

Curriculum Vitae for R. Clint Whaley

January 15, 2018

Personal data

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Highlights

- ◇ One of the pioneers of auto-tuning; ongoing service and widespread visibility across most computational areas in academia, industry and government worldwide due to ATLAS.
- ◇ Winner, SC2016 Test of Time Award, “Recognizing an Outstanding Paper that has Deeply Influenced the HPC Discipline”, Nov 16, 2016. Acceptance talk available here.
- ◇ High impact pubs: g-index=77, h-index=21, 6,178 citations (Pub or Perish, Dec 2016).
- ◇ NSF CAREER Award (\$583,145), 2012-2018.

Research Interests

High performance computing, empirical optimization, parallel computing, backend compiler optimization, scientific computing, and computer architecture.

Research Synopsis

I originally worked in distributed memory parallelization, where I contributed to the design and implementation of ScaLAPACK, and its associated packages, PBLAS and BLACS. This led to the need for high performance on a wide variety of architectures, which motivated research into empirical code optimization, resulting in the ATLAS (Automatically Tuned Linear Algebra Software) project (<http://math-atlas.sourceforge.net/>), which was one of the first projects to demonstrate that empirical tuning could provide the *portable* and *persistent* efficiency required in high performance applications that must run on hardware evolving at the pace dictated by Moore’s Law. The generalization of this approach to arbitrary kernels required expertise in backend compilation, and so I expanded my work into optimizing backend compilers, and as part of this research, produced an empirical and iterative compiler specialized for high performance kernel tuning, iFKO (iterative Floating Point Kernel Optimizer). I am presently fully funded to do ATLAS and iFKO research.

Educational Background

- Dec 04** Doctor of Philosophy in Computer Science at the Florida State University. Adviser: David Whalley.
- May 94** Master of Science in Computer Science at the University of Tennessee in Knoxville Tennessee. Adviser: Jack Dongarra.
- May 91** Bachelor of Science (Summa Cum Laude) in Mathematics at Oklahoma Panhandle State University in Goodwell, Oklahoma.

Professional Employment

- Aug 17 - Present** Associate Professor with tenure, Intelligent Systems Engineering, School of Informatics Computing, and Engineering, Indiana University Bloomington.
- Aug 13 - Aug 17** Associate Professor with tenure, Computer Science and Engineering Division and Center for Computation and Technology, Louisiana State University.
- Sep 12 - Jul 13** Associate Professor with tenure, Department of Computer Science, University of Texas at San Antonio.
- Jul 05 - Sep 12** Assistant Professor, Department of Computer Science, University of Texas at San Antonio.
- Jan 05 - Jun 05** Post-doctoral researcher and adjunct at Florida State University. ATLAS and iFKO research, and taught CS 5930 'Fundamentals of High Performance Optimization'.
- Jan 02 - Dec 04** Graduate Research Assistant, Department of Computer Science, Florida State University. Continued ATLAS work, and extended optimization research to include empirical compilation.
- Jun 99 - Dec 01** Senior Research Associate, Department of Computer Science, University of Tennessee. Continued research on automated empirical optimization of software, and the ATLAS project.
- May 94 - Jun 99** Research Associate, Department of Computer Science, University of Tennessee. Research on automated empirical optimization of software. In particular, founded ATLAS project. Research in parallel computing. In particular, work on ScaLAPACK, PBLAS, and BLACS libraries.
- Aug 91 - May 94** Graduate Research Assistant, Department of Computer Science, University of Tennessee. Work on parallel computing. In particular, work on ScaLAPACK, PBLAS, and BLACS libraries.
- May 91 - Aug 91** Undergraduate student employee, Physics division, Oak Ridge National Laboratory. Worked on parallelization of nuclear collision models.
- Jan 91 - May 91** Lab Assistant, Department of Computer Information Systems, Oklahoma Panhandle State University. Administration of Novel network, and assisting in student computer labs. Half time appointment.
- Jun 90 - Jan 91** Science and Engineering Research Student (SERS), Physics division, Oak Ridge National Laboratory. Worked on parallelization of nuclear collision models as undergraduate student.

