Cuiyu He

Contact Information

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Appointments

Aug. 2022 –Current	**Tenure-Track Assistant Professor** Department of Mathematics, Oklahoma State University	
Sep. 2021 –July 2022	**Tenure-Track Assistant Professor** School of Math. and Stat. Sciences, University of Texas Rio Grande Valley	
Jul. 2019 –Jun. 2021	**Limited Term Assistant Professor** Department of Mathematics, University of Georgia	
Jul. 2019 –Jul. 2021	**Honorary Research Fellow** Department of Mathematics, University College London	
Oct. 2017 –Jul. 2019	**Postdoctoral Researcher** Department of Mathematics, University College London	Mentor: Prof. E. Burman
May. 2016 –Aug 2016	**Summer Intern** Lawrence Livermore National Laboratory	Mentor: Dr. T. Kolev

Education

Aug. 2010 –Aug. 2017	Purdue University **Ph.D. Mathematics**	Mentor: Prof. Z. Cai
May. 2015 –Jul. 2017	Purdue University **Graduate Certificate, Applied Statistics**	
Dec. 2006 –Jun. 2010	Dalian University of Technology **B.S. Mathematics**	

Fundings

- AMS Simons Travel Grant ($5000) 2020-2022
- AIM SQuaRE Workshop 2021-2023
- UGA seed grant "Teaming for Interdisciplinary Research" 2020-2021
- Travel Grant for International Conference on Current Trends... Jul. 2017
- Travel Grant for Joint Mathematics Meeting Jan. 2017
- Purdue Research Foundation (PRF) Research Grant Jun. 2015–May 2016
- Finite Element Circus Travel Grant Apr. 2016
- SIAM CSE15 Travel Grant Mar. 2015
- Purdue Graduate School Summer Research Grant May 2014–Aug. 2014
- Purdue Graduate School Summer Research Grant May 2013–Aug. 2013
- T.T. Moh Graduate Scholarship Fund Aug. 2010

Fundings (Pending)

- (pending) NSF-DMS: Adaptive Unfitted Finite Element Methods for Interface Partial Differential Equations ($277,425).
- (pending) J&J WiSTEM2D Scholars Award: Topology/Structure Optimization through the Integration of the Classical and Machine Learning
- (pending) Travel Support for Mathematicians-MPS-TSM-2023: Adaptive Unfitted Finite Element Methods for Interface Partial Differential Equations. ($36750).
- (pending) 2024 Arts and Sciences Research (ASR) Program (Summer Salary).

Research interests

- Applied and Computational Mathematics
- Numerical analysis; Numerical PDE; Finite element methods
  - Adaptive finite element methods and a posteriori error estimation
  - Unfitted Finite Element Methods and their applications
- Topology (structure) optimization and inverse shape identification
- Machine learning methods
- Interdisciplinary biomath applications

Publications (* indicates corresponding author)

1. Z.Wilson A., **C. He**, and B. A. Zambrano-Luna, p-Adic Statistical Field Theory and Convolutional Deep Boltzmann Machines (accepted), **Progress of Theoretical and Experimental Physics (2023)**, https://doi.org/10.1093/ptep/ptad061.
2. **C. He***, S. Zhang, and X. Zhang, Error Analysis of Petrov Galerkin immersed Finite Element Methods, **Computer Methods in Applied Mechanics and Engineering**, **(2022)**, https://doi.org/10.1016/j.cma.2022.115744
3. P. Oliva, Y. Wu, **C. He** and H. Ni, *Towards fast weak adversarial training to solve high dimensional parabolic partial differential equations using XNODE-WAN*, **Journal of Computational Physics**, **(2022)**. https://doi.org/10.1016/j.jcp.2022.111233
4. **C. He***, X. Hu, and L. Mu, *A Mesh-free Method Using Piecewise Deep Neural Network for Elliptic Interface Problems*, **Journal of Computational and Applied Mathematics (2022)**, accepted. https://doi.org/10.1016/j.cam.2022.114358
5. S. Bertoluzza, E. Burman, and **C. He***, *An a posteriori error estimate of the outer normal derivative using dual weights*, **SIAM J. Numer. Anal. (2021)**. https://doi.org/10.1137/20M1358219
6. D. Capatina, **C. He***, *Flux recovery for Cut finite element method and its application in a posteriori error estimation*, **ESAIM: Mathematical Modelling and Numerical Analysis (2021)**. https://doi.org/10.1051/m2an/2021071
7. E. Burman, **C. He***, and M. G. Larson, *Comparison of Shape Derivatives using CutFEM for Ill-posed Bernoulli Free Boundary Problem*, **Journal of Scientific Computing (2021)**. https://doi.org/10.1007/s10915-021-01544-6.

