

# Andy R. Terrel, Ph.D.

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8835 Tallwood Dr, Austin, TX 78759  
Phone: (806) 410-0187

<http://andy.terrel.us>  
[andy.terrel@gmail.com](mailto:andy.terrel@gmail.com)

## EDUCATION

**Ph.D.** Computer Science, The University of Chicago, Chicago, Illinois, 2010.

Advisers: L. Ridgway Scott and Matthew G. Knepley.

Thesis: FEM software automation of non-Newtonian fluid models.

Concentration: Computational Mathematics.

**M.S.** Computer Science, The University of Chicago, Chicago, Illinois, 2007.

Advisers: L. Ridgway Scott and Robert C. Kirby.

Thesis: FEM software automation with a case study on the Stokes equations.

Concentration: Computational Mathematics.

**B.S.** Physics and Mathematics with honors, cum laude, Texas Tech University, Lubbock, Texas. 2004.

**B.A.** Philosophy with honors, cum laude, Texas Tech University, Lubbock, Texas. 2004.

## ACADEMIC POSITIONS

**Postdoctoral Fellow**, Texas Advanced Computing Center and Institute of Computational Engineering and Sciences, The University of Texas, Austin, Texas. 2010 – present.

## PUBLICATIONS

M.G. Knepley and A.R. Terrel, *Finite element integrations on GPUs*, Submitted to ACM Transactions on Mathematical Software in Feb 2011

A.R. Terrel, *From equations to code: Automated Scientific Computing*. Computing in Science and Engineering, to appear March 2011.

A.R. Terrel, R.C. Kirby, M.G. Knepley, and L.R. Scott, *Finite elements for incompressible fluids*, Submitted as chapter to A. Logg, K.A. Mardal, and G. N. Wells, editors. *Automated Scientific Computing*. Springer-Verlag. <https://launchpad.net/fenics-book>

R.C. Kirby, A. Logg, and A.R. Terrel, *Common and unusual finite elements*. Submitted as chapter to A. Logg, K.A. Mardal, and G.N. Wells, editors. *Automated Scientific Computing*, Springer-Verlag. <https://launchpad.net/fenics-book>

R.C. Kirby, M.G. Knepley, A. Logg, L.R. Scott, and A.R. Terrel, *Discrete optimization of finite element matrix evaluation*, Submitted as chapter to A. Logg, K.A. Mardal, and G.N. Wells, editors. *Automated Scientific Computing*. Springer-Verlag. <https://launchpad.net/fenics-book>

A.R. Terrel, L.R. Scott, M.G. Knepley, and R.C. Kirby, *Automated FEM discretizations for the Stokes equation*, BIT Numerical Mathematics, July 2008, Vol 48, pp 389–404.

R.C. Kirby, L.R. Scott, A. Logg, and A.R. Terrel, *Topological optimization of the evaluation of finite element matrices*, SIAM Journal of Scientific Computing, January 2006, Vol 28 No 1, pp 224–240.

A.R. Terrel and K.R. Long, *Evaluation of level set topology optimization formulations for the design of minimum-dispersion microfluidic devices*, NECIS Summer Proceedings 2006, Sandia National Labs.

## INVITED PRESENTATIONS

*The FEniCS project*, FEMTEC'2011, South Lake Tahoe, May 2011.

*Rheagen: rheology application engine*, Mini-Symposium, SIAM Computational Science and Engineering 2011, Reno, Nevada, February 2011.

*FEniCS tutorial*, 2nd European Seminar on Coupled Problems, Pilzen, Czech Republic, June 2010.

*FEM automation of non-Newtonian fluids*, Seminar, Institute of Computational Engineering and Sciences, University of Texas, Austin, Texas, November 2009.

*Mathematical interfaces for automated scientific computing*, Computing Techniques Seminar, Fermi National Accelerator Laboratory, Batavia, Illinois, November 2009 and ITTC Seminar, University of Kansas, Lawrence, Kansas, November 2007.

*Exact fluid solvers for FEM*, FEniCS'09, Simula Laboratories, Oslo, Norway, June 2009.

*Algorithms for the grade-two fluid model*, Simula Laboratories, Oslo, Norway, September 2008.

*Finite element assembly on arbitrary meshes*, AMS 2008 Spring Central Sectional Meeting, Bloomington, Indiana, April 2008.

*FEniCS and Sieve tutorial*, Automated Scientific Computing Workshop, Center for Computation and Technology, Louisiana State University, Baton Rouge, Louisiana, March 2008.

*Abstractions in FEM software*, FEniCS'06, Delft Technical University, Delft, The Netherlands, November 2006.

*Topology optimizations with applications in microfluidics: a comparison of level set methods*, Applied Mathematics Seminar, Texas Tech University, Lubbock, Texas, September 2006.