Honors and Awards

- ◇ Winner, SC2016 Test of Time Award, “Recognizing an Outstanding Paper that has Deeply Influenced the HPC Discipline”. Click here for award talk and Q&A.
- ◇ IBM Faculty Award (\$10,000), May 31, 2016.
- ◇ IBM Faculty Award (\$25,000), April 28, 2015.
- ◇ NSF CAREER Award (\$583,145), 2012-2018.
- ◇ SiCortex Research Gift (\$10,000), April 2006.
- ◇ 1999 R & D 100 Award for the ATLAS project.
- ◇ Best paper in the systems category, SuperComputing 1998 Conference.

Publication List with Links

- ◇ <http://homes.soic.indiana.edu/rcwhaley/papers.html> (click here)

Doctoral Dissertation

- ◇ R. Clint Whaley, “Automated Empirical Optimization of High Performance Floating Point Kernels”, December 2004. Defended November 2, 2004. (*GSC: 17*)

Master’s Thesis

- ◇ R. Clint Whaley, “Basic Linear Algebra Communication Subprograms: Analysis and Implementation Across Multiple Parallel Architectures”, *UT Technical Report UT-CS-94-234*, University of Tennessee, May 1994. (*GSC: 41*)

Note on References

For the conferences for which I still possess records, I provide the acceptance rate. All published paper entries are annotated with their Google Scholar Citation count (GSC). These number last updated 12/2017, and can be verified here.

Refereed Journal Articles

1. Anthony M. Castaldo, Siju Samuel and R. Clint Whaley, "Scaling LAPACK Panel Operations Using Parallel Cache Assignment", *ACM Transactions on Mathematical Software (TOMS)*, Volume 39, Number 4, pp 22:1–22:30, 2013. (GSC: 2)
2. Anthony M. Castaldo, R. Clint Whaley and Anthony T. Chronopoulos, "Reducing Floating Point Error in Dot Product using the Superblock Family of Algorithms", *SIAM Journal of Scientific Computing*, Volume 31, Number 2, pp 1156-1174, 2008. (GSC: 15)
3. R. Clint Whaley and Anthony M. Castaldo, "Achieving accurate and context-sensitive timing for code optimization", *Software: Practice & Experience*, Volume 38, Number 15, pp 1621-1642, April 2008. (GSC: 40)
4. R. Clint Whaley and Antoine Petit, "Minimizing Development and Maintenance Costs in Supporting Persistently Optimized BLAS", *Software: Practice & Experience*, Volume 35, Number 2, pp 101-121, February, 2005. (GSC: 271)
5. Jim Demmel, Jack Dongarra, Victor Eijkhout, Erika Fuentes, Antoine Petit, Rich Vuduc and R. Clint Whaley, "Self Adapting Linear Algebra Algorithms and Software", *Proceedings of the IEEE*, Volume 93, Number 2, pp 293-312, February, 2005. (GSC: 202)
6. L. Susan Blackford, James Demmel, Jack Dongarra, Iain Duff, Sven Hammarling, Greg Henry, Michael Heroux, Linda Kaufman Andrew Lumsdaine, Antoine Petit, Roldan Pozo, Karin Remington and R. Clint Whaley, "An Updated Set of Basic Linear Algebra Subprograms (BLAS)", *ACM Transactions on Mathematical Software*, 28(2):135–151, June 2002. (GSC: 499)
7. R. Clint Whaley, Antoine Petit and Jack J. Dongarra, "Automated Empirical Optimization of Software and the ATLAS Project", *Parallel Computing*, Volume 27, Numbers 1-2, pp 3-25, 2001, ISSN 0167-8191. Also available as University of Tennessee LAPACK Working Note #147, UT-CS-00-448, 2000. (GSC: 1469)
8. L.S. Blackford, A. Cleary, J. Demmel, J. Dongarra, I. Dhillon, S. Hammarling, A. Petit, H. Ren, K. Stanley, and R. C. Whaley, "Practical Experience in the Numerical Dangers of Heterogeneous Computing", *ACM Transaction on Mathematical Software*, Volume 23, Number 2, pp 133-147, June 1997. (GSC: 24)
9. J. Choi, J. Demmel, J. Dongarra, I. Dhillon, S. Ostrouchov, A. Petit, K. Stanley, D. Walker, and R. C. Whaley, "ScaLAPACK: a Portable Linear Algebra Library for Distributed Memory Computers - Design Issues and Performance", *Computer Physics Communication*, 97 (1996) 1-15. (GSC: 498)