8. Z. Cai, **C. He*** and S. Zhang, *Generalized Prager-Synge Inequality and Equilibrated Error Estimators for Discontinuous Elements*, **Computational and Applied Mathematics (2021)**. https://doi.org/10.1016/j.cam.2021.113673.

9. **C. He**, W. Hu, and L. Mu, *Optimal Control of Convection-Cooling and Numerical Implementation*, **Computers and Mathematics with Applications (2021)**. https://doi.org/10.1016/j.camwa.2021.03.020.

10. E. Burman, **C. He*** and M. Larson, *A posteriori error estimates for cut finite element method with boundary value correction*, **IMA Journal of Numerical Analysis, 2020**, draa085. https://doi.org/10.1093/imanum/draa085

11. Z. Cai, **C. He*** and S. Zhang, *Improved ZZ a posteriori error estimators for diffusion problems: Discontinuous elements*, **Applied Numer. Math., (2020).** https://doi.org/10.1016/j.apnum.2020.09.005

12. E. Burman and **C. He**, *Primal dual mixed finite element method for advection–diffusion problem*, **SIAM J. Numer. Anal. 57(2019)**, 2785–2811. https://doi.org/10.1137/18M1221473

13. **C. He*** and X. Zhang, *Residual based a posteriori error estimations for immersed finite element methods*, **Journal of Scientific Computing (2019)**: 1-29. https://doi.org/10.1007/s10915-019-01071-5

14. Z. Cai, **C. He**, and S. Zhang, *Residual-based a posteriori error estimate for interface problems: nonconforming linear elements,* **Math. Comp., 86(2017)**, 617-636. https://doi.org/10.1090/mcom/3151

15. Z. Cai, **C. He**, and S. Zhang, *Discontinuous finite element methods for interface problems: robust a priori and a posteriori error estimates*, **SIAM J. Numer. Anal., 55(2017)**, 400-418. https://doi.org/10.1137/16M1056171

16. Z. Cai, **C. He**, and S. Zhang, *Improved ZZ a posteriori error estimators for diffusion problems: conforming linear elements*, **Comput. Methods Appl. Mech. Engrg., 313(2017)**, 433-449. https://doi.org/10.1016/j.cma.2016.10.006

Submitted Manuscript(s)

1. C. Capatina., A. Gouasmi and **C. He**, Robust flux reconstruction and a posteriori error analysis for an elliptic problem with discontinuous coefficients, submitted (2023).

2. X. Xie, Y. Wu, H. Ni and **C. He***, NODE-ImgNet: a PDE-informed effective and robust model for image denoising, submitted (2023).

3. S. Bertoluzza, E. Burman, and **C. He***, Best approximation results and essential boundary conditions for novel types of weak adversarial network discretizations for PDEs. arXiv preprint arXiv:2307.05012 (2023).

