

# Curriculum Vitae

Son-Young Yi

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## 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

**Associate Professor**, University of Texas at El Paso Sept. 2015 – Present

**Assistant Professor**, University of Texas at El Paso Sept. 2009 – Aug. 2015

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

## Research Interests

- Numerical methods for partial differential equations (FEM, FDM)
- Flow and transport in porous media
- Computational solid mechanics
- Homogenization and multiscale analysis

**Publications (\* indicates student author)**

- [1] S.-Y. Yi, S. Lee, and L. Zikatanov, *Locking-free enriched Galerkin method for linear elasticity*, SIAM Journal on Numerical Analysis, in press, 2021.
- [2] S.-Y. Yi, X. Hu, S. Lee, J. H. Adler, and L. Zikatanov, *An enriched Galerkin method for the Stokes equations*, arXiv:2110.05310 [math.NA], 2021.
- [3] S.-Y. Yi and K. Lee, *Numerical study for European option pricing equations with non-Lévy jumps*, Applicable Analysis, vol. 100, no. 7, pp. 1454 – 1470, 2021.
- [4] Y. Jeon and S.-Y. Yi, *The immersed interface hybridized difference method for parabolic interface problems*, in review, 2020.
- [5] 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, 2019.
- [6] S.-Y. Yi, *A lowest-order weak Galerkin method for linear elasticity*, Journal of Computational and Applied Mathematics, vol. 350, pp. 286–298, 2019.
- [7] 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.
- [8] 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.
- [9] 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
- [10] 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.
- [11] 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.
- [12] 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.
- [13] 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.

- [14] 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.
- [15] 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.
- [16] 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.
- [17] 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.
- [18] 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.
- [19] S.-Y. Yi, M. Pezyska, 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.
- [20] M. Pezzyńska, R. E. Showalter, and S.-Y. Yi, *Homogenization of a pseudoparabolic system*, Applicable Analysis, vol. 88, no. 9, pp. 1265–1282, 2009.
- [21] M. Pezzyńska 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
- [22] 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.
- [23] 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. PI: Son-Young Yi  
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).
2. PI: Chuan Xiao, Co-PI: Son-Young Yi  
College of Science Research Enhancement Fund, “Visualization and Analysis of Giant Virus Structure,” (01/01/2015–07/31/2015).

3. PI: Son-Young Yi  
The University Research Institute(URI) grant, “Development, analysis and implementation of numerical methods for flow in deformable porous media, ” (01/01/2011–12/31/2011).
4. PI: Małgorzata Peszyńska, Co-PI: Son-Young Yi  
National Science Foundation, DMS 0707562, “Modeling, Analysis and Simulation of Multi-scale Nonlinear Systems: Workshop at Oregon State University,” (05/01/2007–04/30/2008).
5. PI: Ralph Showalter, Co-PI: Małgorzata Peszyńska, Senior Personnel: Son-Young Yi  
Department of Energy, Office of Science, Multiscale Mathematics Initiative Project 98089, “Modeling, Analysis, and Simulation of Multiscale Preferential Flow,” (08/15/2005–08/14/2008).

## Teaching Experience

### Courses taught at the University of Texas at El Paso

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

## Graduate Student Supervision and Committee Participation

### Doctoral Degrees Supervised

1. Maranda Bean (Computational Science Program), December 2018
2. Paul Delgado (Computational Science Program, Primary advisor: Vinod Kumar), May 2013

### **Master's Degrees Supervised**

1. Nathaniel Konu (Mathematics), May 2020
2. Sumi Dey (Mathematics), December 2015
3. Maranda Bean (Mathematics), December 2012
4. Paul Delgado (Computational Science Program, Primary advisor: Vinod Kumar), July 2013

### **Membership on Ph.D. Committees**

1. Jose Avila (Electrical Engineering, Advisor: Raymond Rumpf), current
2. James Adams (Mechanical Engineering, Advisor: Jack Chessa), December 2020
3. Kai Zhao (Mechanical Engineering, Advisor: Jack Chessa), December 2014

