

Curriculum Vitae

Son-Young Yi

Department of Mathematical Sciences
The University of Texas at El Paso
500 W. University Ave.
El Paso, TX 79968-0514

Phone: (915) 747-6864
Fax: (915) 747- 6502
E-mail: syi@utep.edu
URL: <http://www.math.utep.edu/faculty/yi/>

Education

Ph.D. in Mathematics, Purdue University, West Lafayette, IN, USA 2006
Major area: Numerical Analysis and Scientific Computing
Advisor: Dr. Jim Douglas, Jr.
Thesis title: Nonconforming Mixed Finite Element Methods for Linear Elasticity

M. S. in Mathematics, Seoul National University, Seoul, Korea

B. S. in Mathematics Education, Korea University, Seoul, Korea

Professional Employments

Professor, The University of Texas at El Paso 2024 – present

Associate Professor, The University of Texas at El Paso 2015 – 2024

Assistant Professor, The University of Texas at El Paso 2009 – 2015

Postdoctoral Research Associate, Oregon State University 2006 – 2009
Mentors: Drs. Małgorzata Pezzyńska and Ralph Showalter

Research Interests

- Numerical methods for partial differential equations
- Multiscale and multi-physics modeling
- Flow and transport in porous media
- Computational solid mechanics

Publications (* indicates student author)

- [1] S.-Y. Yi and S. Lee, *Physics-preserving enriched Galerkin method for a fully-coupled thermo-poroelasticity*, Numerische Mathematik, vol. 156, pp. 949 -978, 2024.
- [2] X. Hu, S. Lee, L. Mu, and S.-Y. Yi, *Pressure-robust enriched Galerkin methods for the Stokes equations*, Journal of Computational and Applied Mathematics, vol. 436, 115449, 2024.
- [3] F. Ballarin, S. Lee, and S.-Y. Yi, *Projection-based reduced order modeling of an iterative scheme for linear thermo-poroelasticity*, Results in Applied Mathematics, vol. 21, 100430, 2024.
- [4] S. Lee and S.-Y. Yi, *Locking-free and locally-conservative enriched Galerkin method for poroelasticity*, Journal of Scientific Computing, vol. 94, article number 26, 2023.
- [5] S.-Y. Yi, X. Hu, S. Lee, J. H. Adler, and L. Zikatanov, *An enriched Galerkin method for the Stokes equations*, Computers and Mathematics with Applications, vol. 120, pp. 115-131, 2022.
- [6] S.-Y. Yi, S. Lee, and L. Zikatanov, *Locking-free enriched Galerkin method for linear elasticity*, SIAM Journal on Numerical Analysis, vol. 60, no. 1, pp. 52-75, 2022.
- [7] Y. Jeon and S.-Y. Yi, *The immersed interface hybridized difference method for parabolic interface problems*, Numerical Mathematics: Theory, Methods and Applications, vol. 15, no. 2, pp. 336-359, 2022.
- [8] S.-Y. Yi and K. Lee, *Numerical study for European option pricing equations with non-Levy jumps*, Applicable Analysis, vol. 100, no. 7, pp. 1454 - 1470, 2021.
- [9] M.L. Bean* and S.-Y. Yi, *A monolithic mixed finite element method for a fluid-structure interaction problem*, Applied Mathematics and Computation, vol. 363, article 124615, 2019.
- [10] S.-Y. Yi, *A lowest-order weak Galerkin method for linear elasticity*, Journal of Computational and Applied Mathematics, vol. 350, pp. 286-298, 2019.
- [11] S.-Y. Yi, *A study of two modes of locking in poroelasticity*, SIAM Journal on Numerical Analysis, vol. 55, no. 4, pp. 1915-1936, 2017.
- [12] M.L. Bean*, K. Lipnikov, S.-Y. Yi, *A block-diagonal preconditioner for a four-field mixed finite element method for Biot's equations*, Applied Numerical Mathematics, vol. 122, pp. 1-13, 2017.
- [13] S.-Y. Yi and M.L. Bean*, *Iteratively coupled solution strategies for a four-field mixed finite element method for poroelasticity*, International Journal for Numerical and Analytical Methods in Geomechanics, vol. 41, issue 2, pp. 159-179, 2017

