IEEE Computer Society Press, 6 pages.
  42. S. Bhowmick\*, P. Raghavan, L. C. McInnes and B. Norris. 2004. Faster PDE-Based Simulations Using Robust Composite Linear Solvers. *Future Generation Computer Systems* 20, (2004), 373-387.
  43. Z. K. Liu, L. Q. Chen, P. Raghavan, Q. Du, J. O. Sofo, S. Langer and C. Wolverton. 2004. An Integrated Framework for Multi-Scale Materials Simulation and Design. *Journal of Computer-Aided Materials Design* 11, 2-3 (2004), 183-199.
  44. I. Lee\*, P. Raghavan, S. Schofield and P. Fischer. 2003. Dimension Reduction in Spectral Element Methods. *Computational Fluid and Solid Mechanics 2003, Proceedings of the Second MIT Conference on Computational Fluid and Solid Mechanics*, June 2003, Editor K. J. Bathe, 2, 2039-2042.
  45. P. Hovland, K. Keahey, L. C. McInnes, B. Norris, L. F. Diachin and P. Raghavan. 2003. A Quality of Service Approach for High-Performance Numerical Components. In *Proceedings of the Workshop on Quality-of-Service in Component-Based Software Engineering, Software Technologies Conference*, June 2003, Toulouse, France, 89-98.
  46. B. Norris, L. McInnes, S. Bhowmick\* and P. Raghavan. 2003. Adaptive Sparse Linear Solvers for Implicit CFD Using Newton-Krylov Algorithms. In *Proceedings of the Second MIT Conference on Computational Fluid and Solid Mechanics*, June 2003, Editor K. J. Bathe, 2, 1024-1028.
  47. S. Bhowmick\*, L. McInnes, B. Norris and P. Raghavan. 2003. The Role of Multi-Method Linear Solvers in PDE-Based Simulations. *Lecture notes in Computer Science* 2677, (May 2003), 828-839.
  48. K. Teranishi\*, P. Raghavan and C. Yang. 2003. Time-Memory Trade-offs Using Sparse Matrix Methods for Large-Scale Eigenvalue Problems. *Lecture notes in Computer Science* 2677, (May 2003), 840-847.
  49. P. Raghavan, K. Teranishi\* and E. G. Ng. 2003. A Latency Tolerant Hybrid Sparse Solver Using Incomplete Cholesky Factorization. *Numerical Linear Algebra* 10, (2003), 541-560.
  50. K. Teranishi\*, P. Raghavan and E. Ng. 2002. A New Data-Mapping Scheme for Latency-Tolerant Distributed Sparse Triangular Solution. In *Proceedings of the IEEE/ACM Supercomputing 2002, IEEE Computer Society*, November 2002, 27.
  51. P. Raghavan, M. A. James, J. C. Newman and B. R. Seshadri. 2002. Scalable Sparse Matrix Techniques for Modeling Crack Growth. *Lecture Notes in Computer Science, Applied Parallel Computing*, (Jun. 2002), 588-602.
  52. S. Bhowmick\*, P. Raghavan and K. Teranishi. 2002. A Combinatorial Scheme for Developing Efficient Composite Solvers. *Lecture Notes in Computer Science, Computational Science-ICCS 2002* 2330, (May 2002), 325-334.
  53. K. Pierson, G. Reese and P. Raghavan. 2002. Experiences with FETI-DP in a Production Level

- Finite Element Code. In *Proceedings of the 14th International Conference on Domain Decomposition Methods*, January 2002, 233-240. Also available in the electronic archive at <http://www.ddm.org/DD14/>
54. C. Yang, P. Raghavan, L. Arrowood\*, D. W. Noid, B. G. Sumpter and R. E. Tuzun. 2002. Large-scale Normal Coordinate Analysis on Distributed Memory Parallel Systems. *Int. Journal of High Performance Computing Applications* 1, (2002), 409-424.
  55. P. Raghavan, K. Teranishi\* and E. Ng. 2001. Towards Scalable Preconditioning Using Incomplete Factorization. In *Proceedings of the International Conference on Preconditioning Techniques*, November 2001, 63-65.
  56. M. W. Berry, P. Raghavan and X. Zhang\*. 2001. Level Search Techniques for Scalable Information Filtering and Retrieval. *Information Processing and Management* 37, (2001), 313-334.
  57. J. J. Dongarra and P. Raghavan. 2000. A Grid Computing Environment for Enabling Large Scale Quantum Mechanical Simulations. In *Proceedings of IEEE/ACM International Workshop on Grid Computing, Lecture Notes in Computer Science (GRID'00)*, December 2000, 1971, Editors R. Buyya and M. Baker, 102-110.
  58. E. G. Ng and P. Raghavan. 2000. Towards A Scalable Hybrid Sparse Solver. *Concurrency: Practice and Experience* 12, (2000), 1-16.
  59. E. G. Ng, B. W. Peyton and P. Raghavan. 1999. A Blocked Incomplete Cholesky Preconditioner for Hierarchical-Memory Computers. *IMACS Series in Computational and Applied Mathematics: Iterative Methods in Scientific Computation IV*, (Oct. 1999), 211-222.
  60. E. G. Ng and P. Raghavan. 1999. The Performance of Greedy Ordering Heuristics for Sparse Cholesky Factorization. *SIAM Journal of Matrix Analysis and Applications* 20, 4 (1999), 902-914.
  61. M. T. Jones, M. A. Langston and P. Raghavan. 1998. Tools for Mapping Applications to CCMs. In *Proceedings of SPIE, Configurable Computing: Technology and Applications*, November 1998, Editor John Schewel, 72-81.
  62. M. T. Heath, and P. Raghavan. 1998. The Performance of Parallel Sparse Triangular Solution. *IMA Volumes in Mathematics and its Applications: Algorithms for Parallel Processing* 105, (1998), 289-306.
  63. P. Raghavan. 1998. Efficient Parallel Triangular Solution Using Selective Inversion. *Parallel Processing Letters* 8, 1 (1998), 29-40.
  64. M. T. Heath and P. Raghavan. 1997. Performance of a Fully Parallel Sparse Solver. *International Journal of Supercomputing Applications* 11, 1 (1997), 49-64.
  65. M. A. Nasir, P. Raghavan, W. C. Chew and M. T. Heath. 1997. A Comparison of Computational Complexities of HFEM and ABC Finite Element Methods. *Journal of Electromagnetic Waves and Applications* 11, (1997), 1601-1617.
  66. P. Raghavan. 1997. Parallel Ordering Using Edge Contraction. *Parallel Computing* 23, 8 (1997), 1045-1067.
  67. M. W. Berry, B. Hendrickson and P. Raghavan. 1996. Sparse Matrix Reordering Schemes for Browsing Hypertext. *Lectures in Applied Mathematics (The Mathematics of Numerical Analysis)* 32, (1996), 99-123.
  68. M. T. Heath and P. Raghavan. 1995. A Cartesian Parallel Nested Dissection Algorithm. *SIAM Journal of Matrix Analysis and Applications* 16, (1995), 235-253.
  69. P. Raghavan. 1995. Distributed Sparse Gaussian Elimination and Orthogonal Factorization. *SIAM Journal of Scientific Computing* 16, (1995), 1462-1477.
  70. M. A. Nasir, P. Raghavan, W. C. Chew and M. T. Heath. 1994. A Comparison of Computational Complexities of HFEM and ABC Based Finite Element Methods. In *Proceedings of IEEE APS International Symposium*, June 1994, 447-450.
  71. P. Raghavan. 1994. Distributed Sparse Gaussian Elimination and Orthogonal Factorization. In *Proceedings of the 1994 Scalable High Performance Computing Conference, IEEE Computer Society Press*, May 1994, 607-614.

