Sijing Liu

CONTACT INFORMATION

Department of Mathematical Sciences
Worcester Polytechnic Institute, Worcester, MA 01609 sliu13@wpi.edu

RESEARCH INTERESTS

Numerical analysis, Finite element methods, Discontinuous Galerkin methods, Multigrid methods, PDE-constrained optimizations, Optimal control problems, Fluid-structure interaction, Scientific machine learning

EMPLOYMENT

Worcester Polytechnic Institute, Worcester, Massachusetts , USA

Post-doctoral Scholar, August 2024 –

- Mentor: Professor Marcus Sarkis

ICERM, Brown University, Providence, Rhode Island, USA

Institute Postdoc Fellow, August 2023 – June 2024

- Mentor: Professor Johnny Guzmán

University of Connecticut, Storrs, Connecticut, USA

Assistant Research Professor, August 2020 – August 2023

- Mentor: Professor Dmitriy Leykekhman

EDUCATION

Louisiana State University, Baton Rouge, Louisiana, USA

Ph.D., Mathematics, August 2020

- Thesis: *Multigrid Methods for Elliptic Optimal Control Problems*
- Advisor: Professor Susanne C. Brenner

Xiamen University, Xiamen, Fujian, China

M.S., Computational Mathematics, June 2014

- Thesis: *On Time-Stepping Methods For Compressible Navier-Stokes Equations*
- Advisor: Professor Chuanju Xu

Fujian Normal University, Fuzhou, Fujian, China

B.S., Mathematics and Applied Mathematics, June 2011

AWARDS

Travel Awards

- UConn AAUP travel awards, August, 2020-August, 2023
- Math-to-industry Boot Camp IV, IMA June 23-August 02, 2019
- East Coast Optimization Meeting 2019
  George Mason University (NSF supported) April 4-5, 2019
- 2018 NSF-CBMS Conference on Computational Methods in Optimal Control
  Jackson State University (NSF supported) July 23-27, 2018
- Industrial Math/Stat Modeling Workshop for Graduate Students
  SAMSI, NC State (NSF supported) July 16-26, 2017
- Frontiers in PDE-constrained Optimization, IMA June 6-10, 2016

Other Awards

- Institute Postdoctoral Fellowship (NSF supported), ICERM, Brown University, 2023-2024.
- SIAM Certificate of Recognition, for outstanding service and contributions to SIAM LSU student chapter, 2019.
- Special Student Scholarship, Xiamen University, 2011-2014.

PUBLICATIONS ∗: Corresponding Author

Submitted:

1. Sijing Liu and Jinjin Zhang. *Convergence analysis of a balancing domain decomposition method for an elliptic optimal control problem with HDG discretizations*, arXiv:2508.13997, 2025.
2. Sijing Liu* and Jinjin Zhang. *A balancing domain decomposition by constraints preconditioner for a hybridizable discontinuous Galerkin discretization of an elliptic optimal control problem*, arXiv:2504.02072, 2025.

Published:

