

Curriculum Vitae

YONGTAO ZHANG

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Education

- Ph.D. in Applied Mathematics, May 2003.
Division of Applied Mathematics, Brown University
Thesis: *Topics in structured and unstructured Weighted ENO schemes.*
Advisor: Professor Chi-Wang Shu
- M.Sc. in Computational Mathematics, June 1999.
School of Mathematical Science, Nankai University, P.R. China
- B.Sc. in Computational Mathematics, June 1996.
School of Mathematical Science, Nankai University, P.R. China

Professional Appointments

- Assistant Professor, Department of Mathematics, University of Notre Dame, July 2006 – Present.
- Assistant Adjunct Professor, Department of Mathematics, University of California, Irvine, July 2003 – June 2006.

Grants

- **PI**, NSF grant DMS-0810413, 2008-2011, *High Order Numerical Methods for PDEs on Complex Domains and Their Applications in Computational Biology.*
- **PI**, Oak Ridge Associated Universities (ORAU) Ralph E. Powe Junior Faculty Enhancement Award, 2008-2009, *High Order Accuracy Numerical Methods on Unstructured Meshes and Their Applications in Computational Biology.*

Publications

- Refereed Journal Articles (Appeared or Accepted)
 - [1] Y.-T. Zhang and C.-W. Shu, *High order WENO schemes for Hamilton-Jacobi equations on triangular meshes*, **SIAM Journal on Scientific Computing**, v24 (2003), pp.1005-1030.
 - [2] Y.-T. Zhang, J. Shi, C.-W. Shu and Y. Zhou, *Numerical viscosity and resolution of high-order weighted essentially nonoscillatory schemes for compressible flows with high Reynolds numbers*, **Physical Review E**, v68 (2003), article number 046709.

- [3] J. Shi, Y.-T. Zhang and C.-W. Shu, *Resolution of high order WENO schemes for complicated flow structures*, **Journal of Computational Physics**, v186 (2003), pp.690-696.
- [4] C.M. Mizutani, Q. Nie, F. Wan, Y.-T. Zhang, P. Vilmos, R. Sousa-Neves, E. Bier, J.L. Marsh and A.D. Lander, *Formation of the BMP activity gradient in the Drosophila embryo*, **Developmental Cell**, v8, no. 6, (2005), pp. 915-924.
- [5] S. Zhang, Y.-T. Zhang and C.-W. Shu, *Multi-stage interaction of a shock wave and a strong vortex*, **Physics of Fluids**, v17 (2005), article number 116101.
- [6] Y.-T. Zhang, H.-K. Zhao and J. Qian, *High order fast sweeping methods for static Hamilton-Jacobi equations*, **Journal of Scientific Computing**, v29, (2006), pp. 25-56. Appeared online, DOI: 10.1007/s10915-005-9014-3.
- [7] Q. Nie, Y.-T. Zhang and R. Zhao, *Efficient semi-implicit schemes for stiff systems*, **Journal of Computational Physics**, v214 (2006), pp. 521-537.
- [8] Y.-T. Zhang, C.-W. Shu and Y. Zhou, *Effects of shock waves on Rayleigh-Taylor instability*, **Physics of Plasmas**, v13 (2006), article number 062705.
- [9] D. Levy, S. Nayak, C.-W. Shu and Y.-T. Zhang, *Central WENO schemes for Hamilton-Jacobi equations on triangular meshes*, **SIAM Journal on Scientific Computing**, v28, (2006), pp. 2229-2247.
- [10] S. Zhang, Y.-T. Zhang and C.-W. Shu, *Interaction of an oblique shock wave with a pair of parallel vortices: shock dynamics and mechanism of sound generation*, **Physics of Fluids**, v18, (2006), article number 126101.
- [11] Y.-T. Zhang, H.-K. Zhao and S. Chen, *Fixed-point iterative sweeping methods for static Hamilton-Jacobi equations*, **Methods and Applications of Analysis**, v13, (2006), pp. 299-320.
- [12] J. Qian, Y.-T. Zhang and H.-K. Zhao, *Fast sweeping methods for Eikonal equations on triangular meshes*, **SIAM Journal on Numerical Analysis**, v45, (2007), pp. 83-107.
- [13] J. Qian, Y.-T. Zhang and H.-K. Zhao, *A fast sweeping method for static convex Hamilton-Jacobi equations*, **Journal of Scientific Computing**, v31, (2007), pp. 237-271.
- [14] C.-S. Chou, Y.-T. Zhang, R. Zhao and Q. Nie, *Numerical methods for stiff reaction-diffusion systems*, **Discrete and Continuous Dynamical Systems - Series B**, v7, (2007), pp. 515-525.
- [15] Y.-T. Zhang, A. Lander and Q. Nie, *Computational analysis of BMP gradients in dorsal-ventral patterning of the zebrafish embryo*, **Journal of Theoretical Biology**, v248, (2007), pp. 579-589.
- [16] M. Alber, T. Glimm, H.G.E. Hentschel, B. Kazmierczak, Y.-T. Zhang, J. Zhu and S.A. Newman, *The morphostatic limit for a model of skeletal pattern formation in the vertebrate limb*, **Bulletin of Mathematical Biology**, v70, (2008), pp. 460-483.
- [17] Q. Nie, F. Wan, Y.-T. Zhang and X.-F. Liu, *Compact integration factor methods in high spatial dimensions*, **Journal of Computational Physics**, v227, (2008), pp. 5238-5255.
- [18] Y.-T. Zhang and C.-W. Shu, *Third order WENO schemes on three dimensional tetrahedral meshes*, **Communications in Computational Physics**, v5, (2009), pp. 836-848.
- [19] F. Li, C.-W. Shu, Y.-T. Zhang and H.-K. Zhao, *A second order discontinuous Galerkin fast sweeping method for Eikonal equations*, **Journal of Computational Physics**, v227, (2008), pp. 8191-8208.