72. M. T. Heath and P. Raghavan. 1994. Performance of a Fully Parallel Sparse Solver. In *Proceedings of the 1994 Scalable High Performance Computing Conference*, IEEE Computer Society Press, May 1994, 334-341.
73. M. T. Heath and P. Raghavan. 1993. Distributed Solution of Sparse Symmetric Positive Definite Systems. In *Proceedings of the 1993 Scalable Parallel Libraries Conference*, IEEE Computer Society Press, Oct. 1993.
74. A. Pothen and P. Raghavan. 1989. Distributed Orthogonal Factorization: Givens and Householder Algorithms. *SIAM Journal of Scientific Computing* 10, 6 (1989), 1113-1134.
75. A. Pothen and P. Raghavan. 1988. Distributed Orthogonal Factorization. In *Proceedings of the Third ACM Conference on Hypercube Concurrent Computers and Applications*, June 1988, 1610-1620.

### External Funding:

- National Science Foundation, Division of Computer and Communications Foundations, *SHF: Small: Embedded Graph Software-Hardware Models and Maps for Scalable Sparse Computations*, P. Raghavan, \$424,999, 2013-2018, **completed, PI**.
- National Science Foundation, CNS Data-Intensive Computing, DC: Small: *Adaptive Sparse Data Mining on Multicores*, P. Raghavan and M. Kandemir, \$449,998, 2010-2014, **completed, PI**.
- National Science Foundation, Division of Computer and Communication Foundations, *Toward a Linear Time Sparse Solver with Locality-Enhanced Scalable Parallelism*, P. Raghavan, \$200,000, 2008-2013, **completed, PI**.
- National Science Foundation, Major Research Instrumentation Program, *MRI Acquisition of a Scalable Instrument for Discovery through Computing*, P. Raghavan, L. Q. Chen, P. J. Hudson, M. T. Kandemir and B. K. Smith, \$1,855,501, 2008-2012, **completed, PI**.
- National Science Foundation, *Center for Computational Materials Design (IIP-0541674)*, Z. K. Liu, L.Q. Chen, J. Kubucki, P. Raghavan and J. Sofo, approximately \$400,000, October 2005 - October 2011, **completed, Co-PI**.
- U.S. Army Corps of Engineers, Engineer Research and Development Center, *A Smart Solver Selection Toolkit for Faster PDE-Based Simulations*, P. Raghavan, \$105,849, 2009-2011, **completed, PI**.
- IBM, SUR grant, *Toward a Parallel Preconditioned Conjugate Gradients Sparse Solver for the Cell Processor*, P. Raghavan, V. Agarwala, and J. Nucciarone, \$100,000, October 2007-October 2008, **completed, PI**.
- National Science Foundation, Information Technology Research ‘medium’ award, *ITR: Computational Tools for Multicomponent Materials Design (DMR-0205232)*, Z. K. Liu, L.Q. Chen, P. Raghavan and Q. Du, \$2,900,000, 2002-2008, **completed, Co-PI**.
- National Science Foundation, *(I<sup>3</sup>C): An Infrastructure for Innovation in Information Computing (CNS-0102007)*, C. Das, R. Acharya, L. Giles, M. J. Irwin, and P. Raghavan, \$1,795,729, 2002-2008, **completed, Co-PI**.
- National Science Foundation, Information Technology Research ‘small’ award, *ITR: Large Scale Quantum Mechanical Simulations of Nanomechanics (EIA-0221916)*, M. Menon and P. Raghavan, \$394,843, 2002-2006, **completed, Co-PI**.
- Department of Energy, *SciDac Terascale Optimal PDE Simulation: An Enabling Technology Center*, multi-site project lead by D. Keyes, subcontract from the Lawrence Berkeley National Laboratory, P. Raghavan, \$108,000, 2002-2005, **completed, PI**.
- National Science Foundation, *Robust Limited Memory Hybrid Sparse Solvers (0102537)*, P. Raghavan, \$315,473, 2001-2005, **completed, PI**.

