Curriculum Vitae: **Christopher G. Baker**

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mobile:	865.272.9767		Computational Engineering and Energy Studies
website:	http://www.csm.ornl.gov/∼cbaker		PO Box 2008 MS6003
			Oak Ridge, TN 37831-6003

Research Interests

Numerical optimization on Riemannian manifolds, Iterative solvers for large-scale eigenvalue and singular value problems, Large-scale scientific computing, Scientific computing via modern programming paradigms, High-performance computing, Emerging HPC architectures, HPC in nuclear engineering.

Education

THE FLORIDA STATE UNIVERSITY — Tallahassee, FL
Ph.D., Computational Science, August 2008.
Advisors: Kyle A. Gallivan and Pierre-Antoine Absil
"Riemannian Manifold Trust-Region Methods with Applications to Eigenproblems"

M.S., Computer Science, August 2004. Advisor: Kyle A. Gallivan
"A Block Incremental Algorithm for Computing Dominant Singular Subspaces"

B.S. (with high honors), April 2002.
Double major: Pure Mathematics and Computer Science

Employment History

OAK RIDGE NATIONAL LABORATORY — Oak Ridge, TN
Computational Engineering and Energy Studies Group,
Computer Science and Mathematics Division
R&D Staff (January 2012 – present)
R&D Associate (October 2009 – January 2012)

SANDIA NATIONAL LABORATORIES — Albuquerque, NM
Scalable Algorithms Department
Postdoctoral Researcher (June 2008 – September 2009)

SANDIA NATIONAL LABORATORIES — Albuquerque, NM
Applied Mathematics Department
Year-round Graduate Student Intern (May 2005 – May 2008)

FLORIDA STATE UNIVERSITY — Tallahassee, FL
School of Computational Science
Graduate Research Assistant (May 2002 – Dec 2006)

FLORIDA STATE UNIVERSITY — Tallahassee, FL
Undergrad Research Assistant, Computational Science (May 2001 – May 2002)
Undergrad Research Assistant, Neuroscience (May 1999 – September 2001)

Current Research Activities

• High-performance scientific programming and parallel programmming models: the Tpetra distributed, high-performance linear algebra library for multi-precision computing; the Kokkos parallel node programming interface and collection of SMP-aware linear algebra objects; and the Anasazi package for high-performance parallel eigensolvers. With M. Heroux, R. Lehoucq, H. Thornquist, M. Hoemmen and A. Williams.

• Large-scale optimization on Riemannian manifolds with applications. With K. Gallivan, P.-A. Absil and P. Van Dooren.

• Incremental methods for large scale subspace tracking. With K. Gallivan, P. Van Dooren, L. Mathelin and M. Shah.

• Scalable solvers for embedded uncertainty quantification. With C. Webster and M. Stoyanov.

Awards

Best paper, ANS Winter Meeting 2010, Mathematics and Computation Division
Student travel grant to 2008 Copper Mountain Conference on Iterative Methods
ACM Southeast Regional Programming Contest, 5th Place (2001)
Harris Undergraduate Scholarship (2001)
Florida State University Scholarship (1998)
Florida Bright Futures Academic Top Scholar Award (1998)
Florida Bright Futures Scholarship (1998)

Professional and Honor Society Memberships

2004 - present: Society for Industrial and Applied Mathematics (SIAM)
2004 - present: Association for Computing Machinery (ACM)
2002: Phi Beta Kappa
2002: Upsilon Pi Epsilon
2002: Pi Mu Epsilon

Organized Minisymposiums

• "Modern libraries and methods for eigenvalue and singular value problems", for SIAM CSE 2013, Boston, MA.
• "Recent Algorithms and Applications for the Truncated Singular Value Decomposition" (with M. Shah), for SIAM Annual Meeting 2013, San Diego, CA.

