

José C. Garay

Curriculum Vitae

PERSONAL DETAILS

Address	Augsburg, Germany
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RESEARCH INTERESTS

Numerical Analysis in general and Numerical Linear Algebra in particular, Numerical Homogenization, Domain Decomposition Methods, High-Performance Computing, Asynchronous Algorithms, and Multiscale/Multiphysics Problems.

EDUCATION

Ph.D. in Mathematics

Temple University

2018

Philadelphia, PA, USA

- Dissertation title: Asynchronous Optimized Schwarz Methods for Partial Differential Equations in Rectangular Domains. Advisor: Daniel B. Szyld. Co-Advisor: Frédéric Magoulès.

M.Sc. in Mathematics

Temple University

2017

Philadelphia, PA, USA

B.Sc. in Electronics Engineering

Universidad Nacional de Asunción

2011

San Lorenzo, Paraguay

- Thesis title: Simulation of Cyclic Two-Phase Flow in Homogeneous Porous Media.

CERTIFICATIONS

IBM Data Science Professional Certificate

IBM

2021

- Earned certificates on courses “What is data science?” and “Tools for data science.”

PUBLICATIONS

[1] Susanne C. Brenner, José C. Garay, and Li-yeng Sung (2025). *A Spectral LOD Method for Multiscale Problems with High Contrast*. arXiv:2511.05776.

[2] Camilla Belponger, José C. Garay, Peter Munch, and Daniel Peterseim. *Super-Localized Orthogonal Decomposition Method for Heterogeneous Linear Elasticity*. Computational Methods in Applied Mathematics, vol. 25, no. 3, 2025, pp. 561-579. <https://doi.org/10.1515/cmam-2025-0005>

[3] José C. Garay, Hannah Mohr, Daniel Peterseim, and Christoph Zimmer (2024). *Hierarchical Super-Localized Orthogonal Decomposition Method*. arXiv:2407.18671.

[4] Susanne C. Brenner, José C. Garay, and Li-yeng Sung. *A Multiscale Finite Element Method for an Elliptic Distributed Optimal Control Problem with Rough Coefficients*

and Control Constraints. J. Sci. Comput. 100, 47 (2024). <https://doi.org/10.1007/s10915-024-02590-6>.

[5] José C. Garay, Frédéric Magoulès, and Daniel B. Szyld. *Synchronous and Asynchronous Optimized Schwarz Methods for Poisson's Equation in Rectangular Domains*. Electronic Transactions on Numerical Analysis (ETNA), vol. 55 (2022), pp. 744-791.

[6] Susanne C. Brenner, José C. Garay, and Li-yeng Sung. *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients*. J. Sci. Comput. 91, 76 (2022). <https://doi.org/10.1007/s10915-022-01834-7>.

[7] Susanne C. Brenner, José C. Garay, and Li-yeng Sung. *Additive Schwarz Preconditioners for a Localized Orthogonal Decomposition Method*. Electronic Transactions on Numerical Analysis, Vol. 54 (2021), pp. 234-255.

[8] Mireille El Haddad, José C. Garay, Frédéric Magoulès, and Daniel B. Szyld. *Synchronous and Asynchronous Optimized Schwarz Methods for One-way Subdivision of Bounded Domains*. Numerical Linear Algebra with Applications, vol. 27 (2020) paper e2779 (30 pages).

[9] José C. Garay, Frédéric Magoulès, and Daniel B. Szyld. *Convergence of Asynchronous Optimized Schwarz Methods in the plane*. Proceedings of the 24th International Conference on Domain Decomposition Methods. Peter E. Bjostard, Susanne C. Brenner, Laurence Halpern, Ralf Kornhuber, Hyea Hyun Kim, Talal Rahman, and Olof B. Widlund, eds., Lecture Notes in Computer Science and Engineering, vol. 125, Springer, Berlin and Heidelberg, 2018.

[10] José C. Garay, Frédéric Magoulès, and Daniel B. Szyld. *Optimized Schwarz Method for Poisson's Equation in Rectangular Domains*. Proceedings of the 24th International Conference on Domain Decomposition Methods. Peter E. Bjostard, Susanne C. Brenner, Laurence Halpern, Ralf Kornhuber, Hyea Hyun Kim, Talal Rahman, and Olof B. Widlund, eds., Lecture Notes in Computer Science and Engineering, vol. 125, Springer, Berlin and Heidelberg, 2018.

TALKS

2011 - *Simulation of Cyclic Two-Phase Flow in Homogeneous Porous Media*. Facultad Politécnica of the Universidad Nacional de Asunción. Asunción, Paraguay.