- National Science Foundation, *SInRG: A Scalable Intracampus Research Grid*, J. J. Dongarra, M. D. Beck, M. W. Berry, J. Gregor, and M. A. Langston, \$1,751,088, 2000-2005, **completed, senior-personnel**.
- National Science Foundation, *Grant to Support Activities at the Eleventh SIAM Conference on Parallel Processing for Scientific Computing* (CCF-0340869), San Francisco, CA, USA, February 2004, P. Raghavan (conference Co-Chair), \$17,000, August 2003-March 2004, **completed, PI**.
- Argonne National Laboratory (Department of Energy) and the University of Chicago, *The Maria Goeppert-Mayer Distinguished Scholar Award*, P. Raghavan, \$171,349, 2002-2003, **completed, PI**.
- National Aeronautics and Space Administration (NASA), *An Efficient Scheme for Updating Sparse Cholesky Factors*, P. Raghavan, \$20,000, 2001-2002, **completed, PI**.
- National Science Foundation, *Enabling Technology for High-Performance Heterogeneous Clusters*, J. J. Dongarra, P. Raghavan and J. S. Plank, support only for instrumentation, \$150,000, 1999-2002, **completed, Co-PI**.
- National Science Foundation, *Fabrication of Fullerene Based Novel Molecular Electronic Devices Using Quantum Mechanical Simulations*, M. Menon and P. Raghavan, \$87,078, 2001-2002, **completed, PI**.
- National Science Foundation, *Scalable Sparse Solvers*, P. Raghavan, \$182,000, 1998-2002, **completed, PI**.
- National Science Foundation, *Parallel Sparse Matrix Computations*, P. Raghavan, **CAREER award**, \$131,651, 1995-2000, **completed, PI**.
- Defense Advanced Research Projects Agency (DARPA), *Portable Parallel Preconditioning*, J. G. Gilbert, E. G. Ng, B. W. Peyton and P. Raghavan, \$600,000, 1996-1999, **completed, Co-PI**.
- Defense Advanced Research Projects Agency (DARPA), *Scalable Libraries, multi-site project* lead by J. J. Dongarra, subcontract to P. Raghavan, from the Sparse Direct Solvers component directed by M. T. Heath, \$130,000, 1996-1999, **completed, PI**.
- National Science Foundation, *High-Performance ATM Network*, M. W. Berry, J. Gregor, M. T. Jones, J. S. Plank and P. Raghavan, \$100,000, 1996-1997, **completed, PI**.

### **High Performance Computing (supercomputing):**

Energy-efficient, scalable and resilient design and implementation

76. A. Benoit, V. Le Fèvre, P. Raghavan, Y. Robert, H. Sun\*, 2021. Resilient Scheduling Heuristics for Rigid Parallel Jobs. *International Journal of Networking and Computing* 11, 1 (2021), 2–26
77. A. Gainaru\*, B. Goglin, V. Honore, G. P. Aupy\*, P. Raghavan, Y. Robert, H. Sun\*. 2020. Reservation and Checkpointing Strategies for Stochastic Jobs. In *Proceedings of the IEEE International Symposium on Parallel and Distributed Processing (IPDPS '20)*, 2000, New Orleans, LA, USA
78. A. Benoit, V. Le Fèvre, L. Perotin, P. Raghavan, Y. Robert, H. Sun\*. 2020. Resilient Scheduling of Moldable Jobs on Failure-Prone Platforms. In *Proceedings of the IEEE Cluster Conference, 2020*, Kobe, Japan.
79. A. Benoit, V. Le Fèvre, P. Raghavan, Y. Robert, H. Sun\*. 2020. Design and Comparison of Resilient Scheduling Heuristics for Parallel Jobs. In *Proceedings of the 22nd Workshop on Advances in Parallel and Distributed Computational Models (APDCM '20)*, 2020. New Orleans, LA, USA. **(Best Paper Award)**
80. H. Sun\*, A. Gainaru\*, M. Shantharam\*, P. Raghavan. 2020. Selective Protection for Sparse Iterative Solvers to Reduce the Resilience Overhead. In *Proceedings of the IEEE 32nd International Symposium on Computer Architecture and High Performance Computing (SBAC-PAD '20)*, 2020, Porto, Portugal.
81. G. Aupy\*, A. Gainaru\*, V. Honore, P. Raghavan, Y. Robert, H. Sun\*. 2019. Reservation

- Strategies for Stochastic Jobs. In *Proceedings of the IEEE International Symposium on Parallel and Distributed Processing (IPDPS '19)*, 2019, Rio de Janeiro, Brazil.
82. A. Gainaru\*, G. Pallez (Aupy)\*, H. Sun\*, Padma Raghavan. 2019. Speculative Scheduling for Stochastic HPC Applications. In *Proceedings of the International Conference on Parallel Processing (ICPP '19)*, 2019, Kyoto, Japan.
  83. A. Gainaru\*, H. Sun\*, G. Aupy\*, Y. Huo, B. A. Landman, P. Raghavan. 2019. On-the-fly Scheduling versus Reservation-based Scheduling for Unpredictable Workflows. *International Journal of High Performance Computing Applications* 33, 6 (2019), 1140–1158.
  84. T. Phan, G. Pallez\*, S. Ibrahim, P. Raghavan. 2019. A New Framework for Evaluating Straggler Detection Mechanisms in MapReduce. *ACM Transactions on Modeling and Performance Evaluation of Computing Systems* 4, 3 (2019) 14:1-14:23.
  85. H. Sun\*, R. Elghazi, A. Gainaru\*, G. Aupy\* and P. Raghavan. 2018. Scheduling Parallel Tasks under Multiple Resources: List Scheduling vs. Pack Scheduling. *2018 IEEE International Parallel and Distributed Processing Symposium (IPDPS '18)*, May 21-25, 2018, Vancouver, BC, Canada, 194–203.
  86. G. Aupy\*, A. Benoit, S. Dai, L. Pottier, P. Raghavan, Y. Robert and M. Shantharam\*. 2018. Co-scheduling Amdahl applications on cache-partitioned systems. *The International Journal of High Performance Computing Applications (IJHPCA)* 32, 1 (2018), 123–138.
  87. A. Benoit, A. Cavelan, F. Cappello, P. Raghavan, Y. Robert, H. Sun\*. 2018. Coping with silent and fail-stop errors at scale by combining replication and checkpointing. *Journal of Parallel and Distributed Computing* 122, (2018), 209-225.
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  89. A. Benoit, A. Cavelan, F. Cappello, P. Raghavan, Y. Robert, H. Sun\*. 2017. Identifying the Right Replication Level to Detect and Correct Silent Errors at Scale. In *Proceedings of the 7th ACM Workshop on Fault-Tolerance for HPC at Extreme Scale (FTXS '17)*, 2017.
  90. G. Aupy\*, M. Shantharam\*, A. Benoit, Y. Robert and P. Raghavan. 2016. Co-scheduling Algorithms for High-throughput Workload Execution. *Journal of Scheduling* 19, 6 (2016), 627—640.
  91. J. Booth\*, P. Raghavan. 2015. Phase Detection with Hidden Markov Models for DVFS on Many-Core Processors. In *Proceedings of the 35<sup>th</sup> IEEE International Conference on Distributed Computing Systems (ICDCS '15)*, June 2015, Columbus, OH, USA, 185-195.
  92. R. Prabhakar, M. T. Kandemir, P. Raghavan, M. Jung. 2013. Interference Resolver in Shared Storage Systems to Provide Fairness to I/O Intensive Applications. In *Proceedings of the 2013 IEEE International Symposium on Parallel & Distributed Processing, Workshops and PhD Forum*, May 2013, Cambridge, MA, USA, 1971-1980.
  93. M. Shantharam\*, Y. Youn\*, P. Raghavan. 2013. Speedup-Aware Co-Schedules for Efficient Workload Management. *Parallel Processing Letters* 23, 2 (2013).
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  95. M. Frasca\*, A. Chatterjee\*, P. Raghavan. 2011. Can Models of Scientific Software-hardware Interactions Be Predictive? *Procedia Computer Science* 4 (2011), 322-331.
  96. M. Frasca\*, R. Prabhakar, P. Raghavan, M. T. Kandemir. 2011. Virtual I/O Caching: Dynamic Storage Cache Management for Concurrent Workloads. *Supercomputing* 38, (2011).
  97. S. P. Muralidhara\*, M. Kandemir and P. Raghavan. 2010. Intra-Application Shared Cache Partitioning For Multithreaded Applications. In *Proceedings of 15th ACM SIGPLAN Annual Symposium on Principles and Practices of Parallel Programming (PPoPP '10)*, January 2010.
  98. Y. Ding\*, M. Kandemir, M. J. Irwin and P. Raghavan. 2010. Dynamic Core Partitioning for Energy