Peer Review

• Linear Algebra and its Applications ◦ SIAM Journal on Matrix Analysis and Applications ◦ SIAM Journal on Scientific Computing ◦ Parallel Computing ◦ Journal of Computational and Applied Mathematics ◦ ACM Transactions on Mathematical Software ◦ Mathematical Programming ◦ BIT Numerical Mathematics ◦ Computational Optimization and Applications ◦ Numerical Functional Analysis and Optimization ◦ Applied Mathematics and Computation
• American Control Conference ◦ IEEE Transactions on Automatic Control ◦ IEEE Conference on Decision and Control ◦ International Conference on Supercomputing ◦ International Conference for High Performance Computing, Networking, Storage, and Analysis (SuperComputing)

Program Committees

- SuperComputing 2013, Technical papers committee, Applications area
- IEEE Cluster 2011, Program committee, Workshop on Parallel Programming on Accelerator Clusters

Civic and Other Activities

- Judge, Capital Regional Science & Engineering Fair: 2005–2006
- Judge/Problem Writer, FSU Programming Contest: 2003–2005
- Member, Executive Council, ACM (FSU Chapter), 2005–2006
- Chair, ACM (FSU Chapter), 2001–2002, 2003–2005
- Secretary, ACM (FSU Chapter), 2002–2003

Research Proposals and Grants: PI/Co-PI

- "A Novel Uncertainty Quantification Paradigm for Enabling Scalable Predictive Science"
PI: C. G. Webster, Co-PI: C. G. Baker.
Laboratory Directed Research And Development (LDRD), ORNL.
October 2012 – September 2014.
- "eXascale PRogramming Environment and System Software (XPRESS)"
Coordinating PI: R. Brightwell (Sandia), ORNL PI: C. G. Baker.
DOE ASCR X-Stack 2012 (LAB 12-619).
September 2013 – August 2015.

Journal Articles

- G. G. Davidson, T. M. Evans, J. J. Jarrell, R. Slaybaugh and C. G. Baker. *Massively Parallel, Three-Dimensional Transport Solutions for the k-Eigenvalue Problem*. Under review.
- C. G. Baker and M. A. Heroux. *Tpetra, and the use of generic programming in scientific computing*. Scientific Programming, num. 20, 2012, pp. 115-128.
- C. G. Baker, K. A. Gallivan and P. Van Dooren. *Low-Rank Incremental Methods for Computing Dominant Singular Subspaces*. Linear Algebra and its Applications, vol. 436, num. 8, April 2012, pp. 2866-2888.
- C. G. Baker and R. B. Lehoucq. *Preconditioning Constrained Eigenvalue Problems*. Linear Algebra and its Applications, vol. 431, num. 3-4, July 2009, pp. 396-408.
- C. G. Baker, U. L. Hetmaniuk, R. B. Lehoucq and H. K. Thornquist. *Anasazi Software for the Numerical Solution of Large-Scale Eigenvalue Problems*. ACM Transactions on Mathematical Software, vol. 36, num. 3, July 2009, pp. 1-23.
- C. G. Baker, P.-A. Absil and K. A. Gallivan. *An Implicit Trust-Region Method on Riemannian Manifolds*. IMA Journal of Numerical Analysis, vol. 28, num. 4, October 2008, pp. 665-689.
- P.-A. Absil, C. G. Baker and K. A. Gallivan. *Trust-Region Methods on Riemannian Manifolds*. Foundations of Computational Mathematics, vol. 7, num. 3, 7 July 2007, pp. 303-330.
- P.-A. Absil, C. G. Baker and K. A. Gallivan. *A Truncated-CG Style Method for Symmetric Generalized Eigenvalue Problems*. Journal of Computational and Applied Mathematics, vol. 178, num. 1-2, 1 May 2006, pp. 274-285.

Journal Articles In Preparation for Submission

- C. G. Baker, K. Gallivan and L. Mathelin. *A streaming algorithm for the dynamic mode decomposition.*
- C. G. Baker and M. Shah. *Streaming a symmetry-preserving SVD.*
- C. G. Baker and K. Gallivan. *Streaming SVD Computations on Memory-Constrained Platforms.*
- C. G. Baker, M. Marchaund, K. Gallivan and P. Van Dooren. *New error analyses for low-rank incremental SVD methds.*
- C. G. Baker, P.-A. Absil and K. A. Gallivan. *An Implicit Trust-Region Method for Symmetric Generalized Eigenvalue Problems.*
- C. G. Baker, K. A. Gallivan and P. Van Dooren. *Exploring Structure/Efficiency Trade-offs in the Incremental SVD.*
- C. G. Baker and M. A. Heroux. *SPMD Programming of Scalable Heterogeneous Multicore Systems Using MPI.*
- C. G. Baker, M. A. Heroux, R. J. Hoekstra and A. Williams. *The Petra Object Model for Parallel Linear Algebra Computations.*