10. J. Choi, J. Dongarra, S. Ostrouchov, A. Petitet, D. Walker, and R. C. Whaley, "The Design and Implementation of the ScaLAPACK LU, QR, and Cholesky Factorizations", *Scientific Programming*, Volume 5, pp 173-184, 1996. (GSC: 261)

Refereed Conference Proceedings

1. Md Rakib Hasan and R. Clint Whaley, "Effectively exploiting parallel scale for all problem sizes in LU factorization", in *Proceedings of the 28th International Parallel & Distributed Processing Symposium (IPDPS2014)*, pages 1039-1048, Phoenix, AZ, May 19-23, 2014. (21.07% acceptance rate)
2. Majedul Haque Sujon, R. Clint Whaley and Qing Yi, "Vectorization Past Dependent Branches Through Speculation", in *Proceedings of the 22nd International Conference on Parallel Architectures and Compilation Techniques (PACT)*, pages 353-362, Edinburgh, Scotland, September, 9-11, 2013. (17.31% acceptance rate, GSC: 2)
3. Anthony M. Castaldo and R. Clint Whaley, "Achieving Scalable Parallelization For The Hessenberg Factorization", in *IEEE Cluster 2011*, pages 65-73, Austin, TX, September 26-30, 2011. (27.86% acceptance rate), GSC: 3
4. Anthony M. Castaldo and R. Clint Whaley, "Scaling LAPACK Panel Operations Using Parallel Cache Assignment", In *Proceedings of the 2010 ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, pages 223-231, Bangalore, India, January 9-14, 2010. (16.76% acceptance rate, GSC: 37)
5. Anthony M. Castaldo and R. Clint Whaley, "Minimizing Startup Costs for Performance-Critical Threading" In *Proceedings of the 23rd IEEE International Parallel and Distributed Processing Symposium (IPDPS2009)*, pages 1-8, Rome, Italy, May 25-29, 2009. (22.73% acceptance rate, GSC: 8)
6. Qing Yi and R. Clint Whaley, "Automated Transformation for Performance-Critical Kernels", In *ACM SIGPLAN Symposium on Library-Centric Software Design*, Montreal, Canada, October, 2007. (GSC: 17)
7. R. Clint Whaley and David B. Whalley, "Tuning High Performance Kernels through Empirical Compilation", In *The 2005 International Conference on Parallel Processing*, June 2005. (28.63% acceptance rate, GSC: 44)
8. R. Clint Whaley and Jack Dongarra, "Automatically Tuned Linear Algebra Software", *Ninth SIAM Conference on Parallel Processing for Scientific Computing*, March 22-24, 1999, CD-ROM Proceedings.
9. R. Clint Whaley and Jack Dongarra, "Automatically Tuned Linear Algebra Software", *SuperComputing 1998 Conference*, Orlando, FL, November 1998. **Best paper in the systems category.** (GSC: 1012)
10. L. S. Blackford, J. Choi, A. Cleary, E. D'Azevedo, J. Demmel, I. Dhillon, J. Dongarra, S. Hammarling, G. Henry, A. Petitet, K. Stanley, D. Walker, and R. C. Whaley, "ScaLAPACK: A Linear Algebra Library for Message-Passing Computers", *SIAM Conference on Parallel Processing for Scientific Computing*, March 1997. (GSC: 83)

11. J. Choi, J. Dongarra, S. Ostrouchov, A. Petitet, D. Walker and R. C. Whaley. Second International Workshop on Applied Parallel Computing (PARA'05), Lyngby, Denmark, August 21-24, 1996, "A Proposal for a Set of Parallel Basic Linear Algebra Subprograms", Proceedings in *Lecture Notes in Computer Science*, Volume 1041, pp 107-114, Springer-Verlag, Berlin - Heidenberg - New York, 1996. (GSC: 230)
12. Jack Dongarra, Robert van de Geijn, and R. Clint Whaley, "Two Dimensional Basic Linear Algebra Communication Subprograms" *Proceedings of the sixth SIAM Conference on Parallel Processing for Scientific Computing*, SIAM Publications, pp 347-352, Norfolk, Virginia, March 1993. (GSC: 113)

