

# 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.  
**M. S.** in Mathematics, Seoul National University, Seoul, Korea  
**B. S.** in Mathematics Education, Korea University, Seoul, Korea

### Academic Appointments

<b>Professor</b> , The University of Texas at El Paso	2024 – present
<b>Associate Professor</b> , The University of Texas at El Paso	2015 – 2024
<b>Assistant Professor</b> , The University of Texas at El Paso	2009 – 2015
<b>Postdoctoral Research Associate</b> , Oregon State University	2006 – 2009

### Research Interests

- Finite element methods for partial differential equations
- Multiscale and multi-physics modeling and analysis
- Subsurface energy systems modeling
- Deep learning for partial differential equations

### Grants and Sponsored Research

#### Active grants

1. (Lead PI) Department of Energy, DE-SC0024703, “Advanced Multi-Physics Machine Learning for Subsurface Energy Systems Across Scales,” \$4,930,625, 10/15/2023–10/14/2026.
2. (PI) National Science Foundation, DMS 2208426, “Collaborative Research: Physics-Preserving Adaptive Finite Element Methods for Thermo-Poroelasticity,” \$250,518, 07/01/2022–06/30/2026.
3. (PI) Sandia National Laboratories LDRD-SUPN program, “Multi-Physics Modeling and Machine Learning to Support Hydraulically Optimized Tomography for Enhanced Geothermal Systems (HOT EGS),” \$200,000, 10/12/2025–09/30/2027.

**Past grants**

1. (PI) National Science Foundation, DMS 1217123, “A mixed finite element framework for Biot’s consolidation model and its interface problems,” 09/01/2012–08/31/2016, \$263,569.
2. (Co-PI) College of Science Research Enhancement Fund, “Visualization and Analysis of Giant Virus Structure,” \$20,000, 01/01/2015–07/31/2015.
3. (PI) The University Research Institute grant, “Development, analysis and implementation of numerical methods for flow in deformable porous media,” \$5,000, 01/01/2011–12/31/2011.
4. (Co-PI) National Science Foundation, DMS 0707562, “Modeling, Analysis and Simulation of Multiscale Nonlinear Systems: Workshop at Oregon State University,” \$27,634, 05/01/2007–04/30/2008.

**Publications**

- [1] H. Kunwar, S. Lee, and S.-Y. Yi, *Non-Intrusive global-local method for poroelasticity problems with localized pressure effects*, International Journal for Numerical and Analytical Methods in Geomechanics, vol. 50, no. 2, pp. 1033-1044, 2026.
- [2] W.T. Leung, S. Lee, M. Vasilyeva, and S.-Y. Yi, *A Generalized multiscale enriched Galerkin method for flow in heterogeneous porous media*, under revision, 2025.
- [3] 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.
- [4] 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.
- [5] 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.
- [6] 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.
- [7] 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.
- [8] 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.
- [9] 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.
- [10] 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.
- [11] 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.
- [12] S.-Y. Yi, *A lowest-order weak Galerkin method for linear elasticity*, Journal of Computational and Applied Mathematics, vol. 350, pp. 286–298, 2019.

- [13] 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.
- [14] 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.
- [15] 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
- [16] 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.
- [17] 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.
- [18] 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.
- [19] 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.
- [20] 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.
- [21] 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.
- [22] 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.
- [23] 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.
- [24] 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.
- [25] 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.

- [26] M. Pešzyńska, R.E. Showalter, and S.-Y. Yi, *Homogenization of a pseudoparabolic system*, *Applicable Analysis*, vol. 88, no. 9, pp. 1265–1282, 2009.
- [27] M. Pešzyńska 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
- [28] 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.
- [29] 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.

### Recent Presentations (2018–present)

1. “Non-Intrusive Global-Local Methods for Poroelasticity Problems with Localized Pressure Effects,” the 8th SIAM TX-LA Sectional Meeting, Austin, TX, September 26–28, 2025.
2. “Global-Local Method for a Poroelasticity Model with Localized Pressure Effects,” NSF Comp Math Meeting 2025, Salt Lake City, UT, May 8, 2025.
3. (Invited) “Advanced multi-physics machine learning for subsurface energy systems across scales,” Big Data Seminar, Dong-A University, Pusan, Korea, October 18, 2024.
4. (Invited) “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.
5. “Advanced Multi-Physics Machine Learning for Subsurface Energy Systems Across Scales,” 2024 Science Summit for Energy Earthshot Innovation, Rockville, MD, September 4–5, 2024.
6. “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.
7. “Enriched Galerkin Method for Thermo-Hydro-Mechanical Systems,” ICERM workshop on Numerical Analysis of Multiphysics Problems, Providence, RI, February 12–16, 2024.
8. “Physics-preserving enriched Galerkin method for thermo-poroelasticity,” 2023 Finite Element Circus, University of Notre Dame, October 20–21, 2023.
9. “Physics-preserving numerical method for modeling geothermal energy systems,” Mathematics Colloquium Series, University of Texas at El Paso, September 22, 2023.
10. “Physics-preserving enriched Galerkin method for linear thermo-poroelasticity,” SIAM Conference on Mathematical & Computational Issues in the Geosciences, Bergen, Norway, June 21, 2023.
11. “Physics-preserving enriched Galerkin method for linear thermo-poroelasticity,” Finite Element Rodeo, Texas A&M University, College Station, March 24–25, 2023.
12. “A locking-free enriched Galerkin method for linear elasticity,” The 4th SIAM TX-LA Section Annual Meeting, South Padre Island, November 7, 2021.
13. “The Immersed Interface Hybridized Difference Method for Interface Problems,” The Second Joint SIAM/CAIMS Annual Meeting (AN20), Virtual, July 6, 2021.

