CURRICULUM VITAE
Michael Maclean Wolf

Sandia National Labs
Scalable Algorithms Department
P.O. Box 5800, MS 1320
Albuquerque, NM 87185-1320

mmwolf@sandia.gov (work)
mmwolf@gmail.com (home)
(505) 284-3391 (work)
http://www.sandia.gov/˜mmwolf/

Research Interests

- High-performance computing, large-scale graph analytics, scientific computing, combinatorial algorithms.

Education

- Ph.D., Computer Science, University of Illinois at Urbana-Champaign, 2009.
  Advisor: Professor Michael T. Heath.
- B.S., Computer Science and Biology, Harvey Mudd College, 1998.

Selected Professional Experience

- **Technical Staff** (2014-present), Scalable Algorithms Dept., **Sandia National Laboratories**, Albuquerque, NM. Research into large-scale graph and data analytics, data partitioning algorithms, and exascale programming models.

- **Technical Staff** (2011-2014), Computing and Analytics Group, **MIT Lincoln Laboratory**, Lexington, MA. Responsibilities include research, leading software projects, developing software, interacting with program managers (e.g., DARPA), and program development. Leading team in the development of LLMORE software for data to processor mapping and simulation of key Department of Defense applications to existing and experimental computer architectures. Developing high-performance computing algorithms and software for solving very large graph problems.

- **Postdoc** (2009-2011), Scalable Algorithms Dept., **Sandia National Laboratories**, Albuquerque, NM, Staff Mentor: Karen Devine. **Extreme-scale Algorithms and Software Institute (EASI)**: developed architecture-aware algorithms for scalable performance. Developed multithreaded triangular solve algorithms and techniques for interfacing traditional MPI applications with hybrid MPI/multithreaded solvers. **Institute for Combinatorial Scientific Computing and Petascale Simulations (CSCAPES)**: researched and developed partitioning and ordering algorithms, including development of Zoltan2, a package for partitioning, load-balancing, etc. Led Sandia effort in sponsoring Harvey Mudd College clinic project on sparse matrix partitioning. **Other**: developed algorithms to improve performance of FV-MAS climate modeling software and for the GPU acceleration of a finite difference code for seismic modeling.

- **Graduate Professional Intern** (Summers 2007, 2008), Computer Science Research Institute, **Sandia National Laboratories**, Albuquerque, NM, Staff Mentor: Erik Boman. Researched and developed two-dimensional matrix partitioning algorithms for reducing communication volume in parallel sparse matrix-vector multiplication as part of CSCAPES, a DOE SciDAC Institute.

- **DOE CSGF Intern** (Summer 2006), Computer Science Research Institute, **Sandia National Laboratories**, Albuquerque, NM. Researched agent-based disease propagation models to be used in inverse problem of disease characterization from patient data.

- **DOE CSGF Intern** (Summer 2004), NERSC Scientific Computing Group, **Lawrence Berkeley National Laboratory**, Berkeley, CA. Researched and improved performance of parallel matrix-vector multiplication with scalar addition algorithm. Researched computational biology problems of protein folding.

- **Software Developer** (1998-2003), Advanced Computations Dept., **SLAC Linear Accelerator Center**, Stanford, CA. Developed parallel electromagnetic solvers and particle tracking software used in accelerator design as part of DOE SciDAC and Grand Challenge projects. Involved in setting up Linux cluster. Improved parallel performance of applications with better partitioning and communication techniques. Managed software projects and mentored seven summer students.

Journal Articles

- M.M. Wolf and M.T. Heath, "Combinatorial Optimization of Matrix-Vector Multiplication in Finite Element Assembly," *SIAM Journal on Scientific Computing*, Volume 31, Issue 4, 2009, pp. 2960-2980.
- A. Skjellum, D. Wooley, Z. Lu, M. Wolf, P. Bangalore, A. Lumsdaine, J. Squyres, B. McCandless, "Object-Oriented Analysis and Design of the Message Passing Interface," *Concurrency and Computation: Practice and Experience*, Volume 13, Issue 4, 2001, pp. 245-292.