Refereed Workshop Papers

1. Josh Magee, Qing Yi, and R. Clint Whaley, "Automated Timer Generation for Empirical Tuning", Fourth Workshop on Statistical and Machine learning approaches to ARchitecture and compilaTion (SMART'10), January 24, 2010, Pisa, Italy. (GSC: 2)
URL: <http://ctuning.org/workshop-smart10>
2. R. Clint Whaley, "Empirically Tuning LAPACK's Blocking Factor for Increased Performance", *Proceedings of the International Multiconference on Computer Science and Information Technology (Computer Aspects of Numerical Algorithms)*, pages 303-310, Wisla, Poland, October 20-22, 2008. (GSC: 22)

Invited Papers

1. "ATLAS Version 3.8: Overview and Status", Invited paper at *the international Workshop on Automatic Performance Tuning (iWAPT07)*, pages 1-11, Tokyo & Kyoto, Japan, September 16-22, 2007. URL: <http://iwapt.org/2007/>

Chapters in Books

1. R. Clint Whaley, "Automatically Tuned Linear Algebra Software (ATLAS)", in *Encyclopedia of Parallel Computing*, David Padua ed., available August 16, 2011 from Springer Reference books, ISBN: 978-0-387-09765-7.6 (GSC: 15)
2. R. Clint Whaley, "ATLAS version3.9: Overview and Status", in *Software Automatic Tuning: From Concepts to State-of-the-Art Results*, K. Naono, K. Teranishi, J. Cavazos, and R. Suda, ed., Springer New York Dordrecht Heidelberg London, 2010. ISBN: 978-1-4419-6934-7. (GSC: 23)
3. A. Petitet, H. Casanova, J. Dongarra, Y. Robert and R. C. Whaley, "Parallel and Distributed Scientific Computing", J. Blazewicz, K. Ecker, B. Plateau, D. Trystram, ed., *Handbook on Parallel and Distributed Processing*, Springer-Verlag Berlin Heidelberg, 2000. ISBN: 3-540-6641-6. (GSC: 8)

Books

1. L.S. Blackford, J. Choi, A. Cleary, E. D'Azevedo, J. Demmel, I. Dhillon, J. Dongarra, S. Hammarling, G. Henry, A. Petitet, K. Stanley, D. Walker, and R. C. Whaley, *ScaLAPACK Users' Guide*, SIAM Publications, Philadelphia, 1997. ISBN: 0-89871-400-1. (GSC: 1704)

Invited Talks

1. “ATLAS Before, During and After”, Whaley & Dongarra. Award presentation and Q&A by both Whaley & Dongarra for SC2016 Test of Time Award.
2. Panelist for “Languages and Compilers for Linear Algebra Libraries” panel at CScADS workshop (Libraries and Autotuning for Petascale Applications), Snowbird, Utah, August 9-11, 2010.
URL: <http://cscads.rice.edu/workshops/summer-2010/autotuning>
3. Presented IPDPS threading paper and ATLAS overview at CScADS workshop (Automatic Tuning for Petascale Systems), Tahoe City, CA, August 10-12, 2009.
URL: <http://cscads.rice.edu/workshops/summer09/autotuning>
4. Presented SP&E timing paper at CScADS workshop (Automatic Tuning for Petascale Systems), Snowbird, Utah, July 8-10, 2008.
URL: <http://cscads.rice.edu/workshops/summer08/autotuning>
5. R. Clint Whaley “ATLAS Version 3.8: Overview and Status”, Invited paper at *the international Workshop on Automatic Performance Tuning (iWAPT07)*, pages 1-11, Tokyo & Kyoto, Japan, September 16-22, 2007.
I was one of two invited speakers (the other was Markus Pushel of CMU) at this workshop. I gave ATLAS talks both at the conference, and at Kyoto University.
URL: <http://iwapt.org/2007/>
6. Presented at CScADS workshop (Automatic Tuning for Petascale Systems), Snowbird, Utah, July 8-13, 2007. Presented ATLAS research in 30 minute talk, and took part in several key discussions, including giving a presentation on the number and type of transformations required for HPC compilation.
URL:
<http://cscads.rice.edu/workshops/july2007/autotune-workshop-07>

Workshop Presentations

1. Presented SP&E timing paper at the autotuning workshop during HPCSW, Denver, Colorado, April 3-4, 2008.
URL: <http://www.hpcsw.org/>
2. Presented at NSF CRI'07 workshop, Boston, MA, June 3-6, 2007. Presented overview of work performed under my NSF CRI grant, and participated in various sub-meetings, including research at minority-serving institution BOF.
URL: <http://www.cs.bu.edu/NSF-CRI07/>
3. Presented “Tuning High Performance Kernels through Empirical Compilation” at Los Alamos Computer Science Institute (LACSI) Workshop on Automatic Tuning of Whole Applications, October 12, 2005, Sante Fe, NM.
URL: http://lacsi.rice.edu/symposium/agenda_2005

Technical notes, etc.