### **Membership on Master's Committees**

1. Julio Solis (Computational Science Program, Advisor: Natasha Sharma), Aug. 2018
2. Mohammad Arifur Rahman (Mathematical Sciences, Advisor: Natasha Sharma), Aug. 2016
3. Jose Avila (Electrical Engineering, Advisor: Raymond Rumpf), May 2016
4. Todd Dorethy (Computational Science Program, Advisor: Vinod Kumar), May 2014
5. Snigdha Mudunuri (Computer Science, Advisor: Shirley Moor), May 2014

### **Invited (with financial support) and Contributed Presentations**

1. "A locking-free enriched Galerkin method for linear elasticity," The 4th SIAM TX-LA Section Annual Meeting, South Padre Island, November 7, 2021.
2. "Locking-free and locally conservative enriched Galerkin methods for poroelasticity," SIAM Conference on Mathematical & Computational Issues in the Geosciences, June 23, 2021
3. (Invited) "Locking-free and locally conservative enriched Galerkin methods for poroelasticity," Applied and Computational Mathematics Seminar, Oregon State University, April 9, 2021
4. "Locking in Poroelasticity: Causes and Remedies," KSCSE Spring conference, Seoul National University, Korea, May 23–24, 2019
5. "Weak Galerkin method for linear elasticity," KSIAM Spring conference, Yonsei University, Korea, May 17–18, 2019
6. (Invited) "A weak Galerkin method for linear elasticity," Mathematics Colloquium, Florida State University, April 26, 2019

7. (Invited) “Locking in Poroelasticity: Causes and Remedies,” SIAM Geosciences conference, Erlangen, Germany, September 11-14, 2017
8. (Invited) “Locking in Poroelasticity: Causes and Remedies,” Applied Mathematics Seminar, Colorado State University, April 13, 2017.
9. “Locking in Poroelasticity: Causes and Remedies,” Finite Element Rodeo, University of Houston, March 4, 2017.
10. (Invited) “A block-diagonal preconditioner for a four-field mixed finite element method for Biot’s equations,” MAFELAP 2016, Brunel University London, July 14, 2016.
11. (Invited) “A four-field mixed finite element method for the Biot model and its solution algorithms”, From the Continuum to the Tectonic: the Magma/Mantle Dynamics of Planet Earth, Isaac Newton Institute for Mathematical Sciences, Cambridge, UK, July 8, 2016.
12. (Invited) “A four-field mixed finite element method for the Biot model and its solution algorithms,” NIMS Applied Mathematics Seminar, Korea National Institute of Mathematical Sciences, Daejeon, Korea, October 13, 2015.
13. (Invited) “Overcoming locking in poroelasticity,” NIMS Applied Mathematics Seminar, Korea National Institute of Mathematical Sciences, Daejeon, Korea, October 12, 2015.
14. (Invited) “Locking-free mixed finite element method for the Biot model”, 2015 International Congress on Industrial and Applied Mathematics (ICIAM), Beijing, China, August 10, 2015.
15. (Invited) “Iterative coupling algorithms for Biot’s consolidation model”, AMS Spring Central Sectional Meeting, Texas Tech University, Lubbock, April 12, 2014.
16. “Iteratively coupled mixed finite element methods for Biot’s model”, Finite Element Rodeo, University of Texas at Austin, March 1, 2014.
17. “An Immersed Interface Method for a 1D Poroelasticity Problem with Discontinuous Coefficients”, SIAM Conference on Mathematical & Computational Issues in the Geosciences, University of Padova, Italy, June 17–20, 2013.
18. “A mixed finite element method for Biot’s consolidation model”, 13th Joint NMSU/UTEP Workshop, NMSU, April 6, 2013.
19. “A Mixed Finite Element Method for Linear Poroelasticity”, Finite Element Circus & Rodeo, LSU, March 8–9, 2013.
20. (Invited) “A Mixed Finite Element Framework for the Biot Model in Poroelasticity,” 2012 SIAM Annual meeting, Minneapolis, July 10, 2012.
21. “A Locking-Free Numerical Method for Poroelasticity”, 4th International Conference on Porous Media & Annual Meeting of the International Society for Porous Media, May 15, 2012.

