

# Curriculum Vitae

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## Chad Westphal

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### Education

Ph.D. Applied Mathematics, University of Colorado, Boulder, 2004.

Advisor: Tom Manteuffel

M.S. Applied Mathematics, University of Tulsa, 2000.

Research Area: Vortex Energy Distribution Simulation

B.S. Engineering Physics *and* Mathematics, Oral Roberts University, 1998.

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### Research Interests

I'm interested in: numerical analysis and scientific computation with a particular emphasis on partial differential equations arising from applications in continuum mechanics; finite element methods for partial differential equations with emphasis on design and analysis of least-squares methods; continuation approaches to nonlinear and singular problems; iterative solution techniques and preconditioners for large sparse linear systems including Krylov and multigrid methods; analysis of nonlinear systems of partial differential equations and *a priori* estimates in appropriate Sobolev spaces.

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### Experience

Assistant Professor of Mathematics and Computer Science

2007-Present, Wabash College

Visiting Assistant Professor of Mathematics

2004-2007, Wabash College

Instructor

Spring 2003, Summer 2002, Department of Applied Mathematics, University of Colorado

NSF VIGRE Research Assistant

2001-2004, Department of Applied Mathematics, University of Colorado

Teaching Assistant

2000-2001, Department of Applied Mathematics, University of Colorado

Adjunct Instructor

Summer 2000, Summer 1999, Tulsa Community College

Teaching Assistant

1998-2000, Department of Mathematics and Computer Science, University of Tulsa

Student Research Intern  
 Summer 1997, Environment, Safety and Health Division, Argonne National Laboratory

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## Honors, Awards & Funding

Research Mentor, National Science Foundation Research Experiences for Undergraduates (NSF-REU),  
*Wabash Summer Institute in Mathematics (WSIM)*, 2008-2010.

MAA Regional Undergraduate Mathematics Conferences Grant (via NSF Grant DMS-0536991), *2008 Illiana Undergraduate Mathematics Research Conference*, co-organized with J. Stickles.

Co-PI, National Science Foundation Grant DMS-0511430, *Least-Squares Finite Element Methods for Nonlinear Partial Differential Equations*, 2006-2008, \$110,000.

Byron K. Trippet Summer Research Funding, Wabash College, 2008-2009.

SIAM/NSF Travel Grant, International Congress on Industrial and Applied Mathematics (ICIAM), 2007.

Lilly Teaching Fellow, Wabash College, 2004-2006.

Short Term Visiting Research Guest, Lawrence Livermore National Laboratory, Summers 2004, '05, '06.

NSF VIGRE Graduate Fellowship, Department of Applied Mathematics, University of Colorado, 2001-2004.

SIAM Travel Grant, SIAM CS&E Conference, 2003.

Most Outstanding Senior, Engineering and Physics Department, ORU, 1998.

Most Outstanding Senior, Mathematics Department, ORU, 1998.

Most Outstanding Research and Design Project, Engineering and Physics Department, ORU, 1998.

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## Publications

### Journal articles:

“*An Adaptive Mixed Least-Squares Finite Element Method for Viscoelastic Fluids of Oldroyd Type*,” (with Z. Cai), *J. Non-Newton. Fluid. Mech.*, 159, pp. 72-80, 2009.

“*A Weighted  $H(\text{div})$  Least-Squares Method for Second-Order Elliptic Problems*,” (with Z. Cai), *SIAM J. Numer. Anal.*, 46, pp. 1640-1651, 2008.

“*Weighted-Norm First-Order System Least Squares for Problems with Three Dimensional Edge Singularities*,” (with E. Lee and T.A. Manteuffel), *SIAM J. Numer. Anal.*, 46, pp. 1619-1639, 2008.

“*Weighted-Norm First-Order System Least Squares (FOSLS) for Problems with Corner Singularities*,” (with E. Lee and T.A. Manteuffel), *SIAM J. Numer. Anal.*, 44, pp. 1974-1996, 2006.

“*First-Order System Least Squares for Geometrically Nonlinear Elasticity*,” (with T.A. Manteuffel, S.F. McCormick and J.G. Schmidt), *SIAM J. Numer. Anal.*, 44, pp. 2057-2081, 2006.