## CONTRIBUTED PRESENTATIONS

*Code generation for complex fluids*, 2nd European Seminar on Coupled Problems, Pilzen, Czech Republic, June 2010

*FEM automation of Oldroyd-B fluids*, USNCCM 10, Columbus, Ohio, July 2009.

*Automation of finite element assembly using a topology based mesh library*, BIT Numerical Circus, Oslo, Norway, August 2008.

*Finite element assembly on arbitrary meshes*, SIAM Conference on Parallel Processing for Scientific Computing, Atlanta, Georgia. March 2008 and AMS Central Sectional Meeting, Bloomington, Indiana, April 2008.

*A case for developing with a PDE language*, SIAM Computer Science and Engineering, Costa Mesa, California, February 2007.

*Optimizing local matrix computations for finite element methods*, SIAM Annual Meeting, New Orleans, Louisiana, June 2005.

## PUBLIC SOFTWARE

**Ignition** (<http://andy.terrel.us/ignition>) a collection of numerical code generators.

- Principle author,
- Under active development, but current features include domain specific languages for integration, linear algebra and finite element assemble with code generated to Python, C/C++, OpenCL, CUDA, and Latex.

**FEniCS** ([www.fenicsproject.org](http://www.fenicsproject.org)) a collection of free software projects that uses finite element methods to automate computational mathematical modeling.

- Principle author of Rheology Application Engine (rheagen), an automated non-Newtonian fluid model simulation engine. <https://launchpad.net/rheagen>,
- Manager of the FEniCS-Apps repositories, and
- Contributor to DOLFIN, FFC, FErari, and FIAT projects.

**Other contributions to:**

- **SymPy** (<http://www.sympy.org>) a free Python based computer algebra system,
- **Sundance** a finite element modeling package from Sandia National Laboratory, and
- **PETSc** a large scale linear algebra package from Argonne National Laboratory.

## TEACHING

**Certificate in University Teaching**, Center for Teaching and Learning, University of Chicago, 2010.

**Course Assistant**, *Numerical Linear Algebra*, Computer Science Department, University of Texas at Austin, Autumn 2010.

- Lectured on special topics.

**Lecturer**, *World Wide Web Programming: Java and SQL*, Computer Science Department, University of Chicago, Spring 2009.

- Prepared curriculum and materials,
- Lectured 3 hours a week, and
- Oversaw teaching assistants for grading and lab section.

**Lab Assistant**, *Honors introductory computer science*. Computer Science Department, University of Chicago, Autumn 2006 and 2007.

- Prepared lab based on coresponding lecture material, and
- Taught 2 hour weekly lab.

**Discussion Leader**, Honors College, Texas Tech University, Autumn 2003 and 2004.

- Helped develop new first year experience program, and
- Taught weekly 2 hour philosophy and humanities discussion sections.

**Physics Education Research/Teaching Assistant**, Physics Department, Texas Tech University, 2002 – 2004.

- Developed peer-learning projects for non-major physics class,
- Graded assignments, and
- Collected and analyzed data to assess learning.

## AWARDS

**Support from NSF Award 0850680**, V. Eijkhout, M.G. Knepley, and R.A. van de Geijn, *Mechanical transformation of knowledge to libraries*, 2009.

**Givens Fellow**, Mathematics and Computer Science Division, Argonne National Lab, 2009.

**TU Delft Visitor Grant** (Junior Fellow), Civil Engineering Department, TU Delft, Delft, The Netherlands, 2008.

**Phi Kappa Phi National Graduate Fellowship**, 2004.

## SERVICE

**Organizer** of FEniCS 2011 Conference.

**Participant** of Austin GiveCamp 2011.

**Mentor** for Google Summer of Code, Summer 2009 and 2010.

**Reviewer** for

- Journal of Computational and Applied Mathematics,
- International Journal of Computer Applications in Technology,
- Automated Scientific Computing, a contributed collection from Springer-Verlag, and
- Java textbook published by Pearson Addison Wesley.

**Session aide**, AAAS Annual meeting, Chicago, Illinois, January 2009.

**Session chair**, SIAM Conference on Parallel Processing for Scientific Computing, Atlanta, Georgia, February 2008.

## OTHER EXPERIENCE

**System Administrator**. Computer Science Department, University of Chicago, Chicago, Illinois. 2007 – 2009.

- Provided general maintenance on 200+ servers (Debian Linux, OpenBSD, and Solaris),
- Migrated various services such as Apache, MySQL, and Amanda from legacy hardware, and
- Supported custom systems scripts in Python, Perl, and Bash.

**Technical Consultant**. Kove Corporation, Chicago, Illinois. 2007 – 2008.

- First stage start-up company developing a network storage appliance,
- User interface and system management team,
- Engineered distributed testing infrastructure for multiple platforms,
- Provided technical support and client liaison, and
- Recruited, interviewed, and mentored software developers.