- [14] A. Cesmelioglu, H. Lee, A. Quaini, K. Wang, S.-Y. Yi, *Optimization-based decoupling algorithms for a fluid-poroelastic system*, In Topics in Numerical Partial Differential Equations and Scientific Computing, The IMA Volumes in Mathematics and its Applications 160, S. C. Brenner (ed.), pp. 79–98, 2016.
- [15] M. Peszyńska, R. E. Showalter, and S.-Y. Yi, *Flow and transport when scales are not separated: Numerical analysis and simulations of micro- and macro-models*, International Journal of Numerical Analysis and Modeling, vol. 12, no. 3, pp. 476–515, 2015.
- [16] M. L. Bean* and S.-Y. Yi, *An immersed interface method for a 1D poroelasticity problem with discontinuous coefficients*, Journal of Computational and Applied Mathematics, vol. 272, pp. 81–96, 2014.
- [17] S.-Y. Yi, *Convergence analysis of a new mixed finite element method for Biot’s consolidation model*, Numerical Methods for Partial Differential Equations, vol. 30, no. 4, pp. 1189–1210, 2014.
- [18] S.-Y. Yi and S. Lee, *A Locally Conservative Eulerian-Lagrangian Finite Difference Method for the Forced KdV Equation*, Applied Mathematics and Computation, vol. 230, pp. 276–289, 2014.
- [19] P. Delgado*, V. Kumar, and S.-Y. Yi, *A heterogeneous multiscale method for an elliptic reaction diffusion equation*, 4th Southwest Energy Science and Engineering Symposium, El Paso, TX, 2014.
- [20] S.-Y. Yi and J. Douglas, Jr., *An experimental study of several multidimensional, locally conservative, Eulerian-Lagrangian finite element methods for a semilinear parabolic equation*, International Journal of Numerical Analysis and Modeling Series B, vol. 4, no. 3, pp. 299–314, 2013.
- [21] S.-Y. Yi, *A coupling of nonconforming and mixed finite element methods for Biot’s consolidation model*, Numerical Methods for Partial Differential Equations, vol. 29, pp. 1749–1777, 2013.
- [22] J. Douglas, Jr., A. M. Spagnuolo, and S.-Y. Yi, *The convergence of a multidimensional, locally conservative, Eulerian-Lagrangian finite element method for a semilinear parabolic equation*, Math. Models and Methods Appl. Sci. (M3AS), vol. 20, no. 2, pp. 315–348, 2010.
- [23] S.-Y. Yi, M. Peszynska, and R. E. Showalter, *Numerical upscaled model of transport with non-separated scales*, XVIII International Conference on Water Resources, CMWR 2010, J. Carreta (Ed), Barcelona, 2010.
- [24] M. Peszyńska, R. E. Showalter, and S.-Y. Yi, *Homogenization of a pseudoparabolic system*, Applicable Analysis, vol. 88, no. 9, pp. 1265–1282, 2009.

- [25] M. Peszyńska and S.-Y. Yi, *Numerical methods for unsaturated flow with dynamic capillary pressure in heterogeneous porous media*, Int. J. Numer. Anal. Model. vol. 5, Supp, pp. 126-149, 2008
- [26] S.-Y. Yi, *A new nonconforming mixed finite element method for linear elasticity*, Math. Models Methods Appl. Sci., vol. 16, no. 7, pp. 979–999, 2006.
- [27] S.-Y. Yi, *Nonconforming mixed finite element methods for linear elasticity using rectangular elements in two and three dimensions*, Calcolo vol. 42, no. 2, pp. 115–133, 2005.

Grant Support

1. Department of Energy (Lead PI), DE-SC0024703, “Advanced Multi-Physics Machine Learning for Subsurface Energy Systems Across Scales, ” 10/15/2023–10/14/2026, \$4,930,625.
2. National Science Foundation (PI), DMS 2208426, “Collaborative Research: Physics-Preserving Adaptive Finite Element Methods for Thermo-Poroelasticity, ” 07/01/2022–06/30/2025, \$250,518.
3. College of Science Research Enhancement Fund (Co-PI), “Visualization and Analysis of Giant Virus Structure,” 01/01/2015–07/31/2015, \$20,000.
4. National Science Foundation (PI), DMS 1217123, “A mixed finite element framework for Biot’s consolidation model and its interface problems,” 09/01/2012–08/31/2016, \$263,569.
5. The University Research Institute grant (PI), “Development, analysis and implementation of numerical methods for flow in deformable porous media,” 01/01/2011–12/31/2011, \$5,000.
6. National Science Foundation (Co-PI), DMS 0707562, “Modeling, Analysis and Simulation of Multiscale Nonlinear Systems: Workshop at Oregon State University,” 05/01/2007–04/30/2008, \$27,634.

