Xianyi Zeng

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Research Interests

- Numerical methods for PDEs and SDEs, numerical analysis.
- Hyperbolic conservation laws and free boundary problems.
- Computational fluid dynamics, computational solid mechanics, and multiphysics problems.
- Mathematical and numerical modeling of tumor growth.
- Scientific computing and high performance computing.

Academic Appointment

08/2016 - present	Assistant Professor (tenure-track) Department of Mathematical Sciences Computational Science Program **University of Texas at El Paso**, El Paso, TX, USA.
10/2012 - 07/2016	Postdoctoral Associate Department of Civil and Environmental Engineering **Duke University**, Durham, NC, USA.

Education

09/2006 - 06/2012	Ph.D., Computational Mathematics. Institute for Computational and Mathematical Engineering. Advisor: Charbel Farhat. Co-advisors: George Papanicolaou, Adrian Lew. **Stanford University**, Stanford, CA, USA.
09/2007 - 04/2010	M.S., Financial Mathematics. Department of Statistics. **Stanford University**, Stanford, CA, USA.
09/2002 - 06/2006	B.S., Mathematics. School of Mathematical Sciences. **Peking University**, Beijing, China.

Honors & Awards

2015	Travel award, 13rd US National Congress on Computational Mechanics.
2011	Finalist, 3rd BGCE Student Paper Prize, organized by SIAM CS&E.
2006-2009	Stanford Graduate Fellowships in Science and Engineering.
2002-2006	Hong Kong Mingde Fellowship at Peking University.
2002	Gold Medal in International Mathematical Olympiad, Glasgow, Scotland.
2002	Gold Medal in Mathematical Olympiad in China, Shanghai, China.
2001	Gold Medal in National Bulgarian Mathematical Olympiad, Sofia, Bulgaria.

Publications

* indicates a student.   † a copy is included in the package.

1. B. Niu, **X. Zeng**, T. A. Phan, F. Szulzewsky, S. Holte, E. C. Holland, and J. P. Tian
   Mathematical modeling of PDGF-driven glioma reveals the dynamics of immune cells infiltrating into tumors. *Neoplasia* 22 (2020) 323–332.
   https://doi.org/10.1016/j.neo.2020.05.005

$2^\dagger$. **X. Zeng**, Mashriq A. Saleh*, and Jianjun P. Tian

On finite volume discretization for infiltration dynamics in tumor growth models. *Adv. Comput. Math.* 45 (2019) 3057–3094.
https://doi.org/10.1007/s10444-019-09727-4

$3^\dagger$. **X. Zeng**

Linear hybrid-variable methods for advection equations. *Adv. Comput. Math.* 45 (2019) 929–980.
https://doi.org/10.1007/s10444-018-9647-z

$4^\dagger$. **X. Zeng**, K. Li, and G. Scovazzi

An ALE/embedded boundary method for two-material flow simulations. *Comput. Math. Appl.* 78 (2019) 335–361.
https://doi.org/10.1016/j.camwa.2018.05.002

$5^\dagger$. **X. Zeng**, G. Scovazzi, N. Abboud, O. Colomés Gene, and S. Rossi

A dynamic variational multiscale method for viscoelasticity using linear tetrahedral elements. *Int. J. Num. Meth. Eng.* 112 (2017) 1951–2003.
https://doi.org/10.1002/nme.5591

6. G. Scovazzi, T. Song, and **X. Zeng**

A velocity/stress mixed stabilized nodal finite element for elastodynamics: Analysis and computations with strong and weak boundary conditions. *Comput. Methods Appl. Mech. Eng.* 325 (2017) 532–576.
https://doi.org/10.1016/j.cma.2017.07.018

7. A. Main, **X. Zeng**, P. Avery, and C. Farhat

An enhanced FIVER method for multi-material flow problems with second-order convergence rate. *J. Comput. Phys.* 329 (2017) 141–172.
https://doi.org/10.1016/j.jcp.2016.10.028

$8^\dagger$. **X. Zeng**

A General Approach to Enhance Slope Limiters in MUSCL Schemes on Non-Uniform Rectilinear Grids. *SIAM J. Sci. Comput.* 38 (2016) A789–A813.
https://doi.org/10.1137/140970185