- [20] J. Zhu, Y.-T. Zhang, S.A. Newman and M. Alber, *Application of Discontinuous Galerkin Methods for reaction-diffusion systems in developmental biology*, **Journal of Scientific Computing**, to appear.
- Refereed Papers in Book Chapters and Proceedings
 - [21] Y.-T. Zhang and C.-W. Shu, *Third and fourth order Weighted ENO schemes for Hamilton-Jacobi equations on 2D unstructured meshes*, in **Hyperbolic Problems: Theory, Numerics, Applications**, T.Y.Hou and E.Tadmor, editors, Springer-Verlag, Berlin, 2003, pp.941-950.
 - [22] Y.-T. Zhang, J. Shi, C.-W. Shu and Y. Zhou, *Resolution of high order WENO schemes and Navier-Stokes simulation of the Rayleigh-Taylor instability problem*, in **Computational Fluid and Solid Mechanics 2003**, K.J. Bathe, Editor, the Proceedings of the Second MIT Conference on Computational Fluid and Solid Mechanics, June 17-20, 2003, volume 1, pp.1216-1218, Elsevier Science.
 - [23] Y.-T. Zhang, H.-K. Zhao and J. Qian, *High order fast sweeping methods for Eikonal equations*, in **the Proceedings of the 74th SEG Annual International Meeting**, volume 23, pp.1901-1904, 2004.
 - [24] S.A. Newman, S. Christley, T. Glimm, H.G.E. Hentschel, B. Kazmierczak, Y.-T. Zhang, J. Zhu and M. Alber, *Multiscale models for Vertebrate limb development*, **Current Topics in Developmental Biology**, v81, pp. 311-340, 2008.
 - Submitted Journal Papers
 - [25] S. Zhang, S. Jiang, Y.-T. Zhang and C.-W. Shu, *The mechanism of sound generation in shock vortex pair interaction: Linear regime*, submitted to **Physics of Fluids**, (2008).
 - [26] A. Lander, Q. Nie, F. Wan and Y.-T. Zhang, *Localized ectopic expression of Dpp receptors in a Drosophila embryo*, submitted to **Studies in Applied Mathematics**, (2008).
 - Old publications in Chinese
 - [27] Y.-T. Zhang and C. Sun, *Two notes on Petrov-Galerkin methods*, **Acta Sci. Nat. Univ. Nankai**, v33, no. 1, (2000), pp. 88-93.

Awards and Honors

- Ralph E. Powe Junior Faculty Enhancement Award, 2008, Oak Ridge Associated Universities (ORAU).
- Simon Ostrach Graduate Dissertation Fellowship, 2002-2003, Brown University.
- Guang Hua Fellowship for Excellent Graduate Students, 1997-1998, Nankai University.
- University Fellowship for Excellent Graduate Students, 1996-1997, Nankai University.
- Wang Kechang Fellowship for Excellent Undergraduate Students, 1993-1995, Nankai University.

- University Fellowship for Excellent Undergraduate Students, 1992-1993, Nankai University.
- Certificate of National Mathematical Contest in Modeling, 1995, Chinese Society for Industry and Applied Mathematics.

Current Research Interests

- Numerical Methods for PDEs on Structured and Unstructured Meshes.
 - Weighted ENO Finite Volume / Finite Difference Methods.
 - Discontinuous Galerkin (DG) Finite Element Methods.
 - Fast Sweeping Methods.
 - Implicit Integrating Factor and ETD schemes.
- Computational Biology.
 - Computational analysis of morphogen gradient formation in developmental biology.
 - Computational analysis of neurogenesis in a regenerative neuroepithelium.
- Computational Fluid Dynamics.
 - Interaction of shock waves with vortices.
 - Interaction of shock waves with Rayleigh-Taylor flow.

Academic Experience

- Assistant Professor, Department of Mathematics, University of Notre Dame, July 2006 – Present. Course teaching: Math 10260 *Elements of Calculus II-Business* (Fall 2006, Spring 2007); Math 60650 *Partial Differential Equations* (Spring 2007); Math 10350 *Calculus A* (Fall 2007); Math 20580 *Introduction to linear algebra and differential equations* (Fall 2008); Math 60690 *Numerical Analysis I* (Fall 2007, Fall 2008); Math 60790 *Numerical Analysis II (Numerical PDEs)* (Spring 2008).
- Assistant Adjunct Professor, Department of Mathematics, University of California, Irvine, July 2003 – June 2006. Courses taught: Math2A *differential Calculus* (Fall 2004, Fall 2003); Math2B *integral Calculus* (Winter 2005, Winter 2004, Fall 2005); Math2J *Linear Algebra and Infinite Series* (Spring 2004); Math7 *Basic Statistics* (Spring 2005, Winter 2006, Spring 2006).
- Research Assistant, Division of Applied Mathematics, Brown University, September 1999 – August 2000 and June 2001 – May 2003.
- Teaching Assistant: *Methods of Applied Mathematics I, II*, Division of Applied Mathematics, Brown University, September 2000 – May 2001.
- Teaching Assistant: *Advanced Mathematics*, School of Mathematical Science, Nankai University, P.R. China, September 1997 – January 1998.

Professional Societies

- Member of *Society for Industrial and Applied Mathematics (SIAM)*.

Other Professional Activities:

- Professional Referee, *Journal of Computational Physics*; *SIAM Journal on Numerical Analysis*; *Mathematics of Computation*; *SIAM Journal on Applied Mathematics*; *Journal of Scientific Computing*; *Journal of Computational and Applied Mathematics*; *BioEssays*; *Journal of Theoretical Biology*; *Methods and Applications of Analysis*; *Mathematical Biosciences and Engineering*; *Journal of Fluids Engineering*; *International Journal for Numerical Methods in Engineering*; *Mathematics and Computers in Simulation*; *International Journal for Numerical Methods in Fluids*; *Journal of Computational Mathematics*; *Discrete and Continuous Dynamical Systems- Series B*; *Indian Journal of Pure and Applied Mathematics*.

Conference Organized

- Mini-symposium on Modeling of Gene Regulatory Network and Cellular Signaling, Organizer; SIAM Conference on Life Sciences, August 4-7, 2008, Montreal, Quebec, Canada.
- Mini-symposium on Advances in Numerical Methods for PDEs and Their Applications, Organizer; 2008 SIAM Annual Meeting, July 7-11, 2008, San Diego, CA.

Invited Lectures and Conferences

- Invited Lectures
 - Invited Lecture, Workshop on Recent Developments in Numerical Methods for Nonlinear Hyperbolic Partial Differential Equations and their Applications, August 31 - September 5, 2008, Banff, Canada. Talk title: “Uniformly accurate Discontinuous Galerkin fast sweeping methods”.
 - Invited Lecture, Mini-symposium on Modeling of Gene Regulatory Network and Cellular Signaling, SIAM Conference on Life Sciences, August 4-7, 2008, Montreal, Quebec, Canada. Talk title: “Application of Discontinuous Galerkin methods for reaction-diffusion systems in developmental biology”.
 - Invited Lecture, Mini-symposium on Fast sweeping methods for Hamilton-Jacobi Equations, 2008 SIAM Annual Meeting, July 7-11, 2008, San Diego, CA. Talk title: “Discontinuous Galerkin fast sweeping methods”.
 - Invited Lecture, Special Session on Finite Element Methods and Applications, 2008 Spring AMS Central Section Meeting, Bloomington, IN, April 5-6, 2008. Talk title: “Discontinuous Galerkin fast sweeping methods”.
 - PDE, Complex Analysis and Differential Geometry Seminar, Department of Mathematics, University of Notre Dame, Notre Dame, IN, February 26, 2008. Talk title: “Discontinuous Galerkin fast sweeping methods”.
 - Invited Lecture, Workshop on Discontinuous Galerkin Methods for Partial Differential Equations, Banff, Canada, Nov 25-30, 2007. Talk title: ”Application of a discontinuous Galerkin finite element method to reaction-diffusion systems in developmental biology”.

- Invited Lecture, 2007 Midwest Conference on Systems Biology, East Lansing, Michigan, Oct 27-28, 2007. Talk title: "Computational analysis of BMP gradients in dorsal-ventral patterning of the zebrafish embryo".
- Invited Lecture, Mini-symposium on Finite Element Methods in Environmental Fluid Mechanics, 9th United States National Congress on Computational Mechanics (USNCCM-9), San Francisco, CA, July 22-26, 2007. Talk title: "Fast sweeping methods with a discontinuous Galerkin local solver for Eikonal equations".
- Invited Lecture, Mini-symposium on Discontinuous Galerkin methods for PDEs, 9th United States National Congress on Computational Mechanics (USNCCM-9), San Francisco, CA, July 22-26, 2007. Talk title: "An operator splitting discontinuous Galerkin method for stiff reaction-diffusion systems". (Cancelled)
- Invited Lecture, Workshop on Discontinuous Galerkin Method and its applications, Beijing, China, June 13-17, 2007. Talk title: "High order fast sweeping methods based on WENO and DG local solvers".
- Invited Lecture, Mini-symposium on High Order Discontinuous Galerkin Methods and Applications, International Conference On Spectral and High Order Methods, Beijing, China, June 18-22, 2007. Talk title: "An operator splitting Discontinuous Galerkin finite element method for stiff reaction-diffusion systems".
- Invited Lecture, Mini-symposium on High Order WENO Schemes and Applications, International Conference On Spectral and High Order Methods, Beijing, China, June 18-22, 2007. Talk title: "Third order WENO schemes on three dimensional tetrahedral meshes".
- Colloquium, Department of Mathematics, Nanjing University, Nanjing, Jiangsu, P.R. China, June 6, 2007. Talk title: "Computational Analysis of BMP Gradients in Dorsal-ventral Patterning of the Zebrafish Embryo".
- PDE, Complex Analysis and Differential Geometry Seminar, Department of Mathematics, University of Notre Dame, Notre Dame, IN, April 24, 2007. Talk title: "Weighted Essentially Non-Oscillatory schemes for Hyperbolic PDEs on unstructured meshes".
- Mathematical Sciences Colloquium, Department of Mathematical Sciences, Rensselaer Polytechnic Institute, Troy, NY, March 12, 2007. Talk title: "Computational Analysis of BMP Gradients in Dorsal-ventral Patterning of the Zebrafish Embryo".
- Invited Lecture, Numerical Methods for Degenerate Elliptic Equations and Applications, Banff, Canada, Dec 9-14, 2006.
- Invited Lecture, Mini-symposium on Fast Sweeping Methods for Hamilton-Jacobi Equations: Updates, Algorithms and Applications, SIAM Conference on Analysis of Partial Differential Equations, Boston, MA, July 9-12, 2006.
- Invited Lecture, Mini-symposium on Biomechanics of Tissues, 15th U.S. National Congress on Theoretical and Applied Mechanics, Boulder, CO, June 25-30, 2006.
- Special Colloquium, School of Computational Science, Florida State University, Tallahassee, FL, Feb 22, 2006.
- Special Colloquium, Department of Mathematics, the University of Tennessee, Knoxville, TN, Feb 17, 2006.
- Special Colloquium, Department of Mathematics, Oregon State University, Corvallis, OR, Feb 13, 2006.

- Special Colloquium, Department of Mathematics, University of Kentucky, Lexington, KY, Feb 10, 2006.
 - Special Colloquium, Department of Mathematics, University of Kansas, Lawrence, KS, Feb 7, 2006.
 - Special Colloquium, Department of Mathematics and Statistics, South Dakota State University, Brookings, SD, Jan 30, 2006.
 - Special Colloquium, Department of Mathematics, University of Notre Dame, Notre Dame, IN, Jan 25, 2006.
 - Special Colloquium, Department of Mathematics, Purdue University, West Lafayette, IN, Jan 23, 2006.
 - Special Colloquium, Department of Mathematics, Iowa State University, Ames, IA, Jan 19, 2006.
 - Special Colloquium, Department of Mathematical Sciences, University of Colorado at Denver and Health Sciences Center, Denver, CO, Jan 17, 2006.
 - Invited Lecture, Mini-symposium on Mathematical Biology, 12th International Conference of The Forum for Interdisciplinary Mathematics on Statistics, Combinatorics, Mathematics and Applications, Auburn University, Auburn, Alabama, December 2-4, 2005.
 - Applied Mathematics Seminar Talk, Department of Mathematics, The Ohio State University, Columbus, OH, March 31, 2005.
 - Invited Lecture, Mini-symposium on Quantitative Studies of Complex Systems in Cell and Developmental Biology, 2nd SIAM Conference on the Life Sciences, Portland, Oregon, July 11-14, 2004.
 - Invited Lecture, Mini-symposium on High Order Numerical Methods for Hamilton-Jacobi Equations and Applications, International Conference On Spectral and High Order Methods, Providence, RI, June 21-25, 2004.
 - Invited Lecture, Mini-symposium on Weighted Essentially Non-Oscillatory Method and Its Applications, International Conference On Spectral and High Order Methods, Providence, RI, June 21-25, 2004.
 - Invited Lecture, The Second Reunion Conference for IPAM's "Geometrically Based Motions" Program. UCLA Conference Center, Lake Arrowhead, California, December 7-12, 2003.
- Contributed Lectures/Posters
 - Poster session, Harvey Mudd College Mathematics Conference on Scientific Computing, Harvey Mudd College, Claremont, CA, November 5, 2005.
 - Poster session, Southern California Applied Mathematics Symposium and SIAM Southern California Section Meeting, University of Southern California, Los Angeles, CA, April 24, 2005.
 - Poster Session, First Young Researchers Workshop in Mathematical Biology, Mathematical Biosciences Institute, The Ohio State University, Columbus, OH, March 29 - April 1, 2005.
 - Contributed Lecture, Ninth International Conference on Hyperbolic Problems: Theory, Numerics, Applications. California Institute of Technology, Pasadena, CA. March 25-29, 2002.

- Participant
 - Fast Sweeping day. Rice University, Houston, TX, April 6, 2007.
 - Biology and Mechanics: Applications of Mathematics and Computations. University of California, Irvine, May 25-26, 2006.
 - International Conference on the Research Trend for PDE Modeling and Computation, In honor of David Gottlieb's 60th Birthday. Brown University, November 7-8, 2004.
 - Vanderbilt University Summer Conference on Mathematical Models in Signaling Systems, Nashville, Tennessee, June 16-18, 2004.
 - International Conference on Scientific Computing, Partial Differential Equations and Image Processing, On the Occasion of Stanley Osher's 60th birthday. UCLA, April 5-7, 2002.

Service

- Advisory Committee Member for Master's Thesis of Scott Christley, 2007.
- Member of the Ph.D. candidacy examination board for: Tatiana Kazakova (2006), Department of Mathematics.
- Member of the Ph.D. dissertation defense examination board for: Matthew L. Rissler (2008), Department of Mathematics.
- Outside Chairperson of the Ph.D. candidacy examination board for: Sergio Almaraz (2007), Department of Physics; Erin Hurley (2008), Department of Chemistry and Biochemistry.

Students Advising

- Melissa Davidson, Ph.D. student, 2008-Present. (with Prof. A. Himonas)
- Yuan Liu, Ph.D. student, 2007-Present. (with Prof. Mark Alber)
- Jianfeng Zhu, Ph.D. student, 2006-Present. (with Prof. Mark Alber)

Date: July 30, 2008.