Conference Papers

- C. Baker, G. Davidson, T. Evans, S. Hamilton, J. Jarrell, W. Joubert. *High Performance Radiation Transport Simulations - Preparing for TITAN.* SuperComputing 2012, Salt Lake City, UT, November 2012.
- C. Baker, E. G. Boman, M. A. Heroux, E. Keiter, S. Rajamanickam, R. Schiek, and H. Thornquist. *Enabling Next-Generation Parallel Circuit Simulation with Trilinos.* Lecture Notes in Computer Science, vol. 7155, pp. 315-323, Euro-Par 2011: Parallel Processing Workshops.
- G. G. Davidson, T. M. Evans, R. N. Slaybaugh and C. G. Baker. *Massively Parallel Solutions to the K-Eigenvalue Problem.* In session "Mathematical Modeling and Computational Methods." American Nuclear Society 2010 Winter Meeting, Las Vegas, NV, November 2010. Best paper award in the Mathematics and Computation division.
- C. G. Baker, M. A. Heroux, A. B. Williams and H. C. Edwards. *A Light-weight API for Multicore Programming.* In special session "Parallel Algorithms and Software for Sparse Linear Algebra Computations." The 18th Euromicro International Conference on Parallel, Distributed and Network-Based Computing (PDP2010), Pisa, Italy, Feb 2010.
- C. G. Baker, K. A. Gallivan and P. Van Dooren. *Low-Rank Incremental Methods for Computing Dominant Singular Subspaces.* 10th Copper Mountain Conference on Iterative Methods, Copper Moutain, CO, April 2008.
- C. G. Baker, P.-A. Absil and K. A. Gallivan. *An Implicit Riemannian Trust-Region Method for the Symmetric Generalized Eigenproblem.* Proceedings of the 2006 International Conference on Computational Science, Reading, UK, May 2006. Lecture Notes in Computer Science, vol. 3991, pp. 210-217, Springer-Verlag.

- P.-A. Absil, C. G. Baker, K. A. Gallivan and A. Sameh. *Adaptive Model Trust-Region Methods for Generalized Eigenvalue Problems*. Proceedings of the International Conference on Computational Science, Atlanta, GA, May 2005. Lecture Notes in Computer Science, vol. 3514, pp. 33-41, Springer-Verlag.
- P.-A. Absil, C. G. Baker and K. A. Gallivan. *Trust-region Methods on Riemannian Manifolds with Applications in Numerical Linear Algebra*. Proceedings of the Sixteenth International Symposium on Mathematical Theory of Networks and Systems (MTNS). Katholieke Universiteit Leuven, Belgium, July 2004.