$9^\dagger$. **X. Zeng** and G. Scovazzi

A variational multiscale finite element method for monolithic ALE computations of shock hydrodynamics using nodal elements. *J. Comput. Phys.* 315 (2016) 577–608.
https://doi.org/10.1016/j.jcp.2016.03.052

10. G. Scovazzi, B. Carnes, **X. Zeng**, and S. Rossi

A simple, stable and accurate tetrahedral finite element for transient, nearly incompressible, linear and nonlinear elasticity: A dynamic variational multiscale approach. *Intl. J. Num. Meth. Eng.* 106 (2016) 799–839.
https://doi.org/10.1002/nme.5138

11. **X. Zeng** and G. Scovazzi

A frame-invariant vector limiter for flux corrected nodal remap in arbitrary Lagrangian–Eulerian flow computations. *J. Comput. Phys.* 270 (2014) 753–783.
https://doi.org/10.1016/j.jcp.2014.03.054

12. **X. Zeng**

A High-Order Hybrid Finite Difference-Finite Volume Approach with Application to Inviscid Compressible Flow Problems: A Preliminary Study. *Comput. Fluids* 98 (2014) 91–110.
https://doi.org/10.1016/j.compfluid.2014.02.007

13. **X. Zeng** and C. Farhat

    A Systematic Approach for Constructing Higher-Order Immersed Boundary and Ghost Fluid Methods for Fluid-Structure Interaction Problems. *J. Comput. Phys.* 231 (2012) 2892–2923.
    `https://doi.org/10.1016/j.jcp.2011.12.027`

Manuscripts Submitted

* indicates a student.   † a copy is included in the package.

1†. **X. Zeng** and Md M. Hasan*

   On the stability of explicit finite difference methods for advection-diffusion equations.
   `https://arxiv.org/abs/2006.07799`

Manuscripts in Progress

* indicates a student.

1. Md M. Hasan* and **X. Zeng**

   A spectral-like central compact hybrid-variable method for hyperbolic equations.

2. Md M. Hasan* and **X. Zeng**

   Padé type low-pass, conservative, and high-order accurate filters using hybrid variables and compact stencil.

3. **X. Zeng**, M. Ricchiuto, T. Song, and G. Scovazzi

   The shifted boundary method for compressible Euler flows.

4. E. N. Karatzas, G. Stabile, **X. Zeng**, G. Scovazzi, and G. Rozza

   A reduced-order shifted boundary method for shallow water equations in parameterized geometries.

5. G. D. Acheampong*, J. P. Tian, and **X. Zeng**

   Analysis of a free-boundary problem for infiltration dynamics in tumor growth models.

6. **X. Zeng**, G. D. Acheampong*, and Jianjun Paul Tian

   A second-order segregated-flux finite volume method for infiltration dynamics in tumor growth models.

7. **X. Zeng**

   Coupling embedded-boundary and ALE methods for solid-liquid-gas interactions.

8. **X. Zeng**, B. Niu, and J. P.. Tian

   A mathematical model on tumor growth regulated by OPN and immune effect.

9. **X. Zeng**

   Stability barrier of optimally accurate hybrid-variable schemes.

Grants

1. Program: Collaboration Grants for Mathematicians.
   Source: Simons Foundation.
   Title: *Advanced computational methods for complex multi-physics systems*.
   Amount: $42,000.
   Duration: 09/2021-08/2026.
   Status: Funded.

2. Program: Launching Early-Career Academic Pathways in the Mathematical and Physical Sciences.
   Source: National Science Foundation.
   Title: *LEAPS-MPS: Computational Methods for Many-Physics Problems Involving Multi-Material Flows.*
   Amount: $245,654.
   Duration: 01/2022-12/2023.
   Status: Recommended for funding.