**In progress/submitted:**

“*Analysis of a Mixed Least-Squares Method for the Steady Navier-Stokes Equations.*” (with Z. Cai).

“*Numerical Solution of the Laplace-Young Capillary Equation.*”

**Other publications:**

“*A Least-Squares Finite-Element Method for Viscoelastic Fluids,*” Proc. Appl. Math. Mech. (PAMM), 7(1), 1025101-2, 2008.

“*Teaching Time Savers: Encouraging Contact Early in the Semester,*” MAA FOCUS, 27(6), 2007.

**Theses:**

“*First-Order System Least Squares (FOSLS) for Geometrically Nonlinear Elasticity in Nonsmooth Domains,*” Ph.D. Thesis, University of Colorado, 2004.

“*Energy Statistics in Filament Model of 3-D Vorticity,*” (with S. Nuchia), M.S. Group Research Report, University of Tulsa, 2000.

**Student Research Mentoring****Summer research internships:**

Ashley Crish (Notre Dame), Jessica Keeton (Simpson College) and Simon Rush (Dallas Baptist U.), “*Finite Element Solution of a Non-Newtonian Blood Flow Model*” WSIM, 2009.

Myles Baker (Baylor U.), Sarah Farell (Bard College), “*An Adaptively Weighted Least-Squares Finite Element Method for Convection Dominated Diffusion PDEs*” WSIM, 2009.

Genevieve Dupuis (Notre Dame) and Jessica Flores-Rosado (UPR-Humacao), “*Numerical Solutions for Intermediate Angles of the Laplace-Young Capillary Equations,*” WSIM, 2008.

Bryant Watkins (UMBC), Bo Xu (Columbia U.) and Dezhi Xu (Wabash College), “*A Shear-Thinning Viscoelastic Model of Non-Newtonian Blood Flow,*” WSIM, 2008.

Haris Amin (Wabash College), “*Least-Squares Finite Element Models for Viscoelastic Fluids,*” Wabash College Summer Internships, 2006 and 2007.

Sam Calisch (Grinnell College), “*On Weighted-Norm Least Squares for PDEs with Singularities,*” Wabash College Summer Internship, 2006.

**Senior research projects:**

Kyle Prifogle, “*Collective Motion, Flocking, and Emergent Behavior,*” Wabash College, 2009.

Wesley Barnes, “*Sobolev Spaces and Trace Theorems,*” Wabash College, 2008.

Chris Schmaltz, “*Modeling Accuracy in Basketball Free Throws,*” Wabash College, 2008.

Gary Simkus, "*Frisbee Flight Simulation*," Wabash College, 2008.

Vu Tran, "*The Black-Scholes Model via Brownian Motion and DEs*," Wabash College, 2007.

Ryan Nuppau, "*Infectious Disease Modeling with a Modified SIR Model*," Wabash College, 2007.

Hunter Fields, "*Modeling Cooking Techniques with PDEs*," Wabash College, 2006.

Colin McClelland, "*An Analysis of the Three-Body Problem*," Wabash College, 2006.

Daniel Schubert, "*Mathematics of Juggling*," Wabash College, 2005.

## Selected Presentations

June 2009, "*Least-Squares FEM for Problems with Boundary Singularities*," MAFELAP 2009, The Brunel Institute of Computational Mathematics, Uxbridge, UK.

November 2008, "*Least-Squares Finite Element Methods for PDEs in Nonsmooth Domains*," SIAM Graduate Chapter Colloquium, University of Illinois at Urbana-Champaign.

July 2007, "*A Least-Squares Finite Element Method for Viscoelastic Fluid Flow*," 6<sup>th</sup> International Congress on Industrial and Applied Mathematics (ICIAM), Zürich, CH.

July 2007, "*Least-Squares Finite Element Methods for PDEs in Nonsmooth Domains*," Institut für Angewandte Mathematik, Leibniz Universität Hannover, DE.

Jan. 2007, "*Least-Squares Finite Element Methods for PDEs in Nonsmooth Domains*," Computational and Applied Mathematics Seminar, Purdue University.