2011 - *Simulation of Cyclic Two-Phase Flow in Homogeneous Porous Media*. Parque tecnológico de ITAIPU (ITAIPU R&D, an electricity generating government agency). Asunción, Paraguay.

2017 - *Asynchronous Optimized Schwarz Methods for Poisson's Equation in Rectangular Domains*. Mid-Atlantic Numerical Analysis Day. Temple University, Philadelphia, PA, USA.

2018 - *Asynchronous Optimized Schwarz Methods for Poisson's Equation in Rectangular Domains*. SIAM Conference on Applied Linear Algebra. Hong Kong.

2018 - *Asynchronous Optimized Schwarz Methods for Poisson's Equation in Rectangular Domains*. 25th International Domain Decomposition Conference, DD XXV. St. John's, Newfoundland, Canada.

2018 - *Asynchronous Optimized Schwarz Methods for Partial Differential Equations in Rectangular Domains*. Computational Mathematics Seminar Series. Louisiana State University, Baton Rouge, LA, USA.

2019 - *Asynchronous Optimized Schwarz Methods for the Screened Poisson Equation in Rectangular Domains*. Scientific Computing around Louisiana Meeting, SCALA 2019. Tulane University, New Orleans, LA, USA.

2019 - *Asynchronous Optimized Schwarz Methods for the Screened Poisson Equation in Rectangular Domains*. International Congress on Industrial and Applied Mathematics, ICIAM 2019. Valencia, Spain.

2019 - *Preconditioning the Localized Orthogonal Decomposition Method for Multiscale Elliptic PDEs*. Fall 2019 Finite Element Circus. Virginia Tech, Blacksburg, Virginia, USA.

2020 - *Preconditioning the Localized Orthogonal Decomposition Method for Multiscale Elliptic PDEs*. Scientific Computing around Louisiana Meeting, SCALA 2020. Louisiana State University, Baton Rouge, LA, USA.

2020 - *Additive Schwarz Preconditioners for a Localized Orthogonal Decomposition Method*. Communications in NLA. Online seminar.

2020 - *Additive Schwarz Preconditioners for a Localized Orthogonal Decomposition Method*. 26th International Domain Decomposition Conference, DD XXVI. Virtual Conference.

2021 - *Additive Schwarz Preconditioners for a Localized Orthogonal Decomposition Method*. Mathematical Congress of the Americas, MCA 2021. Virtual Conference.

2021 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients*. The Finite Element Circus Fall 2021. State College, Pennsylvania, USA.

2022 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients*. Latest Trends and Insights into Matrix Theory, Iterative Methods, and Preconditioning. Philadelphia, Pennsylvania, USA.

2022 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients*. 17th Copper Mountain Conference On Iterative Methods. Virtual Conference.

2022 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients*. The Second International Conference on Computational Methods and Applications in Engineering, ICCMAE 2022. Starkville, Mississippi, USA.

2022 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients*. 2022 SIAM Annual Meeting (AN22). Pittsburgh, Pennsylvania, USA.

2022 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients And Control Constraints*. The Fall 2022 Finite Element Circus. Pittsburgh, Pennsylvania, USA.

2023 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients And Control Constraints*. The 29th Biennial Numerical Analysis Conference. Glasgow, Scotland.

2023 - *DD-LOD: A Localized Orthogonal Decomposition Method for Elliptic Problems with Rough Coefficients Based on Domain Decomposition Techniques*. Mathematics of Computation Research Seminar. Universität Bonn, Bonn, Germany.

2024 - *Multiscale Finite Element Methods For An Elliptic Optimal Control Problem With Rough Coefficients And Control Constraints*. The 28th International Conference on Domain Decomposition Methods (DD28). King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia.

2024 - *Hierarchical Super-Localized Orthogonal Decomposition Methods for the Solution of Multi-Scale Elliptic Problems*. 10th International Conference on Computational Methods in Applied Mathematics (CMAM-10), Bonn, Germany.

2024 - *Hierarchical Super-Localized Orthogonal Decomposition Methods for Multi-Scale Elliptic Problems*. International Conference on Scientific Computation and Differential Equations (SciCADE 2024), National University of Singapore, Singapore.

2025 - *Hierarchical Super-Localized Orthogonal Decomposition Methods for Multi-Scale*

Elliptic Problems. 15th International Conference on Large-Scale Scientific Computations, Sozopol, Bulgaria.

2025 - *Spectral Localized Orthogonal Decomposition Method for Multi-scale Elