

# CURRICULUM VITAE

*Todd James Arbogast*

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## Personal Data

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## Education

Ph.D. (Mathematics)	University of Chicago	1987
S.M. (Mathematics)	University of Chicago	1983
B.S. (Mathematics, with high distinction)	University of Minnesota	1981
B.S. (Physics, with high distinction)	University of Minnesota	1981

## Professional Experience

W.A. “Tex” Moncrief, Jr. Distinguished Professorship in Computational Engineering and Sciences — Applied Mathematics	University of Texas at Austin	2019–
W.A. “Tex” Moncrief, Jr. Simulation-Based Engineering and Sciences Professorship I	University of Texas at Austin	2014–2019
Professor	University of Texas at Austin	2001–
Associate Professor	University of Texas at Austin	1995–2001
Assistant & Associate Professor	Rice University	1993–1995
Faculty Fellow	Rice University	1992–1993
Visiting Assistant Professor	Rice University	1990–1992
NSF Postdoctoral Research Fellow	University of Houston	1989–1990
Assistant Professor	Purdue University	1988–1991
Research Assistant Professor	Purdue University	1987–1988
Visitor	Institute for Mathematics and its Applications, Univ. of Minnesota	1986–1987
Lecturer	University of Chicago	1983–1986

## Professional Service

Associate Editor, SIAM Journal on Numerical Analysis, 1999–2013  
Editorial Board, Advances in Applied Mathematics and Mechanics, 2014–2018  
Editorial Board, Advances in Water Resources, 2000–  
Editorial Board, Open Modeling and Computation for Flow and Transport Journal, 2012–2014  
Editorial Board, Results in Applied Mathematics (RINAM), 2018–  
Editorial board of Numerical Algorithms, 2021–

## Research Interests

Algorithm development and numerical analysis of partial differential equations  
Homogenization and multi-scale analysis  
Mathematical modeling and simulation of subsurface flow phenomena  
Eulerian-Lagrangian and WENO methods for transport problems  
High performance, parallel, scientific computing

## Professional Societies

American Mathematical Society  
Fellow, 2012–  
Society for Industrial and Applied Mathematics  
Activity Group on Geosciences Early Career Prize Committee, 2020–2021  
Fellow, 2018–  
Chair, Activity Group on Geosciences, 2013–2014  
Program Director, Activity Group on Geosciences, 2007–2008  
Faculty co-advisor of the University of Texas Student Chapter, 2006–  
Society of Petroleum Engineers  
The International Society for Porous Media (InterPore)  
InterPore Rosette award 2014

## Research Centers and Institutes

Department of Statistics and Data Sciences, associated faculty,	2007–
Institute for Computational Engineering & Sciences (ICES)	
Core faculty	2003–
Advisory Board	2009–
Texas Institute for Computational and Applied Mathematics (TICAM)	1995–2003
Center for Subsurface Modeling, TICAM/ICES	1995–
Associate Director	2008–
Center for Numerical Analysis, TICAM/ICES	1997–
Center for Research on Parallel Computation, Rice Univ., Technical Steering Committee	1997–1999

## Honors and Awards

Fellow of the Society for Industrial and Applied Mathematics, 2018  
Simons Visiting Professorship, Mathematisches Forschungsinstitut Oberwolfach, 2014  
Fellow of the American Mathematical Society, 2012  
Moncrief Grand Challenge Faculty Award, 2012 (The University of Texas at Austin)  
ICES Distinguished Research Award, 2011 (The University of Texas at Austin)  
Frank Gerth III Faculty Fellowship, 2008–2017 (The University of Texas at Austin)  
The President's Associates Centennial Teaching Fellowship in Mathematics, 1997–1998 (The University of Texas at Austin)  
National Science Foundation Mathematical Sciences Postdoctoral Research Fellowship, 1989–1992 (University of Houston and Rice University)  
Robert R. McCormick Fellowship, 1981–1984 (University of Chicago)  
Sigma Pi Sigma (physics) and Tau Beta Pi (engineering) honor societies  
Century Fund Scholarship, 1976–1977 (University of Minnesota)

## Invited Presentations since 2012

1. A Self-Adaptive Theta Method for Conservation Laws using Discontinuity Aware Quadrature, 3rd Annual Meeting of the SIAM Texas-Louisiana Section, hosted virtually by Texas A&M University, October 16–18, 2020.
2. “Implicit finite volume approximation of nonlinear advection-diffusion equations,” The Babuška Forum, Oden Institute, University of Texas at Austin, May 29, 2020.
3. “Finite volume WENO schemes for nonlinear parabolic problems with degenerate diffusion on non-uniform meshes,” SIAM Conference on Analysis of Partial Differential Equations, La Quinta, California, December 11–14, 2019.
4. “Approximation of advection-diffusion equations using implicit WENO methods,” King Abdullah University of Science and Technology, Thuwal, Saudi Arabia, November, 2019.
5. “Approximation of advection-diffusion equations using implicit WENO methods,” Conference on Computational Mathematics and Applications (CCMA), University of Nevada, Las Vegas, October 25–27, 2019.
6. Plenary lecture: “Approximation of Advection-Diffusion Equations using Implicit WENO Methods,” Workshop on Scientific Computing meets Machine Learning and Life Sciences, Texas Tech University, Lubbock, Texas, October 7–9, 2019.
7. “Implicit WENO Schemes for Two-Phase Flow in Porous Media,” 15th U.S. National Congress on Computational Mechanics (USNCCM) of the USACM, Austin, Texas, July 18–August 1, 2019.
8. “Mixed finite element methods for second order elliptic problems,” Numerical PDE’s Day, National Sun Yat-Sen University, Kaohsiung, Taiwan (ROC), June 20, 2019.
9. Minisymposium lecture: “Direct Serendipity and Mixed Finite Elements on Quadrilaterals for Flow and Transport in Porous Media,” SIAM Conference on Mathematical & Computational Issues in the Geosciences (GS19), Houston, Texas, Mar. 11–14, 2019.
10. Plenary lecture: “Mixed Methods for Two-Phase Darcy-Stokes Mixtures of Partially Melted Materials with Regions of Zero Porosity,” The 1st Annual Meeting of the SIAM Texas-Louisiana Section, Louisiana State University, Baton Rouge, LA, Oct. 5–7, 2018.
11. “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” Workshop on Reactive Flows in Deformable, Complex Media, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany, Aug. 27–31, 2018.
12. Minisymposium lecture: “A linearly stable, implicit WENO scheme applied to two-phase flow in porous media,” The tenth Annual Meeting and Jubilee of the Int’l. Society for Porous Media (InterPore), New Orleans, LA, May 14–17, 2018.
13. Applied Math Colloquium: “Mixed finite element methods for second order elliptic problems,” University of Arizona, Tucson, Arizona, November 17, 2017.
14. Poster: “H(div) Mixed Finite Elements of Minimal Dimension on Quadrilaterals and Hexahedra,” SIAM Conference on Mathematical and Computational Issues in the Geosciences, Erlangen, Germany, September 11–14, 2017.
15. Minisymposium lecture: “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” SIAM Conference on Mathematical and Computational Issues in the Geosciences, Erlangen, Germany, September 11–14, 2017.
16. Plenary lecture: “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” Current trends and challenges in numerical PDEs, Purdue University, July 7–8, 2017.
17. Poster: “H(div) Mixed Finite Elements of Minimal Dimension on Quadrilaterals and Cuboidal Hexahedra,” Institute for Mathematics and its Applications, Univ. of Minn., workshop on

- Recent Advances and Challenges in Discontinuous Galerkin Methods and Related Approaches*, June 29–July 1, 2017.
18. “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” National Sun Yat-Sen University, Kaohsiung, Taiwan (ROC), June 2017.
  19. Poster: “H(div) Mixed Finite Elements of Minimal Dimension on Quadrilaterals and Hexahedra,” Advances in Computational Sciences and Engineering: A conference in honor of the 80th birthday of Prof. J. Tinsley Oden, USACM, Austin, TX, March 20–21, 2017
  20. “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” Laboratório Nacional de Computação Científica (LNCC), Petropolis, Brazil, March 13, 2017.
  21. Poster: “H(div) Mixed Finite Elements of Minimal Dimension on Quadrilaterals and Hexahedra,” SIAM Conference on Computational Science and Engineering, Atlanta, Georgia, Feb. 27–Mar. 3, 2017.
  22. Minisymposium lecture: “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” SIAM Conference on Computational Science and Engineering, Atlanta, Georgia, Feb. 27–Mar. 3, 2017.
  23. “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” Department of Mathematics, University of Minnesota, Oct. 28, 2016.
  24. Minisymposium lecture: “Some new approaches to simulating two-phase flow in porous media on hexahedral meshes,” The 11th AIMS Conference on Dynamical Systems, Differential Equations and Applications, The American Institute of Mathematical Sciences, Orlando, Florida, July 1–5, 2016.
  25. “New mixed finite elements of minimal dimension on quadrilaterals,” University of Bergen, Bergen, Norway, June 22, 2016.
  26. Minisymposium lecture: “New mixed finite elements on quadrilaterals of minimal dimension,” The Mathematics of Finite Elements and Applications (MAFELAP) 2016, Brunel University, London, England, June 14–17, 2016.
  27. Plenary lecture: “Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity,” Program on Melt in the Mantle, From the Continuum to the Tectonic: the Magma/Mantle Dynamics of Planet Earth, Isaac Newton Institute for Mathematical Sciences, Cambridge, England, June 6–10, 2016, organized by T. Arbogast, A. Deuss, R. Katz, J. Neufeld, J. Rudge (Chair) and Y. Takei.
  28. Minisymposium lecture: “Some new approaches to simulating two-phase flow in porous media on hexahedral meshes,” The eighth International Conference on Porous Media and the Annual meeting of the International Society for Porous Media (InterPore), Cincinnati, Ohio, May 9–12, 2016.
  29. “Approximation of a degenerate elliptic equation arising from a two-phase mixture modeling the Earth’s mantle,” Department of Mathematics, University of Wyoming, November 13, 2015.
  30. “Approximation of a degenerate elliptic equation arising from a two-phase mixture modeling the Earth’s mantle,” Conference on Numerical and Multiscale Issues for Partial and Integral Differential Equations, Department of Mathematics and Institute for Computational Engineering and Sciences, University of Texas at Austin, October 14–17, 2015.
  31. “High-order Eulerian-Lagrangian WENO schemes for nonlinear advection,” The Third International Conference on High Performance Computing and Applications (HPCA 2015), Shanghai, China, July 26–30, 2015.

32. “Approximation of a degenerate elliptic equation arising from a two-phase mixture modeling the motion of the Earth’s mantle,” National Chung Hsing University, Taichung, Taiwan (ROC), July, 2015.
33. “Two families of  $H(\text{div})$  mixed finite elements on quadrilaterals of minimal dimension,” National Sun Yat-Sen University, Kaohsiung, Taiwan (ROC), July 2015.
34. “ $H(\text{div})$  mixed finite elements on quadrilaterals of minimal dimension,” SIAM Conference on Mathematical and Computational Issues in the Geosciences, Stanford University, Palo Alto, CA, June 29–July 2, 2015.
35. “Approximation of a degenerate elliptic equation arising from a two-phase mixture modeling the motion of the Earth’s mantle,” Advanced Numerical Methods in the Mathematical Sciences, Texas A&M University, College Station, TX, May 4–7, 2015.
36. “Approximation of a degenerate elliptic equation arising from a two-phase mixture modeling the motion of the Earth’s mantle,” MAA Invited Paper Session on the Mathematics of Planet Earth, Joint Mathematics Meetings, San Antonio, TX, Jan. 11, 2015.
37. “Approximation of transport using Eulerian-Lagrangian techniques,” King Abdullah University of Science and Technology, Thuwal, Saudi Arabia, January 5, 2015.
38. “Multiscale mixed methods for heterogeneous elliptic problems,” Eindhoven University of Technology, Eindhoven, Netherlands, Oct. 8, 2014
39. “Approximation of a linear degenerate elliptic equation arising from a two-phase mixture,” University of Bergen, Bergen, Norway, Oct. 3, 2014.
40. “Approximation of transport using Eulerian-Lagrangian techniques,” Workshop on Reactive Flows in Deformable, Complex Media, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany, Sept. 21–27, 2014.
41. “Approximation of a linear degenerate elliptic equation arising from a two-phase mixture,” Inria, Paris-Rocquencourt, France, Sept. 17, 2014.
42. “Approximation of a Linear Degenerate Elliptic Equation Arising from A Two-Phase Mixture,” National Sun Yat-Sen University, Kaohsiung, Taiwan (ROC), August, 2014.
43. “Aspects of discontinuous multiscale flow approximations on transport and a two-level mortar preconditioner,” National Sun Yat-Sen University, Kaohsiung, Taiwan (ROC), August, 2014.
44. “Approximation of a linear degenerate elliptic equation arising from a two-phase mixture,” International Workshop on Computational Mathematics — Advances in Computational PDEs ICM 2014, Satellite Conference: 2014 NIMS Hot Topics Workshop, Yonsei University, Seoul, Korea, August 9–12, 2014.
45. “Aspects of discontinuous multiscale flow approximations on transport and a two-level mortar preconditioner,” Workshop on Computational Multiscale Methods, Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach, Germany, June 22–28, 2014.
46. “An Eulerian-Lagrangian WENO scheme for two-phase flow in porous media,” The sixth International Conference on Porous Media and the Annual meeting of the International Society for Porous Media (InterPore), Milwaukee, Wisconsin, May 27–30, 2014.
47. “Approximation of advection using Eulerian-Lagrangian techniques,” Baylor University, Waco, Texas, April 14, 2014.
48. “Approximation of advection using Eulerian-Lagrangian techniques,” Southern Methodist University, Dallas, Texas, March 6, 2014.
49. “Mixed mortar methods for flow in heterogeneous porous media,” National Sun Yat-Sen University, Kaohsiung, Taiwan (ROC), August 15, 2013.
50. “Approximation of transport processes using Eulerian-Lagrangian techniques,” National Sun Yat-Sen University, Kaohsiung, Taiwan (ROC), August 8, 2013.
51. Plenary: “Approximation of transport processes using Eulerian-Lagrangian techniques,” SIAM

- Conference on Mathematical and Computational Issues in the Geosciences, Padova, Italy, June 17–20, 2013.
52. “Mixed mortar methods for flow in heterogeneous porous media,” SIAM Conference on Mathematical and Computational Issues in the Geosciences, Padova, Italy, June 17–20, 2013.
  53. “Homogenization-based mortar mixed methods for heterogeneous elliptic problems,” ICES Thematic Workshop on Multiscale Modeling, The University of Texas at Austin, April 29–May 1, 2013.
  54. “An Eulerian-Lagrangian WENO finite volume scheme for linear transport,” South Central Conference on Advanced Numerical Methods and Applications, Little Rock, Arkansas, April 5–7, 2013.
  55. “A locally conservative Eulerian-Lagrangian method for a two-phase flow problem,” SIAM Conference on Computational Science and Engineering, Boston, MA, February 25–March 1, 2013.
  56. “Mortar methods for flow in heterogeneous porous media,” SIAM Conference on Computational Science and Engineering, Boston, MA, February 25–March 1, 2013.
  57. “Eulerian-Lagrangian finite volume schemes for linear advection problems,” University of Texas, Austin, Texas, September 7, 2012.
  58. “Eulerian-Lagrangian finite volume schemes for linear advection problems,” University of Illinois at Chicago, Chicago, Illinois, August 13, 2012.
  59. “Homogenization-based mortar methods for porous media,” SIAM Annual Meeting, Minneapolis, Minnesota, July 9–13, 2012.
  60. “An Eulerian-Lagrangian WENO Finite Volume Scheme for Advection Problems,” The 4th International Conference on Porous Media and the Annual meeting of the International Society for Porous Media (InterPore), Purdue University, West Layayette, Indiana, May 14–16, 2012.
  61. Semi-plenary: “Multiscale mixed methods for heterogeneous elliptic problems,” The Eighth International Conference on Scientific Computing and Applications, University of Nevada, Las Vegas, April 1–4, 2012.
  62. “A Multiscale Mortar Mixed Space Based on Homogenization for Heterogeneous Elliptic Problems,” Colloquium: Advances in Computational Science, Engineering, and Mathematics, University of Texas, Austin, Texas, Jan. 19–20, 2012.

### Conference and Seminar Organization

1. Minisymposium organizer (with S. Sun and I. Yotov), “Advances in Computational Methods for Subsurface Modeling: In Honor of Professor Mary F. Wheeler,” 15th National Congress on Computational Mechanics (USNCCM), Austin, Texas, July 28–Aug. 1, 2019.
2. Minisymposium organizer (with S. Sun, H. Chen and I. Yotov), “Development in efficient and compatible algorithms for porous media phenomena,” The Mathematics of Finite Elements and Applications 2019 (MAFELAP 2019), Brunel University, London, England, June 18–21, 2019.
3. Minisymposium organizer, “High Order Schemes for Simulation of Flow and Transport in Porous Media,” SIAM Conference on Mathematical & Computational Issues in the Geosciences (GS19), Houston, Texas, Mar. 11–14, 2019.
4. Organizing committee, Finite Element Rodeo, University of Texas at Austin, Austin, Texas, Mar. 1–2, 2019.
5. Session organizer, “High order schemes for simulation of flow and transport in porous media,” The tenth Annual Meeting and Jubilee of the Int’l. Society for Porous Media (InterPore), New

- Orleans, LA, May 14–17, 2018.
6. Organizing committee, Texas Applied Mathematics and Engineering Symposium (TAMES), University of Texas at Austin Chapter of SIAM, Austin, Texas, September 21–23, 2017.
  7. Minisymposium co-organizer (with M. Hesse), “Modeling and Simulation of Melt in the Mantle,” SIAM Conference on Mathematical and Computational Issues in the Geosciences, Erlangen, Germany, September 11–14, 2017.
  8. Minisymposium co-organizer (with M. Peszynska and S.-Y. Yi), “Recent Advances in Numerical Flow and Transport in Porous Media: A Mini Symposium in Honor of the Late Jim Douglas, Jr.,” SIAM Conference on Mathematical and Computational Issues in the Geosciences, Erlangen, Germany, September 11–14, 2017.
  9. Minisymposium co-organizer (with I. Yotov), “Developments in locally conservative conforming methods for elliptic partial differential equations,” The Mathematics of Finite Elements and Applications (MAFELAP) 2016, Brunel University, London, England, June 14–17, 2016.
  10. Research program co-organizer, “Melt in the Mantle,” Isaac Newton Institute for Mathematical Sciences, Cambridge, United Kingdom, February 15–June 17, 2016 with Arwen Deuss (Utrecht University), Richard Katz (Oxford), Jerome Neufeld (Cambridge), John Rudge (Chair, Cambridge) and Yasuko Takei (Tokyo).
  11. Session co-organizer (with Shuyu Sun), “Physics-Preserving Numerical Methods for Subsurface Geochemical Transport Processes,” The sixth Int’l. Conf. on Porous Media and Annual Meeting of the Int’l. Society for Porous Media (InterPore), Milwaukee, WI, May 27–30, 2014.
  12. Organizing Committee, “ICES Thematic Workshop on Multiscale Modeling,” The University of Texas at Austin, April 29–May 1, 2013.
  13. Program Committee, “Flow and Transport: Modeling, Simulations and Algorithms,” An International Workshop in conjunction with the International Conference on Computational Science, June 4–6, 2012, Omaha, Nebraska.
  14. Program Committee and Scientific Committee, the 4th International Conference on Porous Media and the Annual meeting of the International Society for Porous Media (InterPore 2012), Purdue Univ., West Lafayette, IN, May 14–16, 2012.
  15. Program Committee, “Flow and Transport: Computational Challenges,” An International Workshop in conjunction with the International Conference on Computational Science, June 1–3, 2011, Tsukuba, Japan.
  16. Scientific Committee, “InterPore 2011 Conference and Annual Meeting,” The 3rd International Conference on Porous Media and the Annual meeting of the International Society for Porous Media (InterPore), Bordeaux, France, March 15–17, 2011.
  17. Organizer and Speaker, “The Role of Computation in Protecting the Environment: A Workshop on Carbon Sequestration Simulation for High School Mathematics and Science Teachers,” Center for Subsurface Modeling of the Institute for Computational Engineering and Sciences, the Bureau of Economic Geology, and the Texas Advanced Computing Center, The University of Texas at Austin, June 15–16, 2010, sponsored by the National Science Foundation and the Department of Energy.
  18. Scientific Committee, “InterPore 2010 Conference and Annual Meeting,” Texas A&M University, College Station, Texas, March 14–17, 2010.
  19. Organizing Committee Chair, “SIAM Conference on Mathematical and Computational Issues in the Geosciences,” Leipziger Kubus Conference Center, Helmholtz Center for Environmental Research (UFZ), Leipzig, Germany, June 15–18, 2009.
  20. Organizing Committee, “Computational Subsurface Sciences Workshop,” Department of Energy, Offices of Science, Environmental Management, Fossil Energy, and Civilian Radioactive Waste Management, North Bethesda, Maryland, January 9–12, 2007.

21. Organizing Committee, “Summer School in Geophysical Porous Media: Multidisciplinary Science from Nano- to Global-Scale,” Purdue Univ., West Lafayette, IN, July 17–28, 2006.
22. SIAM Minisymposium organizer, “Numerical Solution of Partial Differential Equations and Applications to Flow in Porous Media,” Joint Mathematics Meetings, San Antonio, TX, Jan. 12, 2006.

## Post-doctoral and Student Supervision

### *Program supervision*

1. Undergraduate advisor for Mathematical Sciences degree option in Scientific Computation, 2000–
2. Computational and Applied Mathematics (CAM) GSSC, 1995–2009 (Chair 1997–2009)
3. Computational Science, Engineering, & Mathematics (CSEM) GSSC, 2009– (Chair 2009– )
4. Chair, Undergraduate Certificate Program in Computational Science and Engineering, 2009–
5. Faculty co-advisor of the Society for Industrial and Applied Mathematics UT-Austin student chapter, 2005–

### *Undergraduate supervision*

1. Binglin Zhang, Honors Tutorial Course, Spring 2021.
2. Emily Nguyen, *Richard’s equation in one dimension with hysteresis*, Fall 2018.
3. Roxana Carcamo, *Numerical methods in queueing theory*, independent study, August 2018.
4. Krzysztof A. Drewniak, *gemm3: Constant-workspace high-performance multiplication of three matrices for matrix chaining*, Turing Scholars Degree, April 2018 (Advisor Robert van de Geijn).
5. James Levitt, *Adding aggressive early deflation to the restructured symmetric QR algorithm*, Dean’s Scholars Honors Degree, May 2013 (Advisors Robert van de Geijn and Alan Cline).
6. Kevin Eric Jia, *Improving Data Locality of the Nonsymmetric QR Algorithm*, Undergraduate Honors Thesis, December 2013 (Advisors Robert van de Geijn and Todd Arbogast).
7. Michael S. Lubke, *Studies on Subgrid Upscaling*, Fall 2005.
8. Armando Lara, *Spend a Summer with a Scientist* program, Rice University, 1995.
9. Griselda Mani, *Spend a Summer with a Scientist* program, Rice University, 1994.

### *Masters (M.A.) degrees supervised*

1. Xingyao Wang, *Krylov Methods For Solving Linear Systems* (report), Computational Science, Engineering, and Mathematics, M.S. May 2017.
2. Prabhat K. Jha, *Basic Iterative Methods for Solving Linear Systems*, Department of Mathematics, M.A. December 2003.
3. Eunkyoun Yoon, *Homogenization*, Department of Mathematics, M.A. August 2001.

### *Ph.D. degrees supervised*

1. Chuning Wang, Department of Mathematics, current student.
2. Danielle King, Department of Mathematics, current student.
3. Chenyu Tian, Computational Science, Engineering, and Mathematics, current student.
4. Xikai Zhao, *Implicit Finite Volume WENO Schemes for Solving Hyperbolic Conservation Laws*, Department of Mathematics, Ph.D. May 6, 2019.
5. Zhen (Jane) Tao, *Numerical Analysis of Multiphase flows in Porous Media on Non-Rectangular Geometry*, Computational Science, Engineering, and Mathematics, Ph.D. Dec. 1, 2017.



6. Thiago de Oliveira Quinelato, *Mixed Hybrid Finite Element Methods in Elasticity and Poroe-lasticity*, Graduate Program in Computational Modeling, National Laboratory for Scientific Computing (LNCC), Rio de Janeiro, Brazil (co-advisors: Abimael F. D. Loula and Maicon R. Correa), Ph.D. March 2017.
7. Jamie Pool, *A Quadrature Eulerian-Lagrangian WENO Scheme for Reservoir Simulation*, Department of Mathematics, Ph.D. August 11, 2015.
8. Abraham L. Taicher, *Mixed framework for Darcy-Stokes mixtures*, Computational Science, Engineering, and Mathematics, Ph.D. Dec. 1, 2014 (co-advisor Marc A. Hesse).
9. Hailong Xiao, *Multiscale mortar mixed finite element methods for flow problems in highly heterogeneous porous media*, Computational and Applied Mathematics, Ph.D. Dec. 2, 2013.
10. Wenhao Wang, *An algorithm of the volume corrected characteristics mixed method for trans-  
port problems*, Computational and Applied Mathematics, Ph.D. December 2, 2009.
11. Mario San Martin Gomez, *A three dimensional finite element method and multigrid solver for  
a Darcy-Stokes system and applications to vuggy porous media*, Department of Mathematics,  
Ph.D. April 20, 2007.
12. James M. Rath, *Multiscale basis optimization for Darcy flow*, Computational and Applied  
Mathematics, Ph.D. April 13, 2007.
13. Dana S. Brunson, *Simulating fluid flow in vuggy porous media*, Department of Mathematics,  
Ph.D. August 1, 2005.
14. Heather L. Lehr (now Finotti), *Analysis of a Darcy-Stokes system modeling flow through  
vuggy porous media*, Department of Mathematics, Ph.D. August 2004.
15. Juan-Ming Yuan, *Studies in recurrence and singularity formation in nonlinear dispersive wave  
equations*, Dept. of Mathematics, Ph.D. Dec. 2001 (primary advisor: Jerry L. Bona).

#### Post-doctoral Researcher Supervision

1. Zhen Tao, February–October 2018.
2. Wenhao Wang, January 2010–May 2010.
3. James M. Rath, April 2007–August 2008.

#### Research Grant Support

1. NSF DMS-1912735, \$250,000 (OSP 201803826-001) 1 Sept. 2019 to 31 Aug. 2022, *Implicit  
weighted essentially non oscillatory (iWENO) Schemes for Advection-Diffusion-Reaction Sys-  
tems*.
2. NSF DMS-1720349, \$250,000 (OSP 201603899-001) 15 Aug. 2017 to 31 July 2021, with M.  
Hesse (coPI), *Simulation of Multiphase Flow and Transport in the Partially Molten Mantle*.
3. Center for Subsurface Modeling Industrial Affiliates Program, Univ. of Texas at Austin,  
Directed by Mary F. Wheeler. Currently supported by 4 major petroleum and computer  
companies, \$40,000 (each, renewable annually), 1995–2016.
4. NSF DMS-1418752, \$365,000 (OSP 201303650-001) 1 July 2014 to 30 June 2017 (extended  
to 6 June 2018) *Numerical algorithms for nonlinear subsurface flow and transport*.
5. KAUST UT-Austin Academic Excellence Alliance Program, \$3,001,332 (OSP 200702891)  
1 Sept. 2011 to 31 Aug. 2015, with S. Sun (PI) and I. Hoteit at KAUST and M. F. Wheeler  
(PI), M. Delshad, and M. Hesse at UT-Austin, *Simulation of Subsurface Geochemical Trans-  
port and Carbon Sequestration*.
6. NSF EAR-1025321, \$349,832 (OSP 201000240-001) 1 Sept. 2010 to 31 Aug. 2013 (extended  
to 2014), with M. Hesse (PI), *CMG Research: Robust Numerical Methods for Multi-Phase  
Darcy-Stokes Flow in Heterogeneous and Anisotropic Partially Molten Materials*.

7. Dept. of Energy DE-SC0001114, \$15.1 million, *Center for Frontiers of Subsurface Energy Security* (OSP 200802179-001), 1 Sept. 2009 to 31 Aug. 2014. Director G. A. Pope and S. L. Bryant, Associate Directors M. F. Wheeler and M. Walck (Sandia National Laboratory), and Team Leaders P. Bennett, S. Srinivasan, M. Hesse, M. Delshad, J. Bishop, and T. Arbogast.
8. KAUST UT-Austin Academic Excellence Alliance Program, \$431,253, 1 Sept. 2008 to 31 Aug. 2009, with M. F. Wheeler (PI) and M. Delshad *Computational Models for Evaluating Long Term CO<sub>2</sub> Storage in Saline Aquifers*.
9. NSF DMS-0835745, \$1,332,000 1 Oct. 2008 to 30 Sept. 2012 (extended to 28 Feb. 2014), with M. F. Wheeler (PI) and M. Delshad *CDI-Type II: Collaborative Research: Computational Models for Evaluating Long Term CO<sub>2</sub> Storage in Saline Aquifers*, in collaboration with Manish Parashar, Rutgers University, \$668,000.
10. NSF DMS-0713815 (OSP 200602754), \$258,529 1 Sept. 2007 to 31 Aug. 2010 (extended to 2011), *Fully locally conservative characteristic methods for transport problems*.
11. NSF DMS-0417431 (OSP 200400101), \$676,572 1 Sept. 2004 to 31 Aug. 2007 (extended to 2008), with S. L. Bryant, J. Jennings (replaced by C. Zahm), and C. Kerans, *CMG Research: Multi-scale flow and transport modeling of large-vug Cretaceous carbonates*.
12. NSF DMS-0408489 (OSP 200302296), \$244,001, 1 Sept. 2004 to 31 Aug. 2007 (extended to 2008), *Development and application of subgrid upscaling*.
13. NSF DMS-0215389, \$80,644, 1 Sept. 2002 to 31 Aug. 2003, with M. F. Wheeler, S. L. Bryant, C. N. Dawson, and M. Peszynska, *A parallel computer cluster for multiphysics and multiscale modeling of subsurface and surface flows*.
14. NSF DMS-0074310 (OSP 199902591), \$240,000, 1 Sept. 2000 to 31 Dec. 2003, with S. L. Bryant, *Modeling Flow in Porous Media with Vugular Meso-Scale Heterogeneities*.
15. NSF DMS-9873326, \$1,700,000, 1 Oct. 1998 to 30 Sept. 2001, with M. F. Wheeler, C. L. Bajaj, S. L. Bryant, C. N. Dawson, *KDI: Multiscale Physics-Based Simulation of Fluid Flow for Energy and Environmental Applications*.
16. NSF DMS-9707015, \$75,000, 1 Aug. 1997 to 31 July 2000, *A posteriori error estimation and up-scaling for mixed finite element methods* (OSP Number: P004899700).
17. Department of Energy, Advanced Computing Technology Initiative (ACTI), \$1,157,000, 1995–97, with C. Dawson, L. Lake, D. McKinney, G. Pope, K. Sepehrnoori, and M. Wheeler, and with Argonne National Laboratory (W. Gropp, T. Morgan, and B. Smith), *Research in New Generation Framework for Petroleum Reservoir Simulation*.
18. Participant: Department of Energy, \$826,193, 1995–1997 (P.I.: M. F. Wheeler), Partnership in Computational Science, *Grand Challenge Problems in Environmental Modeling and Remediation: Groundwater Contaminant Transport*.
19. Participant: Department of Energy, DE FG05-92ER25142, 1992–1996 (P.I.: M. F. Wheeler), *Parallel Algorithms for Modeling Flow in Permeable Media*.
20. Participant: Department of Energy through Oak Ridge National Laboratory, Martin Marietta 19X-SK963C, 1992–1995 (P.I.: M. F. Wheeler), *Partnership in Computational Science: Groundwater Modeling*.
21. NSF DMS-8905505, \$75,000, 1989–92, NSF Mathematical Sciences Postdoctoral Research Fellowship, *Simulation of Flow in Naturally Fractured Porous Media*.
22. NSF DMS-8903211, 1989–92, with J. Douglas, Jr., *Mathematical Sciences: Numerical Analysis and Simulation of Reservoir Flows and Waves in Porous Media*.

## Publications

- [1] Todd Arbogast and Chieh-Sen Huang. A self-adaptive theta scheme using discontinuity aware quadrature for solving conservation laws. *In preparation*, 2020.
- [2] T. Arbogast, Zhen Tao, and Chuning Wang. Direct serendipity and mixed finite elements on convex quadrilaterals. *Submitted to Numerische Mathematik*, 2020.

Articles in Journals and Other Refereed Works

- [1] T. Arbogast, Chieh-Sen Huang, Xikai Zhao, and Danielle N. King. A third order, implicit, finite volume, adaptive Runge-Kutta WENO scheme for advection-diffusion equations. *Comput. Methods Appl. Mech. Engrg.*, 368, 2020. DOI <https://doi.org/10.1016/j.cma.2020.113155>.
- [2] T. Arbogast, Ch.-S. Huang, and Xikai Zhao. Finite volume WENO schemes for nonlinear parabolic problems with degenerate diffusion on non-uniform meshes. *J. Comput. Phys.*, 399, 2019, available online. DOI 10.1016/j.jcp.2019.108921.
- [3] T. Arbogast and Zhen Tao. A direct mixed-enriched Galerkin method on quadrilaterals for two-phase Darcy flow. *Computational Geosci.*, 23(5):1141–1160, 2019. DOI 10.1007/s10596-019-09871-2.
- [4] Shinhoo Kang, T. Bui-Thanh, and T. Arbogast. A hybridized discontinuous Galerkin method for a linear degenerate elliptic equation arising from two-phase mixtures. *Comput. Methods Appl. Mech. Engrg.*, 350:315–336, 2019. DOI 10.1016/j.cma.2019.03.018.
- [5] T. O. Quinelato, A. F. D. Loula, M. R. Correa, and T. Arbogast. Full H(div)-approximation of linear elasticity on quadrilateral meshes based on ABF finite elements. *Comput. Methods Appl. Mech. Engrg.*, 347:120–142, 2019. DOI 10.1016/j.cma.2018.12.013.
- [6] T. Arbogast and Zhen Tao. Construction of H(div)-conforming mixed finite elements on cuboidal hexahedra. *Numer. Math.*, 142(1):1–32, 2019. DOI 10.1007/s00211-018-0998-7.
- [7] Ch.-S. Huang and T. Arbogast. An implicit Eulerian-Lagrangian WENO3 scheme for nonlinear conservation laws. *J. Sci. Computing*, 77(2):1084–1114, 2018. DOI 10.1007/s10915-018-0738-2.
- [8] T. Arbogast, Ch.-S. Huang, and Xikai Zhao. Accuracy of WENO and adaptive order WENO reconstructions for solving conservation laws. *SIAM J. Numer. Anal.*, 56(3):1818–1847, 2018. DOI 10.1137/17M1154758.
- [9] T. Arbogast and A. L. Taicher. A cell-centered finite difference method for a degenerate elliptic equation arising from two-phase mixtures. *Comput. Geosci.*, 21(4):701–712, 2017. DOI 10.1007/s10596-017-9649-9.
- [10] T. Arbogast, M. A. Hesse, and A. L. Taicher. Mixed methods for two-phase Darcy-Stokes mixtures of partially melted materials with regions of zero porosity. *SIAM J. Sci. Comput.*, 39(2):B375–B402, 2017. DOI 10.1137/16M1091095.
- [11] Ch.-S. Huang and T. Arbogast. An Eulerian-Lagrangian WENO scheme for nonlinear conservation laws. *Numer. Meth. Partial Diff. Eqns.*, 33(3):651–680, 2017. DOI 10.1002/num.22091.
- [12] T. Arbogast and M. R. Correa. Two families of H(div) mixed finite elements on quadrilaterals of minimal dimension. *SIAM J. Numer. Anal.*, 54(6):3332–3356, 2016. DOI 10.1137/15M1013705.
- [13] T. Arbogast and A. L. Taicher. A linear degenerate elliptic equation arising from two-phase mixtures. *SIAM J. Numer. Anal.*, 54(5):3105–3122, 2016. DOI 10.1137/16M1067846.
- [14] Ch.-S. Huang, T. Arbogast, and Ch.-H. Hung. A semi-Lagrangian finite difference WENO scheme for scalar nonlinear conservation laws. *J. Comput. Phys.*, 322:559–585, 2016. DOI 10.1016/j.jcp.2016.06.027.
- [15] T. Arbogast, D. Estep, B. Sheehan, and S. Tavener. A posteriori error estimates for mixed finite element and finite volume methods for parabolic problems coupled through a boundary. *SIAM/ASA J. Uncertainty Quantification*, 3:169–198, 2015. DOI 10.1137/140964059.

- [16] T. Arbogast and Hailong Xiao. Two-level mortar domain decomposition preconditioners for heterogeneous elliptic problems. *Comput. Methods Appl. Mech. Engrg.*, 292:221–242, 2015. DOI 10.1016/j.cma.2014.10.049.
- [17] Ch.-S. Huang, F. Xiao, and T. Arbogast. Fifth order multi-moment WENO schemes for hyperbolic conservation laws. *J. Sci. Comput.*, 64(2):477–507, 2015. DOI 10.1007/s10915-014-9940-z.
- [18] Ch.-S. Huang, T. Arbogast, and Ch.-H. Hung. A re-averaged WENO reconstruction and a third order CWENO scheme for hyperbolic conservation laws. *J. Comput. Phys.*, 262:291–312, 2014.
- [19] T. Arbogast, D. Estep, B. Sheehan, and S. Tavener. A posteriori error estimates for mixed finite element and finite volume methods for problems coupled through a boundary with non-matching grids. *IMA J. Numer. Anal.*, 34:1625–1653, 2014. DOI 10.1093/imanum/drt049.
- [20] T. Arbogast, M. Juntunen, J. Pool, and M. F. Wheeler. A discontinuous Galerkin method for two-phase flow in a porous medium enforcing  $H(\text{div})$  velocity and continuous capillary pressure. *Comput. Geosci.*, 17(6):1055–1078, 2013.
- [21] T. Arbogast and Hailong Xiao. A multiscale mortar mixed space based on homogenization for heterogeneous elliptic problems. *SIAM J. Numer. Anal.*, 51(1):377–399, 2013.
- [22] T. Arbogast, Zhen Tao, and Hailong Xiao. Multiscale mortar mixed methods for heterogeneous elliptic problems. In Jichun Li et al., editors, *Recent Advances in Scientific Computing and Applications*, volume 586 of *Contemporary Mathematics*, pages 9–21, Providence, Rhode Island, 2013. Amer. Math. Soc.
- [23] T. Arbogast, Ch.-S. Huang, and Ch.-H. Hung. A fully conservative Eulerian-Lagrangian stream-tube method for advection-diffusion problems. *SIAM J. Sci. Comput.*, 34(4):B447–B478, 2012.
- [24] T. Arbogast, Ch.-S. Huang, and T. F. Russell. A locally conservative Eulerian-Lagrangian method for a model two-phase flow problem in a one-dimensional porous medium. *SIAM J. Sci. Comput.*, 34(4):A1950–A1974, 2012.
- [25] Ch.-S. Huang, T. Arbogast, and Jianxian Qiu. An Eulerian-Lagrangian WENO finite volume scheme for advection problems. *J. Comput. Phys.*, 231(11):4028–4052, 2012. DOI 10.1016/j.jcp.2012.01.030.
- [26] T. Arbogast and Wen-Hao Wang. Stability, monotonicity, maximum and minimum principles, and implementation of the volume corrected characteristic method. *SIAM J. Sci. Comput.*, 33(4):1549–1573, 2011.
- [27] T. Arbogast. Homogenization-based mixed multiscale finite elements for problems with anisotropy. *Multiscale Model. Simul.*, 9(2):624–653, 2011.
- [28] T. Arbogast. Mixed multiscale methods for heterogeneous elliptic problems. In I. G. Graham, Th. Y. Hou, O. Lakkis, and R. Scheichl, editors, *Numerical Analysis of Multiscale Problems*, volume 83 of *Lecture Notes in Computational Science and Engineering*, pages 243–283. Springer, 2011.
- [29] T. Arbogast and Wenhao Wang. Convergence of a fully conservative volume corrected characteristic method for transport problems. *SIAM J. Numer. Anal.*, 48(3):797–823, 2010.
- [30] T. Arbogast and Ch.-S. Huang. A fully conservative Eulerian-Lagrangian method for a convection-diffusion problem in a solenoidal field. *J. Comput. Phys.*, 229(9):3415–3427, 2010. DOI 10.1016/j.jcp.2010.01.009.
- [31] Jichun Li, T. Arbogast, and Yunqing Huang. Mixed methods using standard conforming finite elements. *Comput. Methods Appl. Mech. Engrg.*, 198(5):680–692, 2009.
- [32] T. Arbogast and M. S. M. Gomez. A discretization and multigrid solver for a Darcy-Stokes system of three-dimensional vuggy porous media. *Comput. Geosci.*, 13(3):331–348, 2009. DOI

- 10.1007/s10596-008-9121-y.
- [33] T. Arbogast and D. S. Brunson. A computational method for approximating a Darcy-Stokes system governing a vuggy porous medium. *Comput. Geosci.*, 11(3):207–218, 2007.
  - [34] R. Naimi-Tajdar, C. Han, K. Sepehrnoori, T. J. Arbogast, and M. A. Miller. A fully implicit, compositional, parallel simulator for IOR processes in fractured reservoirs. *SPE Journal*, 12(3), September 2007.
  - [35] T. Arbogast, G. Pencheva, M. F. Wheeler, and I. Yotov. A multiscale mortar mixed finite element method. *Multiscale Model. Simul.*, 6(1):319–346, 2007.
  - [36] T. Arbogast, Ch.-S. Huang, and S.-M. Yang. Improved accuracy for alternating-direction methods for parabolic equations based on regular and mixed finite elements. *Mathematical Models & Methods in Applied Sciences*, 17(8):1279–1305, 2007.
  - [37] T. Arbogast and Ch.-S. Huang. A fully mass and volume conserving implementation of a characteristic method for transport problems. *SIAM J. Sci. Comput.*, 28(6):2001–2022, 2006.
  - [38] T. Arbogast and K. J. Boyd. Subgrid upscaling and mixed multiscale finite elements. *SIAM J. Numer. Anal.*, 44(3):1150–1171, 2006.
  - [39] T. Arbogast and H. L. Lehr. Homogenization of a Darcy-Stokes system modeling vuggy porous media. *Comput. Geosci.*, 10(3):291–302, 2006.
  - [40] T. Arbogast and M. F. Wheeler. A family of rectangular mixed elements with a continuous flux for second order elliptic problems. *SIAM J. Numer. Anal.*, 42:1914–1931, 2005.
  - [41] T. Arbogast. Analysis of a two-scale, locally conservative subgrid upscaling for elliptic problems. *SIAM J. Numer. Anal.*, 42:576–598, 2004.
  - [42] T. Arbogast. An overview of subgrid upscaling for elliptic problems in mixed form. In Z. Chen, R. Glowinski, and Kaitai Li, editors, *Current Trends in Scientific Computing*, volume 329 of *Contemporary Mathematics*, pages 21–32. American Mathematical Society, 2003.
  - [43] T. Arbogast and S. L. Bryant. A two-scale numerical subgrid technique for waterflood simulations. *SPE J.*, 7:446–457, Dec. 2002.
  - [44] T. Arbogast. Implementation of a locally conservative numerical subgrid upscaling scheme for two-phase Darcy flow. *Comput. Geosci.*, 6:453–481, 2002.
  - [45] T. Arbogast. Numerical subgrid upscaling of two-phase flow in porous media. In Z. Chen, R. E. Ewing, and Z.-C. Shi, editors, *Numerical treatment of multiphase flows in porous media*, volume 552 of *Lecture Notes in Physics*, pages 35–49. Springer, Berlin, 2000.
  - [46] T. Arbogast, L. C. Cowsar, M. F. Wheeler, and I. Yotov. Mixed finite element methods on non-matching multiblock grids. *SIAM J. Numer. Anal.*, 37:1295–1315, 2000.
  - [47] T. Arbogast, C. N. Dawson, P. T. Keenan, M. F. Wheeler, and I. Yotov. Enhanced cell-centered finite differences for elliptic equations on general geometry. *SIAM J. Sci. Comput.*, 19:404–425, 1998.
  - [48] T. Arbogast and I. Yotov. A non-mortar mixed finite element method for elliptic problems on non-matching multiblock grids. *Comput. Methods Appl. Mech. Engrg.*, 149:225–265, 1997.
  - [49] T. Arbogast, M. F. Wheeler, and I. Yotov. Mixed finite elements for elliptic problems with tensor coefficients as cell-centered finite differences. *SIAM J. Numer. Anal.*, 34:828–852, 1997.
  - [50] T. Arbogast. Computational aspects of dual-porosity models. In U. Hornung, editor, *Homogenization and Porous Media*, Interdisciplinary Applied Math. Series, pages 203–223. Springer, New York, 1997.
  - [51] T. Arbogast, S. Bryant, C. Dawson, F. Saaf, Chong Wang, and M. Wheeler. Computational methods for multiphase flow and reactive transport problems arising in subsurface contaminant remediation. *J. Comput. Appl. Math.*, 74:19–32, 1996.
  - [52] T. Arbogast, M. F. Wheeler, and Nai-Ying Zhang. A nonlinear mixed finite element method for a degenerate parabolic equation arising in flow in porous media. *SIAM J. Numer. Anal.*,

- 33:1669–1687, 1996.
- [53] T. Arbogast, C. N. Dawson, and M. F. Wheeler. A parallel algorithm for two phase multi-component contaminant transport. *Applications of Math.*, 40:163–174, 1995.
  - [54] T. Arbogast and Zhangxin Chen. On the implementation of mixed methods as nonconforming methods for second order elliptic problems. *Math. Comp.*, 64:943–972, 1995.
  - [55] T. Arbogast and M. F. Wheeler. A characteristics-mixed finite element method for advection dominated transport problems. *SIAM J. Numer. Anal.*, 32:404–424, 1995.
  - [56] T. Arbogast. Gravitational forces in dual-porosity systems. II. Computational validation of the homogenized model. *Transport in Porous Media*, 13:205–220, 1993.
  - [57] T. Arbogast. Gravitational forces in dual-porosity systems. I. Model derivation by homogenization. *Transport in Porous Media*, 13:179–203, 1993.
  - [58] T. Arbogast, M. Obeyesekere, and M. F. Wheeler. Numerical methods for the simulation of flow in root-soil systems. *SIAM J. Numer. Anal.*, 30:1677–1702, 1993.
  - [59] J. Douglas, Jr., T. Arbogast, P. J. Paes Leme, J. L. Hensley, and N. P. Nunes. Immiscible displacement in vertically fractured reservoirs. *Transport in Porous Media*, 12:73–106, 1993.
  - [60] T. Arbogast. The existence of weak solutions to single-porosity and simple dual-porosity models of two-phase incompressible flow. *Journal of Nonlinear Analysis: Theory, Methods, and Applications*, 19:1009–1031, 1992.
  - [61] J. Douglas, Jr., J. L. Hensley, and T. Arbogast. A dual-porosity model for waterflooding in naturally fractured reservoirs. *Comput. Methods Appl. Mech. Engrg.*, 87:157–174, 1991.
  - [62] J. Douglas, Jr. and T. Arbogast. Dual-porosity models for flow in naturally fractured reservoirs. In J. H. Cushman, editor, *Dynamics of Fluids in Hierarchical Porous Media*, pages 177–221. Academic Press, London, 1990.
  - [63] T. Arbogast, J. Douglas, Jr., and U. Hornung. Derivation of the double porosity model of single phase flow via homogenization theory. *SIAM J. Math. Anal.*, 21:823–836, 1990.
  - [64] T. Arbogast and F. A. Milner. A finite difference method for a two-sex model of population dynamics. *SIAM J. Numer. Anal.*, 26:1474–1486, 1989.
  - [65] T. Arbogast. On the simulation of incompressible, miscible displacement in a naturally fractured petroleum reservoir. *R.A.I.R.O. Modél. Math. Anal. Numér.*, 23:5–51, 1989.
  - [66] T. Arbogast. Analysis of the simulation of single phase flow through a naturally fractured reservoir. *SIAM J. Numer. Anal.*, 26:12–29, 1989.

#### Articles in Unrefereed Works

- [1] T. Arbogast, Ch.-S. Huang, and Xikai Zhao. Von Neumann stable, implicit, high order, finite volume WENO schemes. In *SPE Reservoir Simulation Conference 2019*, pages 1–16, Galveston, Texas, April 2019. Society of Petroleum Engineers. SPE-193817-MS.
- [2] T. Arbogast. Mixed methods for two-phase darcy-stokes mixtures of partially melted materials with regions of zero porosity. In *Oberwolfach Reports, Reactive Flows in Deformable, Complex Media*, organized by Margot Gerritsen, Iuliu Sorin Pop, Florin A. Radu, and Barbara Wohlmuth. The Mathematisches Forschungsinstitut Oberwolfach (MFO), European Mathematical Society, 2018, to appear.
- [3] T. Arbogast. Composite materials and homogenization. In B. Engquist, editor, *Encyclopedia of Applied and Computational Mathematics*, pages 233–237. Springer, Berlin, 2015.
- [4] T. Arbogast. Flow through heterogeneous porous rocks: What average is the correct average? In H. Kaper and C. Rousseau, editors, *Mathematics of Planet Earth: Mathematicians Reflect on How to Discover, Organize, and Protect Our Planet*, chapter 1.6, pages 9–12. SIAM, Philadelphia, 2015.

- [5] T. Arbogast. Approximation of transport using Eulerian-Lagrangian techniques. In *Oberwolfach Reports*, Reactive Flows in Deformable, Complex Media, organized by Margot Gerritsen, Jan Martin Nordbotten, Iuliu Sorin Pop, and Barbara Wohlmuth, volume 11:3. The Mathematisches Forschungsinstitut Oberwolfach (MFO), European Mathematical Society, 2014.
- [6] T. Arbogast. Aspects of discontinuous multiscale flow approximations on transport and a two-level mortar preconditioner. In *Oberwolfach Reports*, Computational Multiscale Methods, organized by Carsten Carstensen, Björn Engquist, and Daniel Peterseim, volume 11:2. The Mathematisches Forschungsinstitut Oberwolfach (MFO), European Mathematical Society, 2014. DOI 10.4171/OWR/2014/30.
- [7] T. Arbogast. The mixed variational multiscale method and aspects of convergence for heterogeneous porous media. In *Oberwolfach Reports*, volume 6:1, chapter Mini-Workshop on Numerical Upscaling for Flow Problems: Theory and Applications, organized by Achi Brandt, Yalchin Efendiev, and Oleg Iliev. The Mathematisches Forschungsinstitut Oberwolfach (MFO), European Mathematical Society, 2009.
- [8] R. Naimi-Tajdar, C. Han, K. Sepehrnoori, T. J. Arbogast, and M. A. Miller. A fully implicit, compositional, parallel simulator for IOR processes in fractured reservoirs. In *Proceedings of the SPE/DOE Symposium on Improved Oil Recovery* held in Tulsa, Oklahoma, U.S.A. Society of Petroleum Engineers, 22–26 April 2006. SPE 100079.
- [9] T. Arbogast and Kirsten J. Boyd. Mixed variational multiscale methods and multiscale finite elements. In *Oberwolfach Reports*, Vol. 2, Issue 1, Gemischte und nicht-standard Finite-Elemente-Methoden mit Anwendungen, organized by K. Hackl, C. Carstensen, and D. Braess, volume 2:1. The Mathematisches Forschungsinstitut Oberwolfach (MFO), European Mathematical Society, 2005.
- [10] L. Zhang, S. L. Bryant, J. W. Jennings, T. J. Arbogast, and R. Paruchuri. Multiscale flow and transport in highly heterogeneous carbonates. In *Proceedings of the 2004 SPE Annual Technical Conference and Exhibition held in Houston, Texas*, September 26–29, 2004. SPE 90336.
- [11] T. Arbogast, D. S. Brunson, S. L. Bryant, and J. W. Jennings. A preliminary computational investigation of a macro-model for vuggy porous media. In C. T. Miller et al., editors, *Computational Methods in Water Resources XV*, New York, 2004. Elsevier.
- [12] T. Arbogast and S. L. Bryant. Numerical subgrid upscaling for waterflood simulations. In *Proceedings of the 16th SPE Symposium on Reservoir Simulation held in Houston, Texas*, February 11–14, 2001. SPE 66375.
- [13] T. Arbogast and S. Bryant. Efficient forward modeling for DNAPL site evaluation and remediation. In L. R. Bentley et al., editors, *Computational Methods in Water Resources XIII*, pages 161–166, Rotterdam, 2000. Balkema.
- [14] M. Wheeler, T. Arbogast, S. Bryant, J. Eaton, Qin Lu, M. Peszynska, and I. Yotov. A parallel multiblock/multidomain approach for reservoir simulation. In *Proceedings of the 15th SPE Symposium on Reservoir Simulation held in Houston, Texas*, February 14–17, 1999. SPE 51884.
- [15] M. F. Wheeler, T. Arbogast, S. Bryant, and J. Eaton. Efficient parallel computation of spatially heterogeneous geochemical reactive transport. In V. N. Burganos et al., editors, *Computational Methods in Water Resources XII, Vol. 1: Computational Methods in Contamination and Remediation of Water Resources*, pages 453–460, Southampton, U.K., 1998. Computational Mechanics Publications.
- [16] T. Arbogast, S. E. Minkoff, and P. T. Keenan. An operator-based approach to upscaling the pressure equation. In V. N. Burganos et al., editors, *Computational Methods in Water Resources XII, Vol. 1: Computational Methods in Contamination and Remediation of Water*