1. Satyajith Bommana Boyana, Thomas Lewis, Sijing Liu and Yi Zhang, *Convergence Analysis of a Dual-Wind Discontinuous Galerkin Method for an Elliptic Optimal Control Problem with Control Constraints*, Results in Applied Mathematics, 2025.
2. Erik Burman, Rebecca Durst, Miguel Fernández, Johnny Guzmán and Sijing Liu*. *A second-order correction method for loosely coupled discretizations applied to parabolic-parabolic interface problems*, IMA Journal of Numerical Analysis, 2024.
3. Sijing Liu* and Valeria Simoncini. *Multigrid preconditioning for discontinuous Galerkin discretizations of an elliptic optimal control problem with a convection-dominated state equation*, Journal of Scientific Computing, 2024.
4. Satyajith Bommana Boyana, Thomas Lewis, Sijing Liu* and Yi Zhang, *Convergence analysis of novel discontinuous Galerkin methods for a convection dominated problem*, Computers & Mathematics with Applications, 2024.
5. Erik Burman, Rebecca Durst, Miguel Fernández, Johnny Guzmán and Sijing Liu*. *Estimates of discrete time derivatives for the parabolic-parabolic Robin-Robin coupling method*, Numerical Algorithms, 2024.
6. Sijing Liu*. *Robust multigrid methods for discontinuous Galerkin discretizations of an elliptic optimal control problem,* Computational Methods in Applied Mathematics, 2024.
7. Sijing Liu*, Zhiyu Tan and Yi Zhang. *Discontinuous Galerkin methods for an elliptic optimal control problem with a general state equation and pointwise state constraints*, Journal of Computational and Applied Mathematics, 2024.
8. Susanne C. Brenner, Sijing Liu and Li-yeng Sung. *Multigrid methods for an elliptic optimal control problem with pointwise state constraints*, Results in Applied Mathematics, 2023.
9. Susanne C. Brenner, Sijing Liu and Li-yeng Sung. *A P_1 finite element method for a distributed elliptic optimal control problem with a general state equation and pointwise state constraints.*, Computational Methods in Applied Mathematics, 2021.
10. Susanne C. Brenner, Sijing Liu and Li-yeng Sung. *Multigrid methods for saddle point problems: optimality systems*, Journal of Computational and Applied Mathematics, 2020.
11. Samiul Haque, Laszio P. Kindrat, Li Zhang, Vikenty Mikheev, Daewa Kim, Sijing Liu, Jooyeon Chung, Mykhailo Kuian, Jordan E. Massad, and Ralph C. Smith. *Uncertainty-enabled design of electromagnetic reflectors with integrated shape control.* In Behavior and Mechanics of Multifunctional Materials and Composites XII, vol. 10596, p. 105961D. International Society for Optics and Photonics, 2018.

In preparation:

- (with Erik Burman, Miguel Fernandez and Johnny Guzman) *Defect correction for a wave-parabolic interface problem.*
- *Discontinuous Galerkin methods for an elliptic optimal control problem with a convection-dominated state equation and pointwise state constraints.*
- (with Yi Zhang) *Dual-wind discontinuous Galerkin methods for an elliptic optimal control problem with a convection-dominated state equation.*
- (with SeongHee Jeong and Seulip Lee) *EAFE methods for an elliptic optimal control*

problem with a convection-dominated state equation.
- (Maurice Fabien) *A non-overlapping spectral additive Schwarz method for interior penalty discontinuous Galerkin discretizations of anisotropic elliptic problems.*

Special Session Organization

- Recent Advances in Numerical Methods for Partial Differential Equations
  AMS 2025 Spring Eastern Sectional Meeting, Hartford, April 4-5, 2025

Talks

- Multigrid preconditioning for discontinuous Galerkin discretizations of an elliptic optimal control problem with a convection-dominated state equation
  SIAM Texas-Louisiana sectional meeting 2025, Austin, September 27, 2025
- Convergence analysis of novel discontinuous Galerkin methods for a convection dominated problem
  JMM 2025, Seattle, January 9, 2025
- Multigrid preconditioning for discontinuous Galerkin discretizations of an elliptic optimal control problem with a convection-dominated state equation
  JMM 2025, Seattle, January 8, 2025
- A second-order correction method for loosely coupled discretizations applied to parabolic-parabolic interface problems
  CSCDR Seminar, UMass Dartmouth, November 6, 2024
- Multigrid preconditioning for discontinuous Galerkin discretizations of an elliptic optimal control problem with a convection-dominated state equation
  Finite Element Circus Fall 2024, UMBC, October 18-19, 2024
- A second-order correction method for loosely coupled discretizations applied to parabolic-parabolic interface problems
  WPI Department of Mathematical Sciences Colloquium, October 11, 2024
- A second-order correction method for loosely coupled discretizations applied to parabolic-parabolic interface problems
  9th Annual Meeting of the SIAM Central States Section
  University of Missouri-Kansas City, October 5-6, 2024
- Multigrid preconditioning for discontinuous Galerkin discretizations of an elliptic optimal control problem with a convection-dominated state equation
  WPI Numerical Methods Seminar, September 5, 2024
- A second-order correction method for loosely coupled discretizations applied to parabolic-parabolic interface problems
  Finite Element Circus, Brown University, April 20, 2024
- Multigrid Methods,
  Post Doc/Graduate Student Seminar
  ICERM, Brown University, April 9, 2024
- PDE-constrained optimization,
  Post Doc/Graduate Student Seminar
  ICERM, Brown University, March 19, 2024
- Discontinuous Galerkin methods for an elliptic optimal control problem with a general state equation and pointwise state constraints,
  Finite Element Circus, Bridgewater State University, March 17-18, 2023
- An Introduction to Multigrid Methods,
  SIGMA Seminar, University of Connecticut, February 24, 2023
- Robust Multigrid Methods for an Elliptic Optimal Control Problem based on Discontinuous Galerkin Methods,
  JMM 2023, Boston, January 5, 2023
- Multigrid Methods for an Elliptic Optimal Control Problem based on Discontinuous Galerkin Methods,
  Finite Element Circus, Carnegie Mellon University, October 21, 2022
- FEM and Multigrid Methods for Elliptic Optimal Control Problems,