1. R. Clint Whaley, "ATLAS Installation Guide", *Technical Report CS-TR-2008-002*, University of Texas at San Antonio, January 2008. (GSC: 1)
2. R. Clint Whaley and Anthony M. Castaldo, "Achieving accurate and context-sensitive timing for code optimization", *Technical Report CS-TR-2008-001*, University of Texas at San Antonio, January 2008.
3. Qing Yi and R. Clint Whaley, "Automated Transformation for Performance-Critical Kernels" *Technical Report CS-TR-2007-003*, University of Texas at San Antonio, June 2007.
4. Anthony M. Castaldo and R. Clint Whaley, "Error Analysis of Various Forms of Floating Point Dot Products", *Technical Report CS-TR-2007-002*, University of Texas at San Antonio, May 2007.
5. R. Clint Whaley, "A Guide to User Contribution to ATLAS", (GSC: 9)
(URL: http://math-atlas.sourceforge.net/devel/atlas_contrib/).
6. R. Clint Whaley "A User's Guide to Extract",
(URL: <http://www.cs.utsa.edu/~whaley/extract/Extract400.ps>)
7. R. Clint Whaley and Peter Soendergaard "A Collaborative Guide to ATLAS development",
(URL: http://math-atlas.sourceforge.net/devel/atlas_devel/).
8. R. C. Whaley, A. Petitet, J. Dongarra, "Automated Empirical Optimization of Software and the ATLAS Project",
UT Technical Report UT-CS-00-448, University of Tennessee, September 2000.
9. A. Petitet, H. Casanova, J. Dongarra, Y. Robert and R.C. Whaley "A Numerical Linear Algebra Problem Solving Environment Designer's Perspective", *UT Technical Report UT-CS-98-405*, University of Tennessee, October 1998. (GSC: 2)
10. L. S. Blackford, J. J. Dongarra, C. A. Papadopoulos and R. C. Whaley, "Installation Guide and Design of the HPF 1.1 interface to ScaLAPACK SLHPF", *UT Technical Report UT-CS-98-396*, University of Tennessee, August, 1998. (GSC: 9)
11. L. S. Blackford and R. C. Whaley, "ScaLAPACK Evaluation and Performance at the DoD MSRCs", *UT Technical Report UT-CS-98-388*, University of Tennessee, April 1998. (GSC: 7)
12. R. Clint Whaley and J. Dongarra, "Automatically Tuned Linear Algebra Software", *UT Technical Report UT-CS-97-366*, University of Tennessee, December 1997.
13. R. Clint Whaley, "Outstanding Issues in the MPIBLACS"
(URL: <http://www.netlib.org/blacs/mpiblacs-issues.ps>), November 1997.
14. R. Clint Whaley, "Some Plebian Extensions to MPI",
(URL: http://www.netlib.org/blacs/mpi_prop.ps), November, 1997. (GSC: 2)

15. L. S. Blackford, A. Cleary, J. Demmel, I. Dhillon, J. Dongarra, S. Hammarling, A. Petitet, H. Ren, K. Stanley, and R. C. Whaley, "Practical Experience in the Dangers of Heterogeneous Computing", *UT Technical Report UT-CS-96-330*, University of Tennessee, July 1996. (GSC: 16)
16. J. Choi, J. Dongarra, S. Ostrouchov, A. Petitet, D. Walker, and R. C. Whaley, "A Proposal for a Set of Parallel Basic Linear Algebra Subprograms", *UT Technical Report UT-CS-95-292*, University of Tennessee, May 1995. (GSC: 16)
17. J. Choi, J. Demmel, I. Dhillon, J. Dongarra, S. Ostrouchov, A. Petitet, K. Stanley, D. Walker, and R. C. Whaley, "ScaLAPACK: A Portable Linear Algebra Library for Distributed Memory Computers - Design Issues and Performance" *UT Technical Report UT-CS-95-283*, University of Tennessee, March 1995. (GSC: 334)
18. Jack Dongarra and R. Clint Whaley, "BLACS User's Guide V1.1", *UT Technical Report UT-CS-95-281*, University of Tennessee, March 1995. (GSC: 195)
19. J. Choi, J. Demmel, I. Dhillon, J. Dongarra, S. Ostrouchov, A. Petitet, K. Stanley, D. Walker and R. C. Whaley "Installation Guide for ScaLAPACK" *UT Technical Report UT-CS-95-280*, University of Tennessee, March 1995. (GSC: 19)
20. J. Choi, J. J. Dongarra, S. Ostrouchov, A. P. Petitet, D. W. Walker, and R. C. Whaley, "The Design and Implementation of the ScaLAPACK LU, QR, and Cholesky Factorization Routines", *UT Technical Report UT-CS-94-246*, University of Tennessee, September, 1994.