- Resources*, pages 405–412, Southampton, U.K., 1998. Computational Mechanics Publications.
- [17] Peng Wang, I. Yotov, M. Wheeler, T. Arbogast, C. Dawson, M. Parashar, and K. Sepehrnoori. A new generation EOS compositional reservoir simulator: Part I—Formulation and discretization. In *Proceedings of the 14th SPE Symposium on Reservoir Simulation held in Dallas, Texas*, June 8–11, 1997. SPE 37979.
- [18] T. Arbogast, C. N. Dawson, P. T. Keenan, M. F. Wheeler, and I. Yotov. The application of mixed methods to subsurface simulation. In R. Helmig et al., editors, *Modeling and Computation in Environmental Sciences*, volume 59 of *Notes on Numerical Fluid Mechanics*, pages 1–13, Braunschweig, 1997. Vieweg Publ.
- [19] M. F. Wheeler, T. Arbogast, S. Bryant, C. N. Dawson, F. Saaf, and Chong Wang. New computational approaches for chemically reactive transport in porous media. In G. Delic and M.F. Wheeler, editors, *Next Generation Environmental Models and Computational Methods (NGEMCOM)*, pages 217–226, Philadelphia, 1997. Proceedings of the U.S. Environmental Protection Agency Workshop (NGEMCOM), SIAM.
- [20] T. Arbogast, M. F. Wheeler, and I. Yotov. Logically rectangular mixed methods for flow in irregular, heterogeneous domains. In Á. A. Aldama et al., editors, *Computational Methods in Water Resources XI*, volume 1, pages 621–628, Southampton, 1996. Computational Mechanics Publications.
- [21] T. Arbogast. Mixed methods for flow and transport problems on general geometry. In G. F. Carey, editor, *Finite Element Modeling of Environmental Problems*, pages 275–286, Cichester, England, 1995. Wiley.
- [22] T. Arbogast, P. T. Keenan, M. F. Wheeler, and I. Yotov. Logically rectangular mixed methods for Darcy flow on general geometry. In *Proceedings of the 13th SPE Symposium on Reservoir Simulation held in San Antonio, Texas*, pages 51–59, February 12–15, 1995. SPE 29099.
- [23] T. Arbogast, M. F. Wheeler, and I. Yotov. Logically rectangular mixed methods for groundwater flow and transport on general geometry. In A. Peters et al., editors, *Computational Methods in Water Resources X, Vol. 1*, pages 149–156, Dordrecht, The Netherlands, 1994. Kluwer Academic Publishers.
- [24] T. Arbogast, C. N. Dawson, and M. F. Wheeler. A parallel multiphase numerical model for subsurface contaminant transport with biodegradation kinetics. In A. Peters et al., editors, *Computational Methods in Water Resources X, Vol. 2*, pages 1499–1506, Dordrecht, The Netherlands, 1994. Kluwer Academic Publishers.
- [25] T. Arbogast, C. N. Dawson, and P. T. Keenan. Efficient mixed methods for groundwater flow on triangular or tetrahedral meshes. In A. Peters et al., editors, *Computational Methods in Water Resources X, Vol. 1*, pages 3–10, Dordrecht, The Netherlands, 1994. Kluwer Academic Publishers.
- [26] T. Arbogast and M. F. Wheeler. A parallel numerical model for subsurface contaminant transport with biodegradation kinetics. In J. R. Whiteman, editor, *The Mathematics of Finite Elements and Applications VIII (MAFELAP 1993)*, pages 199–213, New York, 1994. Wiley.
- [27] T. Arbogast. A simplified dual-porosity model for two-phase flow. In T. F. Russell et al., editors, *Computational Methods in Water Resources IX, Vol. 2: Mathematical Modeling in Water Resources*, pages 419–426, Southampton, U.K., 1992. Computational Mechanics Publications.
- [28] T. Arbogast, M. Obeyesekere, and M. F. Wheeler. Simulation of flow in root-soil systems. In T. F. Russell et al., editors, *Computational Methods in Water Resources IX, Vol. 2: Mathematical Modeling in Water Resources*, pages 195–202, Southampton, U.K., 1992. Computational Mechanics Publications.
- [29] T. Arbogast, A. Chilakapati, and M. F. Wheeler. A characteristic-mixed method for contaminant transport and miscible displacement. In T. F. Russell et al., editors, *Computational*



- Methods in Water Resources IX, Vol. 1: Numerical Methods in Water Resources*, pages 77–84, Southampton, U.K., 1992. Computational Mechanics Publications.
- [30] T. Arbogast. Gravitational forces in dual-porosity models of single phase flow. In *Proceedings, Thirteenth IMACS World Congress on Computation and Applied Mathematics*, pages 607–608, Dublin, Ireland, July 22–26, 1991. Trinity College.
  - [31] T. Arbogast, M. Obeyesekere, and M. F. Wheeler. Convergence analysis for simulating flow in root-soil systems. In J. R. Whiteman, editor, *The Mathematics of Finite Elements and Applications VII (MAFELAP 1990)*, pages 361–383, London, 1991. Academic Press.
  - [32] T. Arbogast, J. Douglas, Jr., and U. Hornung. Modeling of naturally fractured reservoirs by formal homogenization techniques. In R. Dautray, editor, *Frontiers in Pure and Applied Mathematics*, pages 1–19. Elsevier, Amsterdam, 1991.
  - [33] P. J. Paes Leme, J. Douglas, Jr., T. Arbogast, and N. P. Nunes. A tall block model for immiscible displacement in naturally fractured reservoirs. In *Proceedings, Society of Petroleum Engineers Latin American Petroleum Engineering Conference, Rio de Janeiro, Brazil*, October 15–19, 1990. SPE 21104.
  - [34] J. Douglas, Jr., T. Arbogast, and P. J. Paes Leme. Two models for the waterflooding of naturally fractured reservoirs. In *Proceedings, Tenth SPE Symposium on Reservoir Simulation*, pages 219–225, 1989. Paper SPE 18425.
  - [35] T. Arbogast, J. Douglas, Jr., and J. E. Santos. Two-phase immiscible flow in naturally fractured reservoirs. In M. F. Wheeler, editor, *Numerical Simulation in Oil Recovery*, number 11 in The IMA Volumes in Mathematics and its Applications, pages 47–66. Springer-Verlag, 1988.
  - [36] T. Arbogast. The double porosity model for single phase flow in naturally fractured reservoirs. In M. F. Wheeler, editor, *Numerical Simulation in Oil Recovery*, number 11 in The IMA Volumes in Mathematics and its Applications, pages 23–45. Springer-Verlag, 1988.
  - [37] J. Douglas, Jr., P. J. Paes Leme, T. Arbogast, and T. Schmitt. Simulation of flow in naturally fractured reservoirs. In *Proceedings, Ninth SPE Symposium on Reservoir Simulation*, pages 271–279, 1987. Paper SPE 16019.

### *Technical Reports*

- [1] T. Arbogast, Ch.-S. Huang, and Xikai Zhao. Von Neumann stable, implicit finite volume WENO3 schemes for hyperbolic conservation laws. Technical Report 18–04, Institute for Computational Engineering and Sciences, University of Texas at Austin, March 30 2018.
- [2] Todd Arbogast, Chieh-Sen Huang, and Xikai Zhao. A multilevel-WENO technique for solving nonlinear conservation laws. Technical Report ICES REPORT 17-20, Institute for Computational Engineering and Sciences, Univ. of Texas at Austin, August 2017.
- [3] T. Arbogast. User’s guide to Parssim1: The parallel subsurface simulator, single phase. Technical Report TICAM Report 98–13, The Center for Subsurface Modeling, Texas Institute for Computational and Applied Mathematics, The University of Texas at Austin, Austin, Texas, May 1998.
- [4] T. Arbogast, C. N. Dawson, D. Moore, F. Saaf, C. San Soucie, M. F. Wheeler, and I. Yotov. Validation of the PICS transport code. Technical report, Department of Computational and Applied Mathematics, Rice University, Houston, Texas, 1993.
- [5] T. Arbogast and Zhangxin Chen. Homogenization of compositional flow in fractured porous media. Technical Report 93–045, Army High Performance Computing Research Center, University of Minnesota, Minneapolis, Minnesota, 1993.

*Other Manuscripts*

- [1] T. Arbogast and J. L. Bona. Functional Analysis for the Applied Mathematician. UT Copy Center, Welsh Hall, Department of Mathematics, The University of Texas at Austin, Austin, Texas, 2010–2012.
- [2] T. Arbogast and J. L. Bona. Methods of Applied Mathematics. World wide web address <http://www.ma.utexas.edu/users/arbogast/appMath08c.pdf>, Department of Mathematics, The University of Texas at Austin, Austin, Texas, 1999–2008.