Teaching

University of Georgia

F. 2020 Instructor MA 2250 (Calculus I)

Oklahoma State University

S. 2023 Instructor MA 4553/5503 (Intro. to Optimization)
F. 2022 Instructor MA 2153 (Calculus II)

UT Rio Grande Valley

S. 2022	Instructor **(Evaluation)**	Stat 3337 (Probability & Statistics)
S. 2022	Instructor **(Evaluation)**	Stat 1342 (Elementary Statistical Methods)
F. 2021	Instructor **(Evaluation)**	MA 3326 (Math History)
F. 2021	Instructor **(Evaluation)**	Stat 1342 (Elementary Statistical Methods)

University of Georgia

F. 2020	Instructor **(Evaluation)**	MA 2250 (Calculus I)
F. 2019	Instructor **(Evaluation)**	MA 2250 (Calculus I)

University College London

S. 2018	Instructor **(Evaluation)**	MA 6202 (Mathematics for Physics and Astronomy)

Purdue University

S. 2017	Instructor	MA 158 (Pre-Calculus)
F. 2014	Grader	MA 527 (Advanced Math for Engineer and Physics I)
S. 2014	Grader	MA 528 (Advanced Math for Engineer and Physics II)
F. 2013	Recitation	MA 261 (Multivariate Calculus)
S. 2013	Grader	MA 615 (Numerical PDEs)
F. 2012	Recitation	MA 162 (Calculus II)
S. 2012	Recitation	MA 174 (Multivariable Calculus)
F. 2011	Recitation	MA 181 (Honors Calculus I)

Presentations

1. *Equilibrate flux recovery for Cut FEM and Its Applications*, 2023 Spring Central Sectional Meeting, the University of Cincinnati, Cincinnati, OH, Apr.. 2023.
2. *Equilibrate flux recovery for Cut FEM and Its Applications*, SIAM Southeastern Atlantic Section Annual Meeting, Blacksburg, VA, Mar. 2023.
3. *Equilibrate flux recovery for Cut FEM and Its Applications*, AWM Research Symposium, University of Minnesota, Twin Cities, MN, Jun. 2022.
4. *Cut Finite Element Method and Its Application in Shape Optimization*, Finite Element Rodeo, Dallas, Mar., 2022.
5. *Finite Element Method and its Applications*, Colloquium talk, Department of Mathematics, Oklahoma State University, Jan., 2022.
6. *Cut Finite Element Method and Its Application in Shape Optimization*, The 4th Annual Meeting of the SIAM Texas-Louisiana Section, South Padre Island, TX, Nov., 2021.
7. *Cut Finite Element Method and Its Application in Shape Optimization*, Oberseminar of Numerical Optimization, Department of Mathematics and Statistics, University Konstanz (Germany), July 2021.
8. *Comparison of Shape Derivatives using CutFEM for ill-posed Bernoulli Free Boundary Problem*, ADMOS 2021 (virtual), June 2021.
9. *A Posteriori error estimation for the outer normal flux with dual weights*, Finite Element Circus (2021 Spring, virtual), Apr. 2021.
10. *Adaptive methods for Cut Finite Element Method, 2021 Georgia Scientific Computing Symposium (GSCS21), University of Georgia, Feb. 2021.*
11. *An a posteriori error estimate of the outer normal derivative using dual weights*, Applied Math Seminar, University of Georgia, Oct. 2020.