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

### Conference and Mini-symposium Organization

1. Program Committee member, the International Society for Porous Media (InterPore) Conferences, August 2025 - July 2028
2. Organizer, mini-symposium on “Modeling and Simulation of Multi-Physics Processes in Fractured/Faulted Subsurface Formations,” SIAM Conference on Mathematical & Computational Issues in the Geosciences, Baton Rouge, LA, October 14–17, 2025
3. Main organizer, “GeoEnergy” workshop, El Paso, TX, May 15–17, 2025
4. Organizer, mini-symposium on “Mathematical and numerical methods for multi-scale multi-physics, nonlinear coupled processes,” InterPore2025, Albuquerque, NM, May 19–22, 2025
5. Organizer, mini-symposium on “Recent Advancements in Numerical Methods for Subsurface Simulations,” the 7th SIAM TX-LA Section Annual Meeting, Waco, TX, October 1–13, 2024
6. Organizer, mini-symposium on “Multi-physics Modeling and Simulations for Coupled Problems in Porous Media,” SIAM Conference on Mathematical & Computational Issues in the Geosciences, Bergen, Norway, June 19–22, 2023
7. Organizing Committee member, the 4th SIAM TX-LA Annual Meeting, South Padre Island, November 5–7, 2021
8. Organizing Committee member, the 3rd SIAM TX-LA Annual Meeting (Virtual), October 16–18, 2020
9. Organizing Committee member, the AMS Fall Central Sectional Conference, University of Texas at El Paso, September 12–13, 2020
10. Organizing Committee member, the 2nd SIAM TX-LA Annual Meeting, Southern Methodist University, November 1–3, 2019

11. Organizer, mini-symposium on “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
12. Organizing Committee member, the “36th Annual Texas Partial Differential Equations Conference”, March 2–3, 2013
13. Organizer, mini-symposium on “Coupled and hybrid models and multiple scales in mathematical geosciences” at the SIAM Annual Conference, 2012
14. Session chair, session on “Geomechanics and thermal modeling,” SIAM Geoscience conference, Long beach, March 2011
15. Workshop organizer, “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

## **Mentorship**

### **Ph.D. Students Supervised**

1. Cesar Vazquez (Data Science Program, co-advised with Amy Wagler), Fall 2022 – Fall 2025
2. Nathanael McNair (Computational Science Program), Spring 2024 – Present
3. Paul Delgado (Computational Science Program, co-advised with Vinod Kumar), completed in May 2013, current employment: Senior engineer at Sandia National Laboratories, Albuquerque, NM
4. Maranda Bean (Computational Science Program), completed in December 2018, current employment: Research scientist at Ball Aerospace, Albuquerque, NM

### **Master’s Students Supervised**

1. Nehor Some (Mathematics), Fall 2025 – Present
2. Jeff Amponsah (Mathematics), completed in May 2025, current employment: Metz Middle School, Manassas, VA
3. Nathaniel Konu (Mathematics), completed in May 2020, current employment: senior GRC engineer at Clario, Philadelphia, PA (remote work)
4. Sumi Dey (Mathematics), completed in December 2015, current employment: AI systems integration manager, Schneider Electric, Rueil-Malmaison, Paris (remote work)

### **Postdoctoral Researchers Supervised**

1. Hyun-Geun Shin, funding support by DOE grant DE-SC0024703, Fall 2025 – Present
2. Nana Mbroh, funding support by DOE grant DE-SC0024703, Fall 2025
3. Hemanta Kunwar, funding support by DOE grant DE-SC0024703, Spring 2024–Spring 2025, current position: Assistant Professor at Embry-Riddle Aeronautical University, Daytona Beach, FL

## Teaching at UTEP

- Calculus I & II (MATH 1411, 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)
- Computational Science Dissertation Seminar (CPS 6195, CPS 6185)

## University and Professional 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, Student 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, CPS Ph.D. Qualifying Exam Committee, Summer 2010 – Spring 2025
- Member, CPS Admission Committee, Fall 2013 – Fall 2018
- Member, College of Science Graduate Curriculum Committee, Fall 2011 – Spring 2014

### University Service

- Council member, representing College of Science, Provost's 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**

- Panelist, NSF grant proposal review panel, 2025, 2024, 2021, 2015
- 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, 2021–2023
- Board member (Treasurer), SIAM TX-LA Section, 2019–2021
- 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

### **Honors and Awards**

- University Faculty Marshal, UTEP Fall Commencement, December 2024
- UTEP Faculty Development Leave Award, Fall 2024
- College of Science Faculty Marshal for Students at the UTEP Fall Commencement, December 2013
- The Association for Women in Mathematics (AWM) Travel Award, 2010
- Society for Industrial and Applied Mathematics (SIAM) Early Career Travel Award, 2007
- Outstanding Graduate Instructor, Department of Mathematics, Purdue University, 2005

### **Professional Memberships**

- Society for Industrial and Applied Mathematics (SIAM)
- American Mathematical Society (AMS)
- The International Society for Porous Media (InterPore)
- Korean-American Scientists and Engineering Association (KSEA)