Bridgewater State University Mathematics Seminar, April 28, 2022

- Multigrid Methods for Elliptic Optimal Control Problems,
  UNC Greensboro Applied Mathematics Seminar, November 15, 2021
- A P_1 Finite Element Method for a Distributed Elliptic Optimal Control Problem with a General State Equation and Pointwise State Constraints,
  UNC Greensboro PDE Conference July 24, 2021
- Multigrid Methods for Elliptic Optimal Control Problems,
  UConn Control and Optimization Seminar April 12, 2021
- P_1 Finite Element Methods for a General Optimal Control Problem with Pointwise State Constraints,
  Finite Element Circus Spring 2021(Virtual) April 10, 2021
- Multigrid Methods for Elliptic Optimal Control Problems,
  20th Copper Mountain Conference On Multigrid Methods (Virtual)
  March 29, 2021
- Multigrid Methods for an Optimal Control Problem with Pointwise State Constraints,
  Finite Element Circus Fall 2019, Virginia Tech November 2, 2019
- Multigrid Methods for an Optimal Control Problem with Pointwise State Constraints,
  Scientific Computing Around Louisiana 2019 (SCALA 2019)
  Tulane University February 16, 2019
- Multigrid Methods for an Optimal Control Problem,
  Finite Element Circus Fall 2017, UMBC October 21, 2017
- Multigrid Methods for an Optimal Control Problem,
  Scientific Computing Around Louisiana 2017 (SCALA 2017)
  Tulane University March 17, 2017

Workshops

- From Modeling to Learning with HPC,
  ICERM, Brown University September 13-14, 2025
- Computational Learning for Model Reduction,
  ICERM, Brown University January 6-10, 2025
- Nonlocality: Challenges in Modeling and Simulation,
  ICERM, Brown University April 15-19, 2024
- PDEs and Geometry: Numerical Aspects,
  ICERM, Brown University March 11-15, 2024
- Numerical Analysis of Multiphysics Problems,
  ICERM, Brown University February 12-26, 2024
- CMAI Meets Industry Symposium (Virtual)
  George Mason University June 25, 2021
- CMAI Summer School: An Introduction to Risk-Averse PDE-Constrained Optimization: Theory, Numerical Solution, and Open Problems (Virtual)
  George Mason University June 18, 2021
- ICERM Virtual Workshop: Mathematical and Computational Approaches for Solving the Source-Free Einstein Field Equations October 5-9, 2020
- Math-to-industry Boot Camp IV, IMA June 23-August 02, 2019
  Project: Rail Car Supply Forecasting.
- 1st LBRN-LONI Scientific Computing Bootcamp, LSU May 28-29, 2018
- Industrial Math/Stat Modeling Workshop for Graduate Students,
  SAMSI, NC State July 16-26, 2017
  Project: Uncertainty-enabled design of electromagnetic reflectors with integrated shape control.
- Frontiers in PDE-constrained Optimization, IMA June 6-10, 2016
- Nvidia GPU Workshop, LSU June 1-2, 2016
- 5th Annual LONI HPC Parallel Programming Workshop, LSU May 30-31, 2016