Courses Taught at UTEP

- Calculus I (MATH 1411)
- Calculus II (MATH 1312)
- Differential Equations (MATH 2326)
- Linear Algebra (MATH 4326/5322)
- Introduction to Numerical Analysis (MATH 4329)
- Finite Element Methods I (MATH 5315)
- (Graduate) Numerical Analysis (MATH 5329/6329)

- Computational Methods of Linear Algebra (MATH 5330/6330)
- Numerical Solutions for PDEs (MATH 5343/6343)
- Interdisciplinary Graduate Seminar (CPS 5195)
- Dissertation Seminar (CPS 6195)

Recent Presentations

1. “Advanced multi-physics machine learning for subsurface energy systems across scales,” ., Big Data Seminar, Dong-A University, Pusan, Korea, October 18, 2024.
2. “Multiscale and multi-physics modeling of subsurface energy systems for a safe and effective energy future,” Computational and Applied Mathematics Colloquium, Penn State University, State College, PA, October 3, 2024.
3. “Advanced Multi-Physics Machine Learning for Subsurface Energy Systems Across Scales,” 2024 Science Summit for Energy Earthshot Innovation, Rockville, MD, September 4–5, 2024.
4. “Physics-Preserving Enriched Galerkin Method for Thermo-Hydro-Mechanical Processes in Geomechanics,” the 16th World Congress on Computational Mechanics, , Vancouver, Canada, July 21–26, 2024.
5. “Enriched Galerkin Method for Thermo-Hydro-Mechanical Systems,” ICERM workshop on Numerical Analysis of Multiphysics Problems, Providence, RI, February 12–16, 2024.
6. “Physics-preserving enriched Galerkin method for thermo-poroelasticity,” 2023 Finite Element Circus, University of Notre Dame, October 20–21, 2023.
7. “Physics-preserving numerical method for modeling geothermal energy systems,” Mathematics Colloquium Series, University of Texas at El Paso, September 22, 2023.
8. “Physics-preserving enriched Galerkin method for linear thermo-poroelasticity,” SIAM Conference on Mathematical & Computational Issues in the Geosciences, Bergen, Norway, June 21, 2023.
9. “Physics-preserving enriched Galerkin method for linear thermo-poroelasticity,” Finite Element Rodeo, Texas A&M University, College Station, March 24–25, 2023.
10. “A locking-free enriched Galerkin method for linear elasticity,” The 4th SIAM TX-LA Section Annual Meeting, South Padre Island, November 7, 2021.
11. “The Immersed Interface Hybridized Difference Method for Interface Problems,” The Second Joint SIAM/CAIMS Annual Meeting (AN20), Virtual, July 6, 2021.
12. “Locking-free and locally conservative enriched Galerkin methods for poroelasticity,” SIAM Conference on Mathematical & Computational Issues in the Geosciences, June 23, 2021.

13. “Locking-free and locally conservative enriched Galerkin methods for poroelasticity,” Applied and Computational Mathematics Seminar, Oregon State University, April 9, 2021.
14. “Locking in Poroelasticity: Causes and Remedies,” KSCSE Spring conference, Seoul National University, Korea, May 23–24, 2019.
15. “A Lowest-Order Weak Galerkin Method for Linear Elasticity,” Applied Mathematics Seminar, Konkuk University, Seoul, Korea, May 22, 2019.
16. “Weak Galerkin method for linear elasticity,” KSIAM Spring conference, Yonsei University, Korea, May 17–18, 2019.
17. “A weak Galerkin method for linear elasticity,” Mathematics Colloquium, Florida State University, April 26, 2019.
18. “Two Modes of Locking in Poroelasticity,” Applied Mathematics Seminar, Konkuk University, Seoul, Korea, June 18, 2018.
19. “Finite Difference Methods in Computational Finance,” Computational Finance Seminar, Purdue University, West Lafayette, April 11, 2018.
20. “Locking in Poroelasticity: Causes and Remedies,” SIAM Geosciences conference, Erlangen, Germany, September 11-14, 2017.
21. “Locking in Poroelasticity: Causes and Remedies,” Applied Mathematics Seminar, Colorado State University, April 13, 2017.
22. “Locking in Poroelasticity: Causes and Remedies,” Finite Element Rodeo, University of Houston, March 4, 2017.