Invited Talks and Presentations

- *High Performance Computing (HPC) At All Scales: Implementation of Numerical Algorithms on Heterogeneous Hardware Ranging from Laptops to Supercomputers*. Panel participant. American Nuclear Society Winter Meeting 2012, San Diego, CA. November 2012.
- *An Overview of Trilinos: Scalability in project management and performance*. Keynote presentation. European Seminar on Computing (ESCO 2012), Pilsen, Czech Republic. June 2012.
- *R&D in Trilinos for Emerging Parallel System*. Invited talk and panel. Accelerating Computational Science Symposium 2012, Washington, D.C. March 2012.
- *Incorporating Trilinos Data Classes Into An Application* Workshop presentation. 2011 Trilinos User Group Meeting, Sandia National Labs. November 2011.
- *Parallel Programming with Tpetra and Kokkos*. Workshop presentation. 2010 Trilinos User Group Meeting, Sandia National Labs. November 2010.
- *Trilinos for Emerging Parallel Computing Systems*. Invited talk. 39th SPEEDUP Workshop on High-Performance Computing, ETH Zurich, Switzerland. September 2010.
- *Engineering a Large-Scale Library: Trilinos*. Invited talk. 2010 CScADS Autotuning and Libraries Workshop, Snowbird, UT. August 2010.
- *Migrating the Epetra to Tpetra and a Kokkos Tutorial*. Workshop presentation. 2010 Trilinos Spring Developer Meeting, Sandia National Labs. May 2009.
- *Pedal to the Metal: Experiences Programming Accelerators for HPC*. Presentor and panel participant. The 11th LCI International Conference on High-Performance Clustered Computing, Pittsburgh, PA, March 2010.
- *Teuchos Memory Management Tools: A User Perspective*. Workshop presentation. 2009 Trilinos User Group Meeting, Sandia National Labs. November 2009.
- *Introducing Tpetra and Kokkos*. Workshop presentation. 2009 Trilinos User Group Meeting, Sandia National Labs. November 2009.
- *An Abstract Node API for Heterogeneous and Multi-core Computing*. Invited talk, Los Alamos Computer Science Symposium (LACSS) 2008, Santa Fe, NM. October 2008.
- *Problem and Solutions in Optimization on Manifolds*. Invited talk, 2008 CSRI Summer Seminar, Sandia National Laboratories. June 2008.

- *Manifold Trust-Region Methods with Applications to Eigenproblems.* Poster presentation, SCS Computational Xposition 2006, School of Computational Science, Florida State University.
- *An Overview of Anasazi.* Workshop presentation. 2005 Trilinos User Group Meeting, Sandia National Labs. October 2005.
- *A Block Incremental Algorithm for Computing Dominant Singular Subspaces.* Poster presentation, SCS Computational Xposition 2004, School of Computational Science, Florida State University.

Conference Talks (refereed abstracts)

- C. G. Baker. *An Incremental SVD for Feature Extraction from Fluid Flow.* Refereed abstract in mini-symposium "Recent Algorithms and Applications for the Truncated Singular Value Decomposition." SIAM Annual 2013, San Diego, CA, July 2013.
- C. G. Baker. *Streaming Singular Value Computations on GPU Platforms.* Refereed abstract in mini-symposium "Algorithms, Libraries and Frameworks for Scalable Manycore Computations." SIAM Annual 2013, San Diego, CA, July 2013.
- C. G. Baker. *Fast and reliable trust-region eigensolvers.* Refereed abstract in mini-symposium "Modern libraries and methods for eigenvalue and singular value problems." SIAM CSE 2013, Boston, MA, February 2013.
- C. G. Baker. *Multi-precision inner/outer solvers via generic programming libraries.* Refereed abstract in mini-symposium "Programming Paradigms, Algorithms and Frameworks for High Performance Scalable Manycore Systems." SIAM Annual Meeting 2012, Minneapolis, MN, July 2012.
- C. G. Baker, K. A. Gallivan, P. Van Dooren. *Incremental Methods for Computing Extreme Singular Subspaces.* SIAM Conference of Applied Linear Algebra 2012, Valencia, Spain, June 2012.
- C. G. Baker. *Gradually Transitioning Library users to the Hybrid-parallel Paradigm.* Refereed abstract in mini-symposium "Creating the Next Generation of High Performance Numerical Computing Capabilities." International Congress on Industrial and Applied Mathematics (ICIAM) 2011, Vancouver, CA, July 2011.
- C. G. Baker. *Engineering a Kernel-agnostic Distributed Linear Algebra Library for Multi/many-core in Trilinos.* Refereed abstract in mini-symposium "Parallel Programming Models and Algorithms for Scalable Manycore Systems." SIAM Conference on Computational Science and Engineering 2011, Reno, NV, March 2011.
- C. G. Baker and M. A. Heroux. *Developing Large-Scale Scientific Software For Generic Multi-core Nodes.* Refereed abstract in mini-symposium "Parallel Programming Models and Algorithms for Multicore Clusters and GPGPUs." SIAM Conference on Parallel Processing 2010, Seattle, WA, Feb 2010.
- C. G. Baker, H. C. Edwards, M. A. Heroux and A. B. Williams. *An Abstract Model for Programming Multi-core Nodes.* Mini-symposium on "Supercomputing Challenges: Petascale and Beyond." SIAM Annual Meeting 2009, Denver, CO, July 2009.
- G. M. Reese, T. F. Walsh, C. G. Baker and A. Ames. *Numerical Approaches for the Quadratic Eigenvalue Problem on Large Structural Acoustic Systems.* 10th US National Congress on Computational Mechanics, Columbus, OH, July 2009.