12. *Shape optimization methods for ill-posed Bernoulli Problem using CutFEM method*, AMS Fall Central Virtual Sectional Meeting, Sep. 2020.
13. *A Posteriori Error Estimates for Cut Finite Element Method with Boundary Correction*, Applied Math Seminar, University of Groningen (Virtual), May 2020.
14. *A simple improved ZZ a posteriori error estimation for conforming and nonconforming meshes*, Applied Math Seminar, University of Georgia, Mar. 2020.
15. *Shape Optimization using CutFEM*, SIAM SEAS 19, University of Tennessee-Knoxville, Sep. 2019.
16. *Shape Optimization using CutFEM*, Applied Math Seminar, University of Georgia, Sep. 2019.
17. *A Posteriori Error Estimation for CutFEM with Boundary Correction*, ADMOS 19, Alicante, Spain, May 2019.
18. *A Posteriori Error Estimation for CutFEM with Boundary Correction*, SIAM CSE19, Spokane, WA, Feb. 2019.
19. *A Posteriori Error Estimation for CutFEM with Boundary Correction*, Computational Methods for Interface Problems Workshop, UCL, London, UK, Jan. 2019.
20. *Robust A Posterior Error Estimations for Nonconforming Finite Element Methods on Interface Problems*, MSU CAM Seminar, Mississippi State, MS, Aug. 2017.
21. *Robust equilibrated error estimator for diffusion problems: nonconforming elements of odd order* (Poster), International Conference on Current Trends and Challenges in Numerical Solution of Partial Differential Equations, West Lafayette, IN, Jul. 2017.
22. *Robust A Posteriori Error Estimation for NC FEM without QMA*, Purdue SIAM CSESC, West Lafayette, IN, Apr. 2017.
23. *Equilibrated a posteriori error estimation for nonconforming FEM of odd orders*, Finite Element Circus, New Brunswick, NJ, Apr. 2017.
24. *Improved ZZ robust a posteriori error estimation for diffusion problem for conforming FEM*, SIAM Conference on Computational Science & Engineering (CSE17), Atlanta, GA, Mar. 2017.
25. *Improved ZZ a Posteriori error estimation for diffusion problem*, 2nd Annual Meeting of SIAM Central States Section, Little Rock, AR, Oct. 2016.
26. *Robust residual based a posteriori error estimation without QMA*, 2nd Annual Meeting of SIAM Central States Section, Little Rock, AR, Sep. 2016.
27. *MFEM: A posteriori error estimation for arbitrary order FEM* (poster), Summer Student Poster Symposium, LLNL, CA , Aug. 2016.
28. *Robust residual based a posteriori error estimation for nonconforming FEM without QMA*, Finite Element Circus, College Park, MD, Apr. 2016.
29. *A brief picture: Robust a posteriori error estimation for nonconforming finite element methods*, Purdue Math Graduate Research Day, IN, Nov. 2015.
30. *Inverse heat problem: mapping of coarse temperatures from coarser to finer grid using temporal derivatives*, IMA Math Modeling in Industry XIX, University of Minnesota, Twin Cities, MN, Aug. 2015.

31. *A posteriori error estimation for nonconforming finite element methods*, 1st Annual Meeting of SIAM Central States Section, Rolla, MO, Apr. 2015.
32. *Residual based a posteriori error estimation for nonconforming finite element methods*, SIAM CSE15, Salt Lake City, UT, Mar. 2015.
33. *A brief picture: A posteriori error estimation for nonconforming finite element methods*, Purdue Math Graduate Research Day, IN, Nov. 2014.

Academic Services

- Co-organizer of MS "Recent Advances in Numerical PDE for Multi-Physics Problems", 7th Annual Meeting of SIAM Central States Section, Oct. 2022.
- Organizer of MS "Advanced numerical methods for PDEs", SIAM Annual Meeting, July, 2022.
- Organizer of MS "Recent Development in FEM", 4th Annual Meeting of the SIAM Texas-Louisiana Section, TX. Nov., 2021.
- Organizer of the departmental job seminar in the Department of Mathematics, UGA, Nov. 2019.
- Organizer of MS "Finite Element Methods on Unfitted Meshes", SIAM Conference on Computational Sciences and Engineering, Spokane, Feb. 2019.
- Co-organizer of MS "A Posteriori Error Estimation for Various Finite Element Methods", SIAM Conference on Computational Sciences and Engineering, Spokane, Feb. 2019.
- Co-organizer of "Computational Methods for Interface Problems Workshop", University College London, London, UK, Jan. 2019.
- Ph.D. student interview committee, Department of Mathematics, University College London, London, UK, 2018-2019.
- Co-organizer of "Women in Mathematical Sciences Lunch", Department of Mathematics, University College London, London, UK, Jul. 17, 2018.

Programming Skills

Programming Language:	C/C++, Python, Matlab
Finite Element Package:	MFEM, FEniCS
Finite Element Visualization:	GLVis, ParaView
Statistic Software:	SARS (Base Certificate)
High Performance Computing:	OpenMP, MPI, MKL
AI Package:	Pytorch

Last updated August 17, 2023