Service

Departmental Service

- Director, Graduate Certificate Program in Applied and Computational Mathematics, Fall 2016 - Present
- Chair, MATH Undergraduate Program Assessment Committee, 2019 - Present
- Co-Chair, CPS Faculty Search Committee, Fall 2023 - Spring 2024
- Faculty mentor for a new Assistant Professor, Fall 2023 - Present
- Member, Faculty Evaluation Committee, Fall 2017 – Spring 2020
- Chair, Committee for the Applied Mathematics Track in the MS in Mathematics, Fall 2016 –Fall 2017
- Undergraduate advisor, Department of Mathematical Sciences, Fall 2012 - Summer 2015

- Member, Applied Mathematics Faculty Hiring Committee, Fall 2013 - Spring 2014
- Member, Students Competitions Committee, Spring 2011 - Spring 2014
- Co-advisor, Club Zero (UTEP's student math club), Fall 2009 - Spring 2010

College Service

- Member, Computational Science Program (CPS) Curriculum Committee, Fall 2014 - Present
- Member, Computational Science Program (CPS) Qualifying Exams Committee, Summer 2010 - Present
- Member, Computational Science Program (CPS) Admission Committee, Fall 2013 – Fall 2018
- Member, College of Science Graduate Curriculum Committee, Fall 2011 – Spring 2014
- Attendee, Meeting for developing the Strategic Plan for the College of Science, Fall 2010

University Service

- Representative for College of Science, Community Engagement Council, Fall 2023 - Present
- Faculty senator, UTEP Faculty Senate, Fall 2014 – Summer 2016
- Faculty advisor, SIAM Student Chapter, Spring 2012 – Spring 2015

Professional Service

- Co-organizer, Mini-symposium on “Recent Advancements in Numerical Methods for Sub-surface Simulations,” the 7th SIAM TX-LA Section Annual Meeting, October 1–13, 2024
- Panelist, NSF grant proposal review panel, 2024
- Editor, Special issue on “Coupled processes: modeling, analysis, and numerics” in Results in Applied Mathematics, 2023
- Mentor, Korean-American Women in Science and Engineering (KWise) global mentoring program, May 2021 – November 2023
- Co-organizer, Mini-symposium on “Multiphysics Modeling and Simulations for Coupled Problems in Porous Media,” SIAM Conference on Mathematical & Computational Issues in the Geosciences, Bergen, Norway, June 19–22, 2023
- Member, Organizing committee for the 4th SIAM TX-LA Annual Meeting, South Padre Island, November 5–7, 2021

- Treasurer, SIAM TX-LA Section, April 2019 – April 2021
- Panelist, NSF grant proposal review panel, 2021
- Member, Organizing committee for the 3rd SIAM TX-LA Annual Meeting (Virtual), October 16–18, 2020
- Member, Organizing committee for the AMS Fall Central Sectional Conference, University of Texas at El Paso, September 12–13, 2020
- Member, Organizing committee for the 2nd SIAM TX-LA Annual Meeting, Southern Methodist University, November 1–3, 2019
- Co-organizer, Mini-symposium, “Recent advances in numerical flow and transport in porous media: a mini-symposium in honor of the late Jim Douglas, Jr.” at the SIAM Geosciences conference, Erlangen, Germany, September 11–14, 2017
- Panelist, NSF grant proposal review panel, 2015
- Member, Organizing committee for the “36th Annual Texas Partial Differential Equations Conference”, March 2–3, 2013
- Co-organizer, Mini-symposium, “Coupled and hybrid models and multiple scales in mathematical geosciences” at the SIAM Annual Conference, 2012
- Session chair, Session on “ Geomechanics and thermal modeling,” SIAM Geoscience conference, Long beach, March 2011
- Co-organizer, Workshop on “Modeling, Analysis, and Simulation of Multiscale Nonlinear Systems” in cooperation with the Society for Industrial and Applied Mathematics (SIAM) Activity Group on Geosciences, Oregon State University, June 25–29, 2007
- Journal reviewer, SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing, Journal of Computational and Applied Mathematics, Journal of Scientific Computing, Applied Numerical Mathematics, Journal of Mathematical Modelling and Algorithms, Journal of Applied Mathematics, Computers and Mathematics with Applications, Advances in Applied Mathematics and Mechanics

Fellowships, Awards, and Honors

- University Faculty Marshal, UTEP Fall Commencement, 2024
- UTEP Faculty Development Leave Award, Fall 2024
- College of Science Faculty Marshal for Students at the UTEP Commencement ceremony, December 2013

- The Association for Women in Mathematics (AWM) Travel Grant, 2010
- Society for Industrial and Applied Mathematics (SIAM) Early Career Travel Award, 2007
- Outstanding Graduate Instructor, Department of Mathematics, Purdue University, 2005
- Research Fellowship, Purdue Research Foundation, 2003–2004
- Summer Research Fellowship, Purdue Research Foundation, 2001, 2002

Professional Memberships

- Society for Industrial and Applied Mathematics (SIAM)
- American Mathematical Society (AMS)
- Korean-American Scientists and Engineering Association (KSEA)