Teaching and Advising

Instructor, University of Texas at El Paso, El Paso, TX, USA

MATH1312	*Calculus II.* 2020 Spring.	
MATH3323	*Matrix Algebra.* 2018 Spring.	
MATH3335	*Applied Analysis I.* 2018 Fall, 2019 Fall, 2020 Fall.	
MATH4336	*Applied Analysis II.* 2019 Spring, 2020 Spring, 2021 Spring.	
MATH5330	*Computational Methods of Linear Algebra.* 2017 Spring, 2019 Spring.	
MATH5343	*Numerical Solutions to PDEs.* 2021 Spring.	
CPS5195	*Interdisciplinary Graduate Seminar.* 2017 Spring.	
CPS5401	*Introduction to Computational Science.* 2016 Fall, 2017 Fall, 2018 Fall, 2019 Fall, 2020 Fall.	

Graduate advisor, University of Texas at El Paso, El Paso, TX, USA

Doctoral	Md Mahmudul Hasan.
Master's	Gilbert Acheampong (graduated), Mashriq Saleh (graduated), Pratik Baral (graduated).

Conference Presentations

1. 16th US National Congress on Computational Mechanics, Chicago, IL. July 2021.
2. SIAM Texas-Louisiana Annual Meeting, College Station, TX. October 2020.
3. Joint Mathematics Meeting, Denver, CO. January 2020.
4. SIAM Texas-Louisiana Annual Meeting, Dallas, TX. November 2019.
5. SIAM Conference on Computational Science and Engineering, Spokane, WA. February 2019.
6. 13th World Congress on Computational Mechanics, New York City, NY. July 2018.
7. International Conference on Numerical Methods for Multi-Material Fluid Flows, Santa Fe, NM. September 2017.
8. 14th US National Congress on Computational Mechanics, Montreal, Canada. July 2017.
9. The 20th Joint NMSU/UTEP Workshop on Mathematics, Las Cruces, NM. April 2017.
10. Finite Element Rodeo, University of Houston, Houston, TX. March 2017.
11. SIAM Conference on Computational Science and Engineering, Atlanta, GA. March 2017.
12. SIAM Annual Meeting, Boston, MA. July 2016.
13. 13th US National Congress on Computational Mechanics, San Diego, CA. July 2015.
14. SIAM Conference on Computational Science and Engineering, SLC, UT. March 2015.
15. 11th World Congress on Computational Mechanics, Barcelona, Spain. July 2014.
16. SIAM Annual Meeting, Chicago, IL. July 2014.
17. 12th US National Congress on Computational Mechanics, Raleigh, NC. July 2013.
18. 21st AIAA Computational Fluid Dynamics Conference, San Diego, CA. June 2013.
19. 11th US National Congress on Computational Mechanics, Minneapolis, MN. July 2011.
20. 20th AIAA Computational Fluid Dynamics Conference, Honolulu, HI. June 2011.
21. SIAM Conference on Computational Science and Engineering, Reno, NV. February 2011.

Invited Talks

1. Lehigh University, Bethlehem, PA. November 2018.
2. University of Texas at El Paso, El Paso, TX. September 2018.
3. New Mexico State University, Las Cruces, NM. April 2018.
4. Huazhong University of Science and Technology, Wuhan, China. May 2017.
5. The University of Texas at El Paso, El Paso, TX. February 2016.
6. Old Dominion University, Norfolk, VA. September 2015.
7. Huazhong University of Science and Technology, Wuhan, China. May 2015.
8. University of Nebraska–Lincoln, Lincoln, NE. March 2015.
9. University of Southern California, Los Angeles, CA. February 2015.
10. Duke University, Durham, NC. February 2014.
11. Argonne National Laboratory, Chicago, IL. December 2012.

Services

Conference session organizer

Joint Mathematics Meetings (2020). *SIAM Conference on Computational Science and Engineering* (2017, 2019). *AIAA Computational Fluid Dynamics Conference* (2013).

Invited reviewer

Journal of Computational Physics. Mathematical Modeling and Numerical Analysis. Applied Mathematics and Computations. Computers and Fluids. International Journal for Numerical Methods in Fluids. International Journal for Numerical Methods in Engineering. Engineering Optimization.

Departmental service

Faculty senate. Data science Ph.D. admission committee. Data science program committee. Applied mathematics MS track committee. Actuarial science program committee. Graduate study committee. Faculty advisor of Math Club Zero. Faculty search committees.