Oct. 2006, "*On a Least-Squares Finite Element Method for Viscoelastic Fluids: An Overview of Student/Faculty Summer Research*," with undergraduate Haris Amin, Mathematics Department Colloquium, Wabash College.

Apr. 2006, "*A Least-Squares Finite Element Method for Viscoelastic Flow*," 9<sup>th</sup> Copper Mountain Conference on Iterative Methods, Copper Mountain, CO.

Jan. 2006, "*Iterative Methods: How to Solve Tough Problems Quickly*," Mathematics Department Colloquium, Wabash College.

Apr. 2005, "*Computational Modeling with Partial Differential Equations (PDEs)*," Mathematics Department Colloquium, Rose-Hulman Institute of Technology.

Oct. 2004, "*A Least-Squares Finite Element Formulation of the Geometrically-Nonlinear Elasticity Equations*," Computational and Applied Mathematics Seminar, Purdue University.

May 2004, "*First-Order System Least-Squares for Problems with Boundary Singularities*," Center for Applied Scientific Computing, Lawrence Livermore National Laboratory.

June 2003, "*First-Order System Least Squares for Geometrically Nonlinear Elasticity*," SIAM Annual Meeting, Montreal, QC.

Mar. 2003, “*First-Order System Least Squares for Geometrically Nonlinear Elasticity*,” 11<sup>th</sup> Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO.

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## Courses Taught

### At Wabash College:

Precalculus-Calculus I (F '06 - Sp '07)	Numerical Analysis (F '06, F '08)
Calculus I (Sp '05, F '05, Sp '06, F '07)	Stochastic Simulation (F '08)
Calculus II (F '04, Sp '05, F '06, Sp '07, F '07, Sp '08)	Intro to Programming (Sp '08, Sp '09)
Linear Algebra (Sp '05, Sp '07, Sp '09, F '09)	Advanced Programming (F '09)
Differential Equations (Sp '06, Sp '08)	Cultures and Traditions (F '08)
Partial Differential Equations (F '05, F '07, F '09)	

### Elsewhere:

Calculus I for Engineers (CU, Sp '03)	Physics I (TCC, Sum '99)
Calculus III for Engineers (CU, Sum '02)	Physics II (TCC, Sum '00)

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## Academic Service

### Departmental:

Mathematics and Computer Science Colloquium Organizer, Wabash College, 2008-Present.

Student Mathematics Competitions Coordinator/Coach, Wabash College, 2004-Present.

Faculty Advisor, Math Club, Wabash College, 2008-Present.

Senior Comprehensive Exam Co-Organizer, Wabash College, 2004-2006.

Calculus Course Coordinator, Wabash College, 2005-2008.

### College wide:

Undergraduate Research Committee, Wabash College, 2006-Present (current Chair).

Pre-Engineering Committee, Wabash College, 2007-Present (current Chair).

Wabash College Integrated Marketing Committee, 2008-Present.

Division I Secretary, Wabash College, 2007-2009.

Dill Grant Selection Committee, Wabash College, 2007-2008.

Howard Hughes Medical Institute (HHMI) Proposal Committee (*ad hoc*), Wabash College, 2007.

Hiring Committee, Departments of Political Science, Chemistry, Classics, Rhetoric, Theater and Economics.

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## Professional Activities and Service

Member of SIAM, AMS and MAA.

Co-Organizer, *Illiana Undergraduate Mathematics Research Conference*, Oct. 2008.

Minisymposium Organizer, *Least-Squares Finite Element Methods*, 6<sup>th</sup> International Congress on Industrial and Applied Mathematics (ICIAM) 2007, Zürich, CH.

Journal Referee, *Journal of Computational and Applied Mathematics*

Journal Referee, *SIAM Journal on Numerical Analysis*.

Journal Referee, *SIAM Journal on Scientific Computation*.

Journal Referee, *Numerical Linear Algebra with Applications*.

Participant in Project NEX-T-Indiana, 2004.

Co-Founder and Co-President (2003-04), SIAM Graduate Student Chapter, University of Colorado, Boulder.

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## References

Tom Manteuffel, *Ph.D. Advisor*  
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