Grant Overview

I have obtained more than \$3.3 million dollars in funding; with more than \$2.5 million of this as a sole investigator.

Funded Research Grants as Sole Investigator

1. R. Clint Whaley, 2016 IBM Faculty Award. **Period** : donated May 2016, no expiration. **Total award**: \$10,000. **Funds usage**: any. **NOTE**: This was a gift from IBM to further my ATLAS research (they use ATLAS in their business).
2. R. Clint Whaley, 2015 IBM Faculty Award. **Period** : donated April 2015, no expiration. **Total award**: \$25,000. **Funds usage**: any. **NOTE**: This was a gift from IBM to further my ATLAS research (they use ATLAS in their business).
3. R. Clint Whaley, “NSF CAREER: Empirical Tuning for Extreme Scale”. **Period**: Mar 1, 2012 - Mar 31, 2018. **Total award**: \$583,145. **Funds usage**: Faculty support: 1 month summer salary each year. PhD student support in each year, with modest travel and equipment. Research professor support. **NOTE**: over \$200,000 remaining, no-cost extension through 2018.
4. R. Clint Whaley, ATLAS research and development. Department of Defense Maryland Procurement. **Period**: Sep 1, 2011 - Sep 30, 2016 (1 year + 4 option years). **Total award**: \$984,720. **Funds usage**: Faculty support: 2 months summer salary, 33% time during regular semester (each year). Student support (number varies, with up to three students in later years), with modest travel and equipment. Research professor support. **NOTE**: contract was left at UTSA when moving to LSU.
5. R. Clint Whaley, NSF REU supplement for CNS-0551504. **Period**: 04/22/08 - 02/28/09. **Total Award**: \$12,000 **Funds usage**: Research support for undergraduate students at UTSA.
6. R. Clint Whaley, SiCortex Research Gift. **Period** : donated April 2006, no expiration. **Total award**: \$10,000. **Funds usage**: any. **NOTE**: this was a gift from a private company to help further my ATLAS research, since they use ATLAS in their business.
7. R. Clint Whaley, “Technical Proposal (#H98230-06-R-0914) for ATLAS (Automatically Tuned Linear Algebra Software)”. Department of Defense Maryland Procurement H98230-06-C-0443, **Period**: August 1, 2006 - September 30, 2011 (1 year + 4 option years, with extension). **Total award**: \$790,446. **Funds usage**: Faculty support: 2 months summer salary, 33% time during regular semester (each year). Student support (number varies, with up to three students in later years), with modest travel and equipment.
8. R. Clint Whaley, “CRI, Community Resource Development: ATLAS Support and Development”, NSF CRI award, CNS-0551504. **Period**: March 01, 2006 - February 28, 2009. **Total award**: \$100,000. **Funds usage**: Mainly student support with some travel and equipment.

Funded Research Grants as Collaborative Investigator

1. Qing Yi, Daniel J. Quinlan and R. Clint Whaley, "A Multi-Language Environment For Programmable Code Optimization and Empirical Tuning", DOE Office of Science award DE-SC0001770 **Period:** 09/15/09 - 09/14/12. **Total award:** \$360,000.
2. Qing Yi, Daniel J. Quinlan and R. Clint Whaley, "Programmable Code Optimization and Empirical Tuning For High-end Computing", NSF award CCF-0833203. **Period:** 09/01/08 - 09/31/10. **Total award:** \$462,000.