22. “Mixed Finite Element Method for Coupled Flow and Geomechanics”, Mathematics Colloquium, UTEP, April 13, 2012.
23. “A Mixed Finite Element Framework for Biot’s Consolidation Model”, Finite Element Rodeo, Rice University, March 2, 2012.
24. “Numerical Upscaled Model of Flow and Transport with Non-Separated Scale”, the 10th Joint UTEP/NMSU Workshop on Mathematics, Computer Science, and Computational Sciences, UTEP, El Paso, TX, November 5, 2011.
25. “Numerical modeling and methods for some applications in porous media”, CPS Graduate Seminar, UTEP, El Paso, TX, September 28, 2011.
26. “A Nonconforming Mixed Finite Element Method for Poroelasticity”, the 7th International Congress on Industrial and Applied Mathematics - ICIAM 2011, Vancouver, BC, Canada, July 22, 2011.
27. “Numerical Method for Poroelasticity Based on a Coupling of Nonconforming and Mixed Finite Element Methods”, SIAM Conference on Mathematical & Computational Issues in the Geosciences, Long Beach, CA, March 22, 2011.
28. “Numerical upscaled model of transport with non-separated scales”, XVIII International Conference on Computational Methods in Water Resources, Barcelona, Spain, June 24, 2010.
29. (Invited) “Non-uniform Particle Size Explains Reduction in Filtration Rates with Transport Distance in Porous Media”, Applied Mathematics and Computational Seminar, Oregon State University, Nov. 6, 2009.
30. (Invited) “Flow with dynamic capillary pressure over multiple scales”, Applied Mathematics Seminar, New Jersey Institute of Technology, April 9, 2009.
31. (Invited) “Flow with dynamic capillary pressure over multiple scales”, CPS Colloquium, University of Texas at El Paso, March 12, 2009.
32. “Numerical methods for unsaturated flow with dynamic capillary pressure in heterogeneous porous media”, XVII International Conference on Computational Methods in Water Resources, San Francisco, July 7, 2008.
33. “Numerical methods for saddle point problems”, Applied Mathematics and Computation Seminar, Oregon State University, May 25, 2008.
34. “Comparison of numerical methods for unsaturated flow with dynamic capillary pressure”, Applied Mathematics and Computation Seminar, Oregon State University, Oct. 19, 2007.
35. “Modeling preferential flow in subsurface”, US Congress on Computational Mechanics, San Francisco, July 23–26, 2007 (joint with M. Peszyńska and R. E. Showalter).
36. “Numerical modeling of unsaturated flow with dynamic capillary pressure”, Multiscale Workshop at Oregon State University, June 26, 2007.

37. “Multidimensional, Locally Conservative, Eulerian-Lagrangian Finite Element Methods for a Semilinear Parabolic Equation”, SIAM Conference on Mathematical and Computational Issues in the Geosciences”, Santa Fe, Mar. 21, 2007.
38. (Invited) “Nonconforming Mixed Finite Element Methods for Linear Elasticity”, Applied Mathematics and Computation Seminar, Oregon State University, Feb. 2, 2007.
39. “Multidimensional, Locally Conservative Eulerian-Lagrangian Finite Element Methods for a Semilinear parabolic equation”, Applied Mathematics and Computation Seminar, Oregon State University, Feb. 24, 2006.
40. “Nonconforming Mixed Finite Element Method for Linear Elasticity”, Computational Applied Mathematics Seminar, Purdue University, Nov. 19, 2004.
41. “Nonconforming Mixed Finite Element Method for Linear Elasticity Using Rectangular Elements”, Finite Element Circus, University of Pittsburgh, Apr. 16, 2004.

## Service

### Departmental Service

- Director, Graduate Certificate Program in Applied and Computational Mathematics, Fall 2016 – Present
- Chair, MATH Undergraduate Program Assessment Committee, 2019 - 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

- Faculty senator, UTEP Faculty Senate, Fall 2014 – Summer 2016
- Faculty advisor, SIAM Student Chapter, Spring 2012 – Spring 2015

### Professional Service

- Member, Organizing committee for the 4th SIAM TX-LA Annual Meeting, South Padre Island, November 5–7, 2021
- Mentor, Korean-American Women in Science and Engineering (KWise) global mentoring program, May 2021 – November 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, 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**

- College of Science Faculty Marshal for Students for the December 2013 UTEP Commencement ceremony, 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)