- Efficiency. In *Proceedings of the 6th Workshop on High Performance, Power-Aware Computing (HPPAC), in conjunction with 24th IEEE/ACM International Parallel and Distributed Symposium, (IPDPS '10), IPDPS Workshops*, 2010, 1-8.
99. K. Malkowski\*, P. Raghavan and M. Kandemir. 2010. Analyzing the Soft-Error Resilience of Linear Solvers on Multicore Multiprocessors. In *Proceedings of the 24th IEEE/ACM International Parallel and Distributed Symposium (IPDPS '10)*, 2010, 1-12.
  100. K. Malkowski\*, P. Raghavan, M. Kandemir and M. J. Irwin. 2010. T-NUCA -A Novel Approach to Non-Uniform Access Latency Cache Architectures for 3D CMPs. In *Proceedings of the 6th Workshop on High Performance, Power-Aware Computing (HPPAC '10), in conjunction with 24th IEEE/ACM International Parallel and Distributed Symposium (IPDPS Workshops '10)*, 2010, 1-8.
  101. S. P. Muralidhara, M. Kandemir and P. Raghavan. 2010. Intra-Application Cache Partitioning. In *Proceedings of the 24th IEEE/ACM International Parallel and Distributed Symposium (IPDPS '10)*, 2010, 1-12.
  102. S. Akioa\*, F. Li, K. Malkowski\*, P. Raghavan, M. Kandemir and M. J. Irwin. 2009. Ring Data Location Prediction Scheme for Non-Uniform Cache Architectures. In *Proceedings of XXVI IEEE International Conference on Computer Design (ICCD'08)*, 2009, 693-698.
  103. R. Garg\*, S. Woo Son, M. T. Kandemir, P. Raghavan, R. Prabhakar. 2009. Markov Model Based Disk Power Management for Data Intensive Workloads. *9th IEEE/ACM International Symposium on Cluster Computing and the Grid (CCGRID '09)*, 2009, 76-83.
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  105. Y. Ding\*, M. Kandemir, P. Raghavan and M. J. Irwin. 2009. Adapting Application Execution in CMPs Using Helper Threads. In *Journal of Parallel and Distributed Computing* 69, 9 (2009),790-806. **Invited Paper.**
  106. M. Shantharam\*, P. Raghavan and M. Kandemir. 2009. Hybrid Techniques for Fast Multicore Simulation. In *Proceedings of the 15th International Euro-Par Conference on Parallel Processing (Euro-Par '09)*, 2009, Springer Verlag, 122-134.
  107. M. Shantharam\*, K. Malkowski\* and P. Raghavan. 2008. Performance and Power Impacts of Memory Latency Hiding for Sparse Matrix Vector Multiplication on Multi-Core Architectures. *Post conference Proceedings of the 9th International Workshop on State-of-the-Art in Scientific and Parallel Computing (PARA '08)*, May 2008.
  108. Y. Ding\*, K. Malkowski\*, P. Raghavan and M. Kandemir. 2008. High Performance, Power-Aware Computing Workshop. 2008. Towards Energy Efficient Scaling of Scientific Codes. In *Proceedings of 22nd IEEE/ACM International Parallel and Distributed Symposium (IPDPS '08)*, April 2008, 1-8.
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  111. Y. Ding\*, M. Kandemir, P. Raghavan and M. J. Irwin. 2008. A Helper Thread Based EDP Reduction Scheme for Adapting Application Execution in CMPs. *22nd IEEE/ACM International Parallel and Distributed Symposium (IPDPS '08)*, 2008, 1-14. DOI: 10.1109/IPDPS.2008.4536297. **Best Paper, Software Track; 4 Best Papers, one per track out of 410 submitted papers.**
  112. S. W. Son\*, K. Malkowski\*, G. Chen, M. T. Kandemir, P. Raghavan. 2007. Reducing energy consumption of parallel sparse matrix applications through integrated link/CPU voltage scaling. *The*

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113. K. Malkowski\*, P. Raghavan, M. Kandemir and M. J. Irwin. 2007. Phase-Aware Adaptive Hardware Selection for Power-Efficient Scientific Computing. *ISLPED*, August 2007, 403-406. DOI:10.1145/1283780.1283869
  114. I. Lee\*, P. Raghavan. 2007. Scientific Algorithms: Performance, Power, Thermal Properties on Modern Computing Architectures. *Workshop on Unique Chips and Systems*, April 2007, 1-8.
  115. K. Malkowski\*, G. Link\*, P. Raghavan and M. J. Irwin. 2007. Load Miss Prediction for Energy-Aware High Performance Computing. *21st IEEE/ACM International Parallel and Distributed Symposium (IPDPS '07), High Performance, Power-Aware Computing Workshop*, March 2007, 1-8. DOI:10.1109/IPDPS.2007.370536
  116. S. Conner, S. Akioka\*, G. M. Link, M. J. Irwin and P. Raghavan. 2007. Modeling of Link Shutdown Opportunities During Collective Communication Primitives in 3-D Torus Nets. *21st IEEE International Parallel and Distributed Symposium (IPDPS '07), High Performance, Power-Aware Computing Workshop*, March 2007, 1-8.
  117. K. Malkowski\*, P. Raghavan and M.J. Irwin. 2007. Memory Optimizations for Fast Power-Aware Sparse Computations. In *Proceedings of the 21st IEEE/ACM International Parallel and Distributed Symposium (IPDPS '07), Next Generation Software Workshop*, March 2007, 1-8. DOI:10.1109/IPDPS.2007.370501
  118. Y. Ding\*, M. Kandemir, P. Raghavan and M. J. Irwin. 2007. Adapting Application Execution to Reduced CPU Availability. *INTERACT at IEEE 13th International Symposium on High Performance Computer Architecture (HPCA-INTERACT '07)*, February 2007, 24-31.
  119. K. Malkowski\*, I. Lee\*, P. Raghavan and M. Irwin. 2006. Conjugate Gradient Sparse Iterative Solvers: Performance-Power Characteristics. In *Proceedings of the 20th IEEE/ACM International Parallel and Distributed Symposium, Second High Performance, Power-Aware Computing Workshop*, April 2006, 1-8. DOI: 10.1109/IPDPS.2006.1639595
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  121. S. W. Son, K. Malkowski\*, G. Chen, M. T. Kandemir and P. Raghavan. 2006. Integrated Link/CPU Voltage Scaling for Reducing Energy Consumption of Parallel Sparse Matrix Applications. In *Proceedings of the 20th IEEE/ACM International Parallel and Distributed Symposium (IPDPS '06), Second High-Performance, Power-Aware Computing Workshop*, April 2006, 1-8. DOI:10.1109/IPDPS.2006.1639596
  122. S. Akioka\*, K. Malkowski\*, P. Raghavan, M. J. Irwin, L. C. McInnes and B. Norris. 2006. Characterizing the Performance and Energy Attributes of Scientific Simulations. *Lecture Notes in Computer Science* 399/2006 (January 2006), 242-249.
  123. G. Chen, K. Malkowski\*, M. Kandemir and P. Raghavan. 2005. Reducing Power with Performance Constraints for Parallel Sparse Applications. G. Chen, Reducing Power with Performance Constraints for Parallel Sparse Applications. In *Proceedings of the High Performance, Power-Aware Computing Workshop at the 19th IEEE/ACM International Parallel and Distributed Symposium (IPDPS '05)*, 2005, Workshop 12, 12, 231a.
  124. P. Raghavan, M. J. Irwin L. C. McInnes and B. Norris. 2005. Adaptive Software for Scientific Computing: Co-Managing Quality-Performance-Power Tradeoffs. In *Proceedings of the Next Generation Software Workshop at the 19th IEEE/ACM International Parallel and Distributed Symposium (IPDPS '05)*, 2005, Workshop 11, 11, 220b.

#### External Funding:

- National Institutes of Health, NCATS, The Vanderbilt Institute for Clinical Translational Research (VICTR), subcontract Vanderbilt University Medical Center, \$972,840, 2017-2022, **in progress, PI.**

- National Science Foundation, XPS: FULL: DSD: End-to-end Acceleration of Genomic Workflows on Emerging Heterogeneous Supercomputers, K. Madduri, M. Kandemir, P. Medvedev, P. Raghavan, \$849,984, 2014-2017, **completed, Co-PI.**
- National Science Foundation, CISE Computer Systems Research, SHF: Medium: *Automatic Control Driven Resource Management in Chip Multiprocessors*, M. Kandemir, P. Raghavan and Q. Wang, \$1,200,000, 2010-2014, **completed, Co-PI.**
- National Science Foundation, CISE HECURA program, *Collaborative Research: Achieving End-to-End QoS in the I/O Stack on Petascale Multiprocessors*, M. Kandemir, P. Raghavan, J. Dennis and Q. Wang, \$708,551, 2009-2014, **completed, Co-PI.**
- National Science Foundation, OCI, US and China Workshop Series to Build a Collaborative Framework for Developing Shared Software Infrastructure, \$443,233, multi-university. PSU sub-award, \$18,967, 2008-2012, **completed, PSU lead.**
- National Science Foundation, CISE-Computer Systems Research, *Toward Model-Driven Multilevel Analysis and Optimization of Multicomponent Computer Systems*, P. Raghavan, M. J. Irwin, M. Kandemir, J. Li, and S. Shontz, \$855,729, 2007-2010, **completed, PI.**
- Maryland Procurement Office (NSA), *CMP Optimizations- Parts I & II*, P. Raghavan, \$184,571, 2007-2009, **completed, PI.**
- National Science Foundation, *Adaptive Software for Extreme-Scale Scientific Computing: Co-Managing Quality-Performance-Power Tradeoffs* (CCF-0444345), P. Raghavan, M. J. Irwin (Co-PI), L. C. McInnes and B. Norris (collaborators) \$950,000, 2004-2009, **completed, PI.**
  - National Science Foundation, *A Set of Multi-Tiered Interventions at Critical Pipeline Stages: Broadening Participation in Computing Supplement*, \$149,900, 2006-2007, **completed, PI.**
  - *Research Experience for Undergraduates Supplement*, \$6,000, May 2005-December 2005, **completed, PI.**
- National Science Foundation, *A Study of an Automated Development Environment for Parallel Computing with Reconfigurable Processing Elements*, M. A. Langston, P. Raghavan and D. W. Bouldin, \$315,473, 2000-2003, **completed, Co-PI.**
- The University of Tennessee (SARIF Equipment and Infrastructure Fund), A Linux-Based Parallel Computing Cluster for Computational Chemistry Algorithm Design, R. J. Hinde and P. Raghavan, instrumentation, \$12,000, 1999-2000, **completed, Co-PI.**

## RESEARCH SOFTWARE

Software developed by Raghavan embodies novel algorithms for computational science and engineering and mathematical principles.

1. **DSCPACK:** A Domain-Separator Cholesky Package for the multifrontal solution of sparse linear systems, P. Raghavan. The software is suitable for multiprocessors with message passing (MPI) and includes mechanisms for latency tolerant, fast repeated solves (by inquiry).
2. **MATCASE:** A Web-Based Laboratory for Multicomponent Materials Design, P. Raghavan and K. Teranishi. Raghavan is the principal developer of the services based software architecture to combine knowledge bases with on-demand multi-scale simulations on computational grids (wide-area high performance computing systems). The system enables scientists to interactively explore the design of the technologically important Al-Cu-Mg-Si alloys. It enables the prediction of macro-structural properties such as stress fields, by automating the generation of simulated micro-structures, their subsequent analyses using finite-element methods, and design-space exploration using reduced-order representations. Limited-use release to industry partners through the NSF funded IUCRC “Center for Computational Materials Design.”

## SELECTED INVITED PRESENTATIONS (2005 – PRESENT)

- 11/18 IEEE/ACM Supercomputing, SC'18, Dallas, TX, USA, *Superscaling Performance through Energy-Efficient Supercomputing.*
- 7/18 Workshop on Clusters, Clouds and Data for Scientific Computing, Chemin de Chanze, France, *Rethinking the Computational Complexity and Efficiency in the Age of 'Big Data.'*
- 4/18 Purdue University, West Lafayette, IN, USA, *Rethinking Performance and Resiliency for Massively Parallel Processing of Large Sparse Data Sets.*
- 9/16 The 28th International Workshop on Languages and Compilers for Parallel Computing, Raleigh, NC, USA, Keynote, *Toward Programming Models for Parallel Processing of Sparse Data Sets.*
- 7/15 Algorithms and Scheduling Techniques to Manage Resilience and Power Consumption in Distributed Systems, Schloss Dagstuhl, Germany, *Scheduling for Parallel Sparse Matrix Computations.*
- 3/15 SIAM Conference on Computational Science and Engineering (SIAM CSE15), Salt Lake City, UT, USA, Panel Speaker, *The Future of CSE as a Discipline.*
- 9/14 Clusters and Computational Data for Scientific Computing Workshop, Lyon, France, *Sparse Computations and Soft Errors.*
- 7/14 9<sup>th</sup> Scheduling for Large Scale Systems Workshop, Lyon, France, *Energy-aware High Throughput Co-schedules.*
- 11/13 EarthCube End-User Domain Workshop for Rock Deformation and Mineral Physics Research 2013, Alexandria, VA, USA, *Cyberscience: Driving Innovations Through Computational and Data-enabled Research.*
- 8/13 National Science Foundation Division of Advanced Cyberinfrastructure Directorate for Computer and Information Science and Engineering, Washington, D.C., USA, *Science in the Digital Age: Experiences & Perspectives.*
- 9/12 Clusters, Clouds & Data for Scientific Computing CCDSC 2012, Dareizé, France, *Strong Scaling for Sparse Codes: Myth or Reality?*
- 6/12 7th International Workshop on Parallel Matrix Algorithms and Applications (PMAA'12), Birkbeck University of London, UK, *Achieving Energy-aware High Performance for Parallel Sparse Matrix and Graph Computations.*
- 9/11 China-USA Computer Software Workshop, sponsored by the National Natural Science Foundation of China (NSFC) and the US National Science Foundation (NSF), Peking University, Beijing, China, *Extreme-Scale Software.*
- 5/11 Advanced Computing and Computational Sciences Division, Army Research Laboratory, Aberdeen, MD, USA, *New Dimensions to Parallel Computing: Co-managing Performance,*

- Reliability, Energy Trade-offs.*
- 4/10 Computer Science, Cornell University, Ithaca, NY, USA, *Energy-Aware Scalability of Parallel Sparse Scientific Computing.*
  - 5/09 Scheduling for Large-scale Systems, Knoxville, TN, USA, *Energy-Aware Scheduling for Scalable Matrix Computations.*
  - 2/09 Indiana University School of Informatics, Bloomington, IN, USA, *Sparsity, Structure, Parallelism and Power.*
  - 11/08 International Conference for High Performance Computing, Networking, Storage and Analysis (Supercomputing 2008), Austin, TX, USA, *Energy-Aware Algorithms at the Exascale.*
  - 3/08 Thirteenth SIAM Conference on Parallel Processing for Scientific Computing (SIAM-PP08), Atlanta, GA, USA, *When Sparse Applications Meet Architecture.*
  - 12/07 Third Asian-Pacific Congress on Computational Mechanics, with the Eleventh International Conference on Enhancement and Promotion of Computational Methods in Engineering and Science, Kyoto International Conference Center, Kyoto, Japan, *Scalable Parallel Preconditioning through Selective Sparse Approximate Inversion.*
  - 8/07 1007 ASM/TMS Annual Symposium, Computational Materials Design, GE Global Research, Niskayuna, NY, USA, *Readily Regenerable Reduced Microstructure Representations.*
  - 7/07 Department of Defense, Conference on Multicore Processing, Washington, D.C., USA, *Challenges in Co-Managing Performance and Power Profiles of Advanced Systems.*
  - 7/07 International Conference on Preconditioning Techniques for Large Sparse Matrix Problems, Toulouse, France, *Parallel Hybrid Preconditioners.*
  - 12/06 Computer Science and Engineering, The Ohio State University, Columbus, OH, USA, *Sparse Computations and Computer Architecture: Improving Performance and Energy Profiles.*
  - 10/06 International Symposium for Integrated Predictive Simulation System for Earthquake and Tsunami Disaster, University of Tokyo, Tokyo, Japan, *Power-Aware High Performance Scientific Computing.*
  - 10/06 International Workshop on Numerical Methods and Large-Scale Scientific Computation, University of Tokyo, Tokyo, Japan, *SuperSolvers: Hybrid, Adaptive and Composite Solvers.*
  - 8/06 Workshop on Cyberinfrastructure for Materials Science, National Science Foundation, Division of Materials Research, Washington D.C., USA, *Cyberinfrastructure Challenges for Materials Design Optimization.*
  - 7/06 SIAM Annual Meeting, Boston, MA, USA, *Parallel Hybrid Solvers.*
  - 2/06 Architectures and Algorithms for Petascale Computing, Dagstuhl Seminar, Schloss Dagstuhl, International Conference and Research Center for Computer Science, Universität des Saarlandes, Saarbrücken, Germany, *Energy Aware Optimization for Sparse Scientific Computing.*

9/05 Information Technology Division, Air Force Rome Laboratory, Rome, NY, USA, *Parallel Scientific Computing and Its Applications*.