Formal Courses Taught

Semester	Course	# stud	Description
Fall 2017	ISE 201	19	Computer Systems Engineering
Spring 2016	CSC 3501	56	Computer Organization and Design†
Spring 2015	CSC 3501	92	Computer Organization and Design
Fall 2014	CSC 7700	5	High Performance Optimization
Spring 2014	CSC 3501	49	Computer Organization and Design§
Fall 2012	CS 1713	45	Intro to Computer Programming II§
Spring 2012	CS 3853	37	Computer Architecture
Fall 2011	CS 6463	6	Fundamentals of High Performance Optimization
Spring 2011	CS 4823	15	Parallel Programming†
Fall 2010	CS 5513	51	Computer Architecture†
Spring 2010	CS 6643	21	Parallel Processing
Fall 2009	CS 1073	51	Intro Computer Prog for Scientific Apps§
Spring 2009	CS 6463	9	Fundamentals of High Performance Optimization
Fall 2008	CS 3853	22	Computer Architecture
Spring 2008	CS 6643	8	Parallel Processing
Fall 2007	CS 4753	19	Computer Architecture
Spring 2007	CS 6463	9	Fundamentals of High Performance Optimization§
Fall 2006	CS 4753	25	Computer Architecture
Spring 2006	CS 6643	9	Parallel Processing§
Fall 2005	CS 4753	25	Computer Architecture§

§New Course Development

†Significant Course Adaptation or Extension

Completed Theses and Dissertations Supervised

1. Rakib Hasan, "Maintaining High Performance Across All Problem Sizes and Parallel Scales Using Microkernel-based Linear Algebra", Doctoral Dissertation; successfully defended July, 2017.
2. Majedul Haque Sujon, "Empirically Tuning HPC Kernels with iFKO", Doctoral Dissertation; successfully defended July, 2017.
3. Siju Samuel, "Maintaining High Performance in the QR Factorization While Scaling Both Problem Size and Parallelism", Master's Thesis; successfully defended May, 2011.
4. Anthony M. Castaldo, "Parallelism and Error Reduction in a High Performance Environment", Doctoral Dissertation; successfully defended November, 2010. (*GSC: I*)
5. Anthony M. Castaldo, "Error Analysis of Various Forms of Floating Point Dot Products", Master's Thesis; successfully defended August, 2007.

Completed Master's Projects Supervised

1. Majedul Haque Sujon, "Vectorization Past Dependent Branches Through Speculation", Master's project; successfully defended Summer, 2013.

2. Chad Zalkin, "SSE Code Generation for General Matrix Matrix Multiply", Master's project; successfully defended April, 2011.

Completed Master's projects, co-chaired

1. Michael Stiles, "Enhancing the Role in Inlining in Effective Interprocedural Parallelization", Master's project; successfully defended November, 2012.

Graduate Committees (non-chair)

1. Jichi Guo, Doctoral Proposal defense, passed Spring 2012. Chair: Qing Yi.
2. Faizur Rahman, Doctoral Proposal defense, passed Spring 2012. Chair: Qing Yi.
3. Akshatha Bhat, "Automatically Tuning Task Scheduling Policies on Multicore Architectures", Master's Thesis, successfully defended Aug 2012. Chair: Qing Yi.
4. Samira Khan, "Intelligent Cache Management Techniques", Doctoral Dissertation; successfully defended Spring, 2011. Chair: Daniel Jimenez.
5. Emre Brookes, "New High Performance Computational Strategies for Inverse Problems with Application to Analytical Ultracentrifugation", Doctoral Dissertation; successfully defended November, 2007. Chair: Hugh Maynard.
6. "Game Theory Based Job Allocation/Load Balancing in Distributed Systems with Communication and Applications to Grid Computing", Doctoral Dissertation; defended September, 2007. Chair: Anthony Chronopoulos.
7. Sam Adams, MS project defense, passed Fall 2006. Chair: Rajendra Boppana.

