Yuan Chen

Contact Information

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Education

June 2026 | **The Ohio State University**
Ph.D. in Mathematics

June 2021 | **The George Washington University**
M.S. in Statistics and Mathematics

June 2019 | **Hohai University**
B.E. in Environmental Science

Research Interests

1. Numerical Methods for Partial Differential Eq.s: Finite Element Method
2. Stochastic Methods for Partial Differential Eq.s: Deep Ritz Method, Monte Carlo Method
3. Interface problems: Partial Differential Eq.s with discontinuities coefficients across 'interfaces'
4. Immersed Finite Element Method (IFEM) for interface problems
5. Applications of statistics and economics on environmental problems

Publications

6. **Y. Chen**, and X. Zhang. *Solving Navier-Stokes Interface Problems with Fixed/Moving Interfaces on Unfitted Meshes*, (**2021+**), preprint.

5. **Y. Chen**, S. Hou, and X. Zhang. *Error Estimates for a Partially Penalized Immersed Finite Element Method for Elastodynamic Interface Problems*, (**2021+**), preprint.

4. **Y. Chen**, H. Wang, H. Yan, D. Liang, X. He, and R. Li. *A Novel View to Understand the Spatiotemporal Variation of Nutrients in Urban River Networks from Energy Scale*, (**2021+**), under review.

3. **Y. Chen** and X. Zhang. *A $\mathcal{P}_2$-$\mathcal{P}_1$ Partially Penalized Immersed Finite Element Method for Stokes Interface Problems*, Int. J. Numer. Anal. Mod., 18(**2021**), no. 1, 120-141.

2. **Y. Chen**, S. Hou, and X. Zhang. *A Bilinear Partially Penalized Immersed Finite Element Method for Elliptic Interface Problems with Multi-domains and Triple Junction Points*, Results Appl. Math., 8(**2020**), 100100.

1. **Y. Chen**, S. Hou, and X. Zhang. *An Immersed Finite Element Method for Elliptic Interface Problems with Multi-domain and Triple Junction Points*, Adv. Appl. Math. Mech., 11(**2019**), no. 5, 1005-1021.

Talks and Posters

2. Immersed Finite Element Methods for Interface Problems with Multi-Domains and Triple-Junction Points. **GW Research Day**, The George Washington University, D.C. (April 2020, Online).

1. Immersed Finite Element Methods for Interface Problems with Multi-Domains and Triple-Junction Points. **AMS Southeastern Sectional Meeting**, University of Virginia, VA (March 2020, Cancelled).

Teaching Experiences

George Washington University

Fall 2020 Recitation MATH 1051 (Finite Math for the Social and Management Sciences)

Research Experiences

Nov. 2020 | **Research on High Order IFEM for Stokes Interface Problem on Actual Interface**

Advised by Prof. Xu Zhang

- Constructed an immersed Taylor-Hood $\mathcal{P}_2$-$\mathcal{P}_1$ finite element space according to actual interface using least square construction for stokes interface problems
- Tested approximation capability of the space on numerical examples, both velocity and pressure showed optimal order convergence in $\mathbf{L}_2$ and semi-$\mathbf{H}_1$ norm under moderate and high contrast
- Designed a weak formulation with penalty terms. Extra ghost penalty terms are added to stabilize the scheme, validated optimal convergence rate of this scheme on numerical examples.
- Vectorized program of proposed method, speed up CPU time significantly by NumPy in Python

May 2020 | **Research on Time-dependent Elasticity Interface Problem**

Co-advised by Prof. Xu Zhang and Prof. Songming Hou

- Designed a fully discrete scheme for time-dependent elasticity interface problems based on Partially Penalized Immersed Finite Element Method (PPIFEM)
- Implemented multi-processing programs to verify the proposed scheme on numerical examples, showed optimal order convergence in $\mathbf{L}_2$ and semi-$\mathbf{H}_1$ norm using NumPy, SciPy package in Python
- Proved the unconditional stability for Symmetric case. Completed a-priori error estimation for proposed scheme: proved the optimal convergence of numerical solution in energy norm and $\mathbf{L}^2$ norm under the standard piecewise H^2 regularity assumption of exact solution

Nov. 2019 | **Improved Research on Multi-domain Elliptic Interface Problem**

Advised by Prof. Songming Hou

- Constructed new bilienar IFE functions on elements intersected with multiple interfaces or with triple-junction points to accommodate interface jump conditions.
- Enriched the local approximating spaces by adding up to three local flux basis functions. Verified the Lagrange interpolations converge optimally in L_2, semi-H_1 norm with numerical examples
- Designed a weak formulation with additional penalty terms on both element edges and interface
- Tested optimal order convergence rate of partial penalized IFEM solutions in L_2, semi-H_1 norm without deterioration

Nov. 2018 | **Research on Multi-domain Elliptic Interface Problem**

Advised by Prof. Songming Hou

- Established a immersed finite element space by modifying local basis functions to accommodate interface conditions with multi-domains and triple-junction points
- Enriched proposed space by adding local flux basis functions to handle with the non-homogeneous flux jump interface condition. Verified the Lagrange interpolations converge optimally in L_2, semi-H_1 norm with numerical examples
- Implemented proposed method on three numerical examples using NumPy package in Python to show the optimal order convergence of IFE solutions in L_2 and semi-H_1 norm

Scholarships & Certificates

- GWU Department of Mathematics Award of Graduate Assistantship 2020
- Hohai University Honored Student Scholarship 2016, 2018, 2019
- Hohai University Science & Technology Innovation Scholarship 2019
- Certificate of Honored Achievement in Bayesian Statistics I & II, Coursera online course by UCSC 2018
- Certificate of Achievement in Practical Time Series Analysis, Coursera online course by SUNY 2018
- 3^{rd} Prize of China Undergraduate Mathematical Contest in Modeling 2017

Skills

Programming	C/C++, Python, R, MySQL, LaTeX, VB, Matlab
Vectorization	Python(NumPy), Matlab
Data Analysis	Python (pandas, matplotlib, geopy), R (ggplot, dplyr, tidyr), Qgis, Echarts, D_3, sas
Sci. Computing	Python (NumPy, SciPy, SymPy, multiprocessing), Matlab, Mathematica
Deep Learning	Python (Numpy, PyTorch, TensorFlow)