Select Conference Proceedings

- M.M. Wolf, H.C. Edwards, and S.L. Olivier, "Kokkos/Qthreads Task-Parallel Approach to Linear Algebra Based Graph Analytics," *Proc. of 20th Annual IEEE High Performance Extreme Computing Conference*, 2016.
- M.M. Wolf, A.M. Klinvex, and D.M. Dunlavy, "Advantages to Modeling Relational Data using Hypergraphs versus Graphs," *Proc. of 20th Annual IEEE High Performance Extreme Computing Conference*, 2016.
- M.M. Wolf, J.W. Berry, and D.T. Stark "A Task-Based Linear Algebra Building Blocks Approach for Scalable Graph Analytics," *Proc. of 19th Annual IEEE High Performance Extreme Computing Conference*, 2015.
- M.M. Wolf and B.A. Miller, "Improving the performance of graph analysis through partitioning with sampling," *Proc. of 19th Annual IEEE High Performance Extreme Computing Conference*, 2015.
- M.M. Wolf and B.A. Miller, "Sparse Matrix Partitioning for Parallel Eigenanalysis of Large Static and Dynamic Graphs," *Proc. of 18th Annual IEEE High Performance Extreme Computing Conference*, 2014.
- D. Kimball, E. Michel, P. Keltcher, and M. Wolf, "Quantifying the Effect of Matrix Structure on Multithreaded Performance of the SpMV Kernel," *Proc. of 18th Annual IEEE High Performance Extreme Computing Conference*, 2014.
- E.G. Boman and M.M. Wolf, "A Nested Dissection Partitioning Method for Parallel Sparse Matrix-Vector Multiplication," *Proc. of 17th Annual IEEE High Performance Extreme Computing Conference*, 2013.
- J.S. Mullen and M.M. Wolf and A. Klein, "PAKCK: Performance and Power Analysis of Key Computational Kernels on CPUs and GPUs," *Proceedings of 17th Annual IEEE HPEC Conference*, 2013.
- Whelihan, et al., "P-sync: A Photonically Enabled Architecture for Efficient Non-local Data Access," *Proceedings of 27th International Symposium on Parallel and Distributed Processing*, pp. 189–200, 2013.
- M.M. Wolf, et al., "LLMORE: A Framework for Data Mapping and Architecture Analysis," *Proc. of 16th Annual IEEE High Performance Extreme Computing Conference*, 2012.
- M.M. Wolf, M.A. Heroux, and E.G. Boman, "Factors Impacting Performance of Multithreaded Sparse Triangular Solve," VECPAR 2010, LNCS 6449, pp. 32–44, 2011.
- E.G. Boman, U.V. Catalyurek, C. Chevalier, K.D. Devine, I. Safro, and M.M. Wolf. "Advances in Parallel Partitioning, Load Balancing, and Matrix Ordering," *J. of Physics: Conference Series*, vol. 180, 012008. (SciDAC09 Conference, San Diego, June 2009.)
- M.M. Wolf, E.G. Boman and B. Hendrickson, "Optimizing Parallel Sparse Matrix-Vector Multiplication by Corner Partitioning," PARA08, Trondheim, Norway, May 2008.
- M. Wolf, A. Guetz and C.-K. Ng, "Modeling Large Accelerator Structures with the Parallel Field Solver Tau3P," *18th Annual Review of Progress in Applied Computational Electromagnetics: ACES 2002*.
- L.-Q. Lee, L. Ge, M. Kowalski, Z. Li, C.-K. Ng, G. Schussman, M. Wolf, K. Ko, "Solving Large Sparse Linear Systems in End-to-end Accelerator Structure Simulations," *Proceedings of 18th International Parallel and Distributed Processing Symposium*, 2004.

Select Presentations

- "Task Parallel Approach to the Linear Algebra-Based Implementation of miniTri," SIAM Annual Meeting (AN16), Boston, MA, July 11-15, 2016. (Minisymposium Presentation.)
- "Hypergraph Exploitation for Data Sciences," Graph Exploitation Symposium, Dedham, MA, May 18-19, 2016. (Invited Talk.)
- "Effects of Graph Structure on 2D Partitioning of Scale-Free Graphs with Sampling," SIAM Workshop on Network Science 2015, Snowbird, UT, May 2015. (Peer reviewed poster)
- "Zoltan2 for Extreme-Scale Data Partitioning: Sampling and Partitioning," SIAM Conference on Computational Science and Engineering (CSE15), Salt Lake City, UT, March 14-19, 2015. (Minisymposium Presentation.)