- C. G. Baker. *Optimization and Eigenvalue Problems.* Mini-symposium on "Unconventional Uses of Optimization in Scientific Computing." 7th International Conference on Large-Scale Scientific Computations, Sozopol, Bulgaria, June 2009.
- C. G. Baker, P.-A. Absil and K. A. Gallivan. *An Implicit Riemannian Trust-Region Method.* Mini-symposium on "Advances in Constrained Optimization: Algorithms on Manifolds." SIAM Conference on Optimization 2008, Boston, MA, May 2008.
- C. G. Baker, P.-A. Absil and K. A. Gallivan. *Implicit Riemannian Trust-Region Method for Symmetric Generalized Eigenproblems.* SIAM Conference on Applied Linear Algebra 2006, Dusseldorf, Germany, July 2006.
- P.-A. Absil, C. G. Baker and K. A. Gallivan. *Model-based Methods for Computing Extreme Eigenpairs of Definite Matrix Pencils.* Workshop on Numerical Linear Algebra. Foundations of Computational Mathematics Conference 2005, Santander, Spain, July 2005.
- P.-A. Absil, C. G. Baker and K. A. Gallivan. *Model-based Methods for Computing Extreme Eigenpairs of Definite Pencils.* 16th Householder Symposium on Numerical Linear Algebra, May 2005.
- P.-A. Absil, C. G. Baker, K. A. Gallivan and A. Sameh. *Adaptive Model Trust-Region Methods for Generalized Eigenvalue Problems.* 16th Householder Symposium on Numerical Linear Algebra, May 2005.
- P.-A. Absil, C. G. Baker and K. A. Gallivan. *Trust-region algorithms for the Generalized Symmetric Eigenvalue Problem.* 11th International Congress on Computational and Applied Mathematics, Katholieke Universiteit Leuven, Belgium, July 2004.

Technical Reports

- C. G. Baker, P.-A. Absil and K. A. Gallivan. *An Implicit Trust-Region Method on Riemannian Manifolds.* Optimization Online, 6 June 2007. http://www.optimization-online.org/DB_HTML/2007/06/1676.html
- C. G. Baker, P.-A. Absil and K. A. Gallivan. *An Implicit Riemannian Trust-Region Method for the Symmetric Generalized Eigenproblem.* Tech. Report FSU-SCS-2005-152, School of Computational Science, Florida State University, February 2005.
- M. Sala, M. Heroux, D. Day, C. Baker and H. Thornquist *Trilinos Tutorial*, Technical Report SAND2004-2189, Sandia National Laboratories, September 2005.
- C. G. Baker, P.-A. Absil and K. A. Gallivan. *A Model-Trust-Region Framework for Symmetric Generalized Eigenvalue Problems.* Tech. Report FSU-SCS-2005-096, School of Computational Science, Florida State University, June 2005.
- P.-A. Absil, C. G. Baker, K. A. Gallivan and A. Sameh. *Adaptive Model Trust-Region Methods for Generalized Eigenvalue Problems.* Tech. Report FSU-CSIT-04-28, School of Computational Science, Florida State University, December 2004.
- P.-A. Absil, C. G. Baker and K. A. Gallivan. *Convergence Analysis of Riemannian Trust-Region Methods.* Optimization Online, 19 June 2006. http://www.optimization-online.org/DB_HTML/2006/06/1416.html
- C. G. Baker. *A Block Incremental Algorithm for Computing Dominant Singular Subspaces.* Tech. Report TR-041112, Department of Computer Science; Tech. Report FSU-CSIT-04-29, School of Computational Science. Florida State University, November 2004. Master's Thesis.