Conferences

- Finite Element Circus 2025 Fall, George Mason University — October 17-18, 2025
- SIAM TXLA Sectional Meeting 2025, Austin, — September 26-28, 2025
- AMS 2025 Spring Eastern Sectional Meeting, Hartford — April 4-5, 2025
- JMM 2025, Seattle — January 8, 2025
- Finite Element Circus 2024 Fall, UMBC — October 18-19, 2024
- 9th Annual Meeting of the SIAM Central States Section, University of Missouri-Kansas City — October 5-6, 2024
- Mathematical Models and Numerical Methods for Multiphysics Systems, University of Pittsburgh — May 1-3, 2024
- Finite Element Circus 2024 Spring, Brown University — April 19-20, 2024
- Finite Element Circus 2023 Spring, Bridgewater State University — March 17-18, 2023
- Joint Mathematics Meeting 2023, Boston — January, 2023
- Finite Element Circus 2022 Fall, Carnegie Mellon University — October, 2022
- SIAM Annual Meeting, Pittsburgh — July 13-15, 2022
- East Coast Optimization Meeting 2022 (Virtual), George Mason University — March 31-1, 2022
- Finite Element Circus 2021 Fall, The Pennsylvania State University — November 5-6, 2021
- UNC Greensboro PDE Conference of 2021 (Virtual) — July 24-25, 2021
- Finite Element Circus 2021 Spring (Virtual) — April 9-10, 2021
- East Coast Optimization Meeting 2021 (Virtual), George Mason University — April 1-2, 2021
- 20th Copper Mountain Conference On Multigrid Methods (Virtual) — March 29-April 2, 2021
- Finite Element Circus 2020 Fall (50th Anniversary) (Virtual) — November 6-7, 2020
- IMSI Opening Conference: Vistas in the Applied Mathematical Sciences (Virtual) — October 7-9, 2020
- SIAM Annual Meeting 2020 (Virtual) — July 6-17, 2020
- Scientific Computing Around Louisiana 2020 (SCALA 2020), Louisiana State University — February 7-8, 2020
- Finite Element Circus 2019 Fall, Virginia Tech — November 1-2, 2019
- East Coast Optimization Meeting 2019, George Mason University — April 4-5, 2019
- Scientific Computing Around Louisiana 2019 (SCALA 2019), Tulane University — February 15-16, 2019
- Finite Element Circus 2018 Fall, University of Delaware — November 9-10, 2018
- Celebrating 75 Years of Mathematics of Computation, ICERM, Brown University — November 1-3, 2018
- 2018 NSF-CBMS Conference on Computational Methods in Optimal Control, Jackson State University — July 23-27, 2018
- Finite Element Rodeo 2018, Louisiana State University — February 23-24, 2018
- Scientific Computing Around Louisiana 2018 (SCALA 2018), Louisiana State University — February 2-3, 2018
- Finite Element Circus 2017 Fall, UMBC — October 20-21, 2017
- International Conference on Current Trends and Challenges in Numerical Solution of Partial Differential Equations, Purdue University — July 7-8, 2017
- Scientific Computing Around Louisiana 2017 (SCALA 2017), Tulane University — March 17-18, 2017
- Scientific Computing Around Louisiana 2016 (SCALA 2016), Louisiana State University — February 12-13, 2016

- International Conference on Mathematical Modeling, Analysis and Computation
  Xiamen, China July 21-25, 2012

Teaching Experiences

Instructor August 2024 to present
Department of Mathematical Sciences,
Worcester Polytechnic Institute

Instructor August 2020 to August 2023
Department of Mathematics,
University of Connecticut

Teaching Assistant\Instructor August 2014 to May 2020
Department of Mathematics,
Louisiana State University

Teaching Assistant June 2011 to May 2014
School of Mathematical Sciences,
Xiamen University

Professional Memberships

- American Mathematical Society
- Society for Industrial and Applied Mathematics

Referee

- Applied Mathematics and Optimization
- Journal of Computational and Applied Mathematics
- Results in Applied Mathematics
- Science China: Mathematics
- Journal of Numerical Mathematics
- Computers & Mathematics with Applications
- Applied Numerical Mathematics
- Numerical Methods for Partial Differential Equations

Service

Secretary, LSU SIAM Student Chapter	2016
Vice President, LSU SIAM Student Chapter	2017
President, LSU SIAM Student Chapter	2018, 2019
Session Chair, UNC Greensboro PDE Conference	2021
Judge, AWM Poster Session at JMM 2023	2023