- "Detecting Anomalies in Very Large Graphs," The Sixth SIAM Workshop on Combinatorial Scientific Computing (CSC14), Lyon, France, July 21-23, 2014. (Refereed)
- "Effective Parallel Computation of Eigenpairs to Detect Anomalies in Very Large Graphs," SIAM Conference on Parallel Processing for Scientific Computing (PP14), Portland, OR, February 18-21, 2014. (Contributed Presentation.)
- "Hybrid MPI/Multithreaded PCG: A Use Case for MPI Shared Memory Allocation," Supercomputing 2010, New Orleans, November 13-19, 2010. (Peer reviewed poster)
- "Obtaining Parallelism on Multicore and GPU Architectures in a Painless Manner," 2010 SEG Post-Convention Workshop on High Performance Implementation of Geophysical Applications, Denver, Oct. 21, 2010. (Invited Talk)
- "Recent Advances in 2D Sparse Matrix Partitioning," SIAM Conference on Parallel Processing for Scientific Computing, Seattle, WA, Feb. 24-26, 2010. (Minisymposium Talk and **Co-Organizer** MS60.)
- "Improved Data Partitioning by Nested Dissection with Applications to Information Retrieval," SIAM Workshop on Combinatorial Scientific Computing, Seaside, CA, Oct. 29-31, 2009. (Refereed presentation).
- "Hypergraph-Based Combinatorial Optimization of Matrix-Vector Multiplication," 2008 SIAM Annual Meeting, San Diego, CA, July 7-11, 2008. (Talk and **Co-Organizer** MS110.)
- "Optimizing Parallel Sparse Matrix-Vector Multiplication by Partitioning," 2008 CSCAPES Workshop, Santa Fe, NM, June 10-13, 2008. (Invited Talk.)
- "Nested Dissection Approach for Sparse Matrix Partitioning," SIAM Conference on Parallel Processing for Scientific Computing, Atlanta, GA, 2008. (Contributed Talk.)
- "Combinatorial Optimization of Matrix-Vector Multiplication," SciDAC 2007 Conference, Boston, MA. (Poster Presentation.)

Technical Reports and Other Papers
- M. Wolf and E. Boman, "An Increasing Role for Combinatorial Methods in Large-Scale Parallel Simulations," *SIAM News*, Volume 41, Number 5, June 2008.
- J. Ray, B. M. Adams, K. D. Devine, Y. M. Marzouk, M. M. Wolf, and H. N. Najm, "Distributed Micro-Releases of Bioterror Pathogens: Threat Characterizations and Epidemiology from Uncertain Patient Observables," SANDIA Technical Report SAND2008-6044, Sandia National Laboratories, 2008.
- M. Wolf and E. Boman, "Partitioning for Parallel Sparse Matrix-Vector Multiplication," SANDIA Technical Report SAND2007-7977, Sandia National Laboratories, 2007, pp. 75–86.

Selected Honors/Awards
- **Department of Energy Computational Science Graduate Fellowship (CSGF)**, 2003-2007.
- IEEE HPEC **Best Paper Finalist**, 2015.
- **University of Illinois Fellowship**, 2007-2008.
- Co-author of Best Poster, International Computational Accelerator Physics Conference, 1998.

Service
- Department of Energy CSGF: **Practicum Coordinator** (2015-), **Selection Committee** (2015-).
- IEEE HPEC Conference Technical Committee (2015-).
- Reviewer for Department of Energy
- SIAM CSC 2016 Local Organizing Committee.
- **Liaison**, SNL sponsored Harvey Mudd College Computer Science Clinic (2010-2011).
- **Organizer**, Gene Golub Symposium at UIUC, Urbana, Illinois, February 29 - March 1, 2008.
- SIAM UIUC Student Chapter: **President** (2007-2009), Vice-President (2006-2007).
- Reviewer: *Trans. on Mathematical Software*, *App. Math. and Computation*, *Intl. Journal of High Performance Computing*, et al.

Computer Skills
- **Languages**: C++, C, R, Perl, Matlab, Java, Fortran, Python, Lex, Yacc, et al.
- **Libraries**: MPI, CUDA, OpenMP, Pthreads, Intel TBB, HPX, Zoltan, Trilinos, PETSc, SLEPc, et al.