### **SELECTED CONTRIBUTED CONFERENCE PRESENTATIONS (2005 – PRESENT)**

The presenter is listed first, students supervised by Raghavan are indicated by an ‘\*’.

- 12/14 21<sup>st</sup> IEEE International Conference on High Performance Computing (HiPC 2014), Goa, India, *A Multilevel Compressed Sparse Row Format for Efficient Sparse Computations on Multicore Processors*, H. Kabir\*, J. Booth\*, P. Raghavan.
- 6/14 International Meeting High Performance Computing for Computational Science (VECPAR 2014), Eugene, OR, USA, *Hybrid Sparse Linear Solutions with Substituted Factorization*, J. Booth\*, P. Raghavan.
- 11/13 International Conference for High Performance Computing, Networking, Storage and Analysis (SC’13), Denver, CO, USA, *Scalable parallel graph partitioning*, S. Kirmani\*, P. Raghavan.
- 2/13 SIAM Conference on Computational Science and Engineering (CSE 2013). Boston, MA, USA, *Algorithms for Soft-error Resilience in Sparse Linear Solvers*, R. Saksena\*, P. Raghavan.
- 2/13 SIAM Conference on Computational Science and Engineering (CSE 2013). Boston, MA, USA, *Locality Aware Scheduling of Sparse Computations for Energy and Performance Efficiencies*, P. Raghavan, M. Frasca.
- 2/12 Conference on Parallel Processing for Scientific Computing, Savannah GA, USA, *Speedup-aware Co-schedules for Energy Efficient Workload Management*, M. Shantharam and P. Raghavan.
- 11/11 Supercomputing, Seattle, WA, USA, *Virtual I/O Caching: Dynamic Storage Cache Management for Concurrent Workloads*, M. Frasca\*, R. Prabhakar, P. Raghavan, M. T. Kandemir.
- 6/11 International Conference on Computational Science, Singapore, *Can Models of Scientific Software-hardware Interactions be Predictive?* P. Raghavan, M. Frasca\*, A. Chatterjee\*.
- 6/11 International Conference on Computational Science, Singapore, *A Multilevel Cholesky Conjugate Gradients Hybrid Solver for Linear Systems with Multiple Right-hand Sides*, P. Raghavan, J. Booth\*, A. Chatterjee\*, M. Frasca\*.
- 5/11 International Conference on Supercomputing 2011, Phoenix AZ, USA, *Characterizing the Impact of Soft Errors on Iterative Methods in Scientific Computing*, M. Shantharam\*, S. Srinivasmurthy\*, P. Raghavan.
- 4/08 SIAM Text Mining in conjunction with the 8<sup>th</sup> SIAM International Conference on Data Mining, Atlanta, GA, USA, *FAST: Force-directed Approximate Subspace Transformation Improve Unsupervised Classification*, A. Chatterjee\*, S. Bhowmick and P. Raghavan.
- 2/08 Center for Computational Materials Design Annual Meeting 2008, Atlanta, GA, USA, *Software Engineering of Phase-field Codes*, A. Chatterjee\*, J. Zhang, P. Raghavan and L. Q. Chen.

- 2/08 Gene Golub Symposium, University of Illinois, USA, Urbana-Champaign, IL, *Preconditioning with Selective Sparse Approximate Inversion*, P. Raghavan and K. Teranishi\*.
- 10/07 Center for Advanced Studies Conference 2007 (CASCON 2007), Toronto, ON, Canada, *Challenges in Parallelizing Irregular Computations*, K. Malkowski\* and P. Raghavan.
- 8/07 International Symposium on Low Power Electronics and Design 2007 (ISLPED 2007), Portland, OR, USA, *Phase-Aware Hardware Adaptivity for Energy-Aware High Performance Computing*, K. Malkowski\*, P. Raghavan, M. Kandemir and M. J. Irwin.
- 7/07 IEEE Symposium on Computers and Communications (ISCC'07), Aveiro, Portugal, *Analysis of the IPv4 Address Space Delegation Structure*, A. Sriraman\*, K. Butler, P. McDaniel and P. Raghavan.
- 4/07 Workshop on Unique Chips and Systems (UCAS-3), San Jose, CA, USA, *Scientific Algorithms: Performance, Power, Thermal Properties on Modern Computing Architectures*, I. Lee\*, P. Raghavan.
- 2/07 INTERACT at IEEE 13th International Symposium on High Performance Computer Architecture, HPCA-INTERACT'07, Phoenix, AZ, USA, *Adapting Application Execution to Reduced CPU Availability*, Y. Ding\*, M. Kandemir, P. Raghavan and M. J. Irwin.
- 2/07 SIAM Computational Science, Costa Mesa, CA, USA, *On-Line Microstructure Repository for Predictive Analyses*, K. Teranishi\*, P. Raghavan, Z. K. Liu and L. Q. Chen
- 2/06 SIAM Conference on Parallel Processing for Scientific Computing. San Francisco, CA, USA, *Improving Performance and Power for Sparse Scientific Computing*, P. Raghavan, K. Malkowski and M. J. Irwin.
- 2/06 SIAM Conference on Parallel Processing for Scientific Computing. San Francisco, CA, USA, *Parallel Incomplete Cholesky Preconditioner with Selective Sparse Approximate Inversion*, K. Teranishi\* and P. Raghavan.
- 11/05 The IEEE/ACM International Workshop on High Performance Computing for Nano-science and Technology (HPCNano05), Seattle, WA, USA, *Large scale simulations of branched Si-nanowires*, I. Lee\*, E. Richter, M. Menon and P. Raghavan.
- 11/05 Poster session, IEEE/ACM Supercomputing (SC05), 2005. Seattle, WA, USA, *Co-Managing Performance and Power for High-Performance Scientific Computing*, S. Akioka\*, M. J. Irwin, S. Kennedy, K. Malkowski\*, L. C. McInnes, B. Norris and P. Raghavan.
- 2/05 SIAM Conference on Computational Science and Engineering (CSE05), Orlando, FL, USA, *A Grid Enabled Multicomponent Materials Design System*, K. Teranishi\*, P. Raghavan and Z. K. Liu.
- 1/05 The 16th International Conference on Domain Decomposition Methods, New York City, NY, USA, *A Hybrid Parallel Preconditioner Using Incomplete Cholesky Factorization and Sparse Approximate Inversion*, K. Teranishi\* and P. Raghavan.