Departmental Service

1. **Undergraduate Program ommittee, Fall 2017 - Present**
2. **Faculty Hiring Committee, Computer Engineering, Fall 2017 - Present**
3. **Bloomington Policy Committee, Fall 2017 - Present**
4. **Graduate Admission/Assistantship Committee, Fall 2013 - Summer 2017.**
5. **Qualifying Exam Committee (Computer Architecture), Fall 2013 - Summer 2017.**
6. **ABET review, Course coordinator, CSC 3501, Fall 2013 - Summer 2017.**
7. **Graduate Curriculum Committee, Fall 2013 - Fall 2014.**
8. **CS 1713 Course Coordinator, Spring 2012 - Summer 2013:** Since I was one of the main developers of the new introduction to programming sequence, and have always been enthusiastic about teaching beginning CS-centric programming, I agreed to serve as the course coordinator for the new CS 1713 (intro to programming in C for computer scientists). As course coordinator, I was responsible for creating the new course, including making slides, assignments, programming exercises, lecture notes and sample tests for other instructors to use, as well as helping new instructors understand the material and best practices in the area.
9. **Qualifying Exam Committee, Fall 2007 - Spring 2011.** Along with either Dr. Jimenez or Dr. Maynard, I created and graded the computer architecture qualifier exam twice a year.
10. **Curricula Redesign.** I was one of the primary designers of UTSA's approved update to the introduction to programming sequence. This involved extensive consultation with various faculty in order to get ideas and formulate a high level view of the problems and challenges, as well as creating detailed documentation for consideration by the faculty as the proposal was completed.
11. **Faculty governance.** I have been extremely active in faculty governance both in taking part in the discussions and in helping to draft formal proposals. I have also filled in for our faculty senate representative on several occasions.
12. **Computer Architecture Redesign:** I was an active member of the committee overseeing the redesign of UTSA's architecture series after we dropped Computer Organization I from our required list of courses.
13. **CS library liaison, Fall 2008 - July 2013.**
14. **Faculty Search Committee, Fall 2008 - Summer 2009.**
15. **Program Assessment and SACS accreditation, Fall 2009 - Spring 2012.** Since I normally teach Computer Architecture, I am usually involved in the program assessment in both regular semesters, either as the primary or secondary assessor.

16. **Computer Architecture Qualifying Exam Syllabus Update.** As part of UTSA's ongoing effort to improve student achievement, I (in consultation with Drs. Maynard & Jimenez) updated the CA QE syllabus to match current teaching materials and to better describe the subjects students are expected to know.
17. **Lab committee, Fall 2005 - July 2013.**
18. **Communications Committee Fall 2007 - Summer 2009.**

External Service Through Open Source Software

By developing and maintaining the open source ATLAS project, I perform an unprecedented amount of external service that affects almost every field that utilizes Linear Algebra. ATLAS (Automatically Tuned Linear Algebra Software) is the embodiment of my pioneering research on empirical tuning as applied to dense linear algebra. It is used by scientists, engineers, researchers and business-persons worldwide. In my area (high performance computing), ATLAS is used primarily in scientific simulation and modeling across most fields of science and engineering. It is also heavily used by applied mathematicians, including numerical analysts and statisticians. ATLAS is used in an enormous array of applications beyond those discussed above; examples include problem solving environments (eg., Maple, Matlab and Octave), medical imaging, movie special affects, search and data mining, machine learning, and certain security-related applications. ATLAS is built into Apple's OS X, and is provided by almost every Linux and BSD distribution. ATLAS is used by a wide variety of technology companies that work in the previously described areas, as well as hardware oriented companies from embedded system designers up through traditional big-iron companies like IBM. My software is used at almost all the national labs for a wide array of government-critical research. More details can be found at <http://math-atlas.sourceforge.net/>.

I was also one of the core developers of the ScaLAPACK and BLACS projects, which are still the defacto standards for handling dense linear algebra on distributed memory machines. More details can be found at the ScaLAPACK homepage, http://www.netlib.org/scalapack/scalapack_home.html.

Panels

1. Panelist on the NSF MRI SUBPANEL 4-R held 04/24/2008.
2. Program committee member for the Fourth Workshop on Statistical and Machine learning approaches to ARchitectures and compilaTion (SMART2010).
3. Steering committee member for the Fifth International Workshop on Automatic Performance Tuning (iWAPT2010).

Paper Reviews

I usually average roughly four paper reviews a year, for journals such as Transactions on Mathematical Software, Parallel Computing, Concurrency: Practice and Experience, Software: Practice and Experience, Transactions on Architecture and Code Optimization, and the Journal of Parallel and Distributed Computing. I also occasionally review for related conferences such as the International Conference on High Performance Computing, Networking, Storage and Analysis (SC), the International Conference on Supercomputing (ACM/ICS), the International Symposium on Code Generation and Optimization (CGO), and the IEEE International Parallel & Distributed Processing Symposium (IPDPS).