## RESEARCH SUPERVISION

**At Penn State unless otherwise indicated.**

S. Bhowmick, PhD 2004; J. Booth, PhD 2014; M. Carter, B.S. Honors 2005; A. Chatterjee, M.S. 2009, PhD 2011; B. Cover, M.S. 2007; X. Ding, M.S. 2004 (U Tenn); A. Dongarra, M.S. 1999 (U Tenn); K. Fermoye, M.S. 2010; W. Figurelle, M.S. 2013; M. Frasca, PhD 2012; A. Gokhale, M.S. 2013; T. Harrold, M.S. 1997 (U Tenn); K. Hart, M.S. 1996 (U Tenn); B. Heidorn, M.S. 2017; M. Iturriaga, M.S. 2000 (U Tenn); J. Johnson, M.S. 2009; H. Kabir, M.S. 2017; R. Kaulakis, B.S. Honors 2007; S. Kirmani, PhD 2015; J. Koehler, M.S. 2000 (U Tenn); I. Lee, PhD 2007; Y. Li, M.S. 1999 (U Tenn); T. Liang, B.S. Honors 2006; K. Malkowski, PhD 2008; J. Park, PhD 2015; P. Philip, M.Eng (2016) S. Poku, M.Eng. 2006; P. Renaud-Goud, PhD 2012 (ENS Lyon); A. Ruslander, B.S. Honors 2007; A. Shaffer, M.S. 2009; M. Shantharam, PhD 2012; S. Srinivasamurthy, M.S. 2011; A. Sriraman, M.S. 2007; W. Stevenson, M.Eng. 2004; T. Stitt, B.S. 2015; B. Suchoski, M.S. 2012; J. Sun, M.S. 2005; K. Teranishi, M.S. 2000 (U Tenn), PhD 2007; B. Toth, M.S. 2009; A. Viswanath, M.S. 2008; C. Walker, M.S. 2007; X. Zhang, M.S. 1999 (U Tenn).

**Total Theses Supervised: 44.**

**Post-doctoral Research Supervision:** A. Gainaru (2017-2020, Vanderbilt), H. Sun (2016-2021, Vanderbilt), G. Aupy (2015-2017, Vanderbilt), S. Akioka (2006-2008), K. Malkowski (2010), K. Teranishi, (2005-2007), R. Saxena (2012-2013).

International Research Interns Supervised at Vanderbilt: T. Phan (2016), R. Elghazi (2017), V. Honere (2018), L. Jouans (2019), L. Perotin (2020).

**STUDENT EVALUATION OF TEACHING****Student Ratings of Teaching Effectiveness (SRTE)**

Student ratings of Teaching Effectiveness have been consistently high with scores for the “overall quality of the course” in the range of 5.2 – 6.5 and “overall quality of instruction” in the range of 5.0 – 6.5 on a scale of 0 to 7 (*most recent 5 years*).

**Faculty Teaching Award, Department of Computer Science and Engineering, The Pennsylvania State University, 2006.**

**BROADENING PARTICIPATION IN COMPUTING**

(Computer Research Association's Committee on the Status of Women in Computing Research CRA-W)

- Department Chair, Lab Director, Dean, What Next? Career Success after Tenure and Promotion, CRA-W Panel at Grace Hopper, August 2017.
- Graduate Cohort Workshop, P. Raghavan, CRA-W Graduate Cohort Workshop, San Francisco, April 10-11, 2015.
- Graduate Cohort Workshop, P. Raghavan, CRA-W Graduate Cohort Workshop, Santa Clara, April 11-12, 2014.
- Graduate Cohort Workshop, P. Raghavan, CRA-W Graduate Cohort Workshop, Boston, April 5-6, 2013.
- Graduate Cohort Workshop, P. Raghavan, CRA-W Graduate Cohort Workshop, Bellevue, April 13-14, 2012.
- Graduate Cohort Workshop, P. Raghavan, CRA-W Graduate Cohort Workshop, Boston, April 1-2, 2011.
- Professional Development Workshop, CRA-W Distinguished Professor for NSF-sponsored Cohort of



Associate Professors Project, Providence, RI, June 25-26, 2010.

- Graduate Cohort Workshop, P. Raghavan, CRA-W Graduate Cohort Workshop, Bellevue, April 23-24, 2010.
- Graduate Cohort Workshop, P. Raghavan, CRA-W Graduate Cohort Workshop, San Mateo, March 27-28, 2009.
- Workshop on Computational Education for Scientists, Microsoft Research, Redmond, WA, September 27-28, 2007.
- Graduate Cohort Workshop, P. Raghavan, Fourth CRA-W Graduate Cohort Workshop, San Francisco, March 23, 2007.
- Presentation at the Computer Research Association, CAPP-Research Professional Development Workshop, P. Raghavan, CRAW- Distinguished Professor, Fort Myers, FL, October 20, 2006.
- Presentation at the Penn State College of Engineering Graduate Cohort Program, P. Raghavan, September 23, 2006.
- Presentation at the Computer Research Association Graduate Program Professional Development Workshop, P. Raghavan, CRA-W Graduate Cohort Program, San Francisco, March 31, 2006.
- Organized Professional Development Workshop for Faculty at Penn State, March 21, 2005.
- Commission for Women at Penn State, Co-Chair Faculty Issues and Development Committee, and member Executive Committee, 2004-2005.

### **Support for Broadening Participation in Computing and Student Recruitment and Retention**

- National Science Foundation, A Set of Multi-Tiered Interventions at Critical Pipeline Stages: BPC Supplement, \$149,900, May 2006 - October 2007, (completed, PI, 25%), Joint with Argonne National Laboratory and the Department of Energy.
- National Science Foundation, Research Experience for Undergraduates Supplement, \$6,000, May 2005 - December 2005, (completed, PI, 60%).
- National Science Foundation, Grant to Support Activities at the Eleventh SIAM Conference on Parallel Processing for Scientific Computing (CCF-0340869), San Francisco, CA, February 2004, P. Raghavan (conference Co-Chair), \$17,000, August 2003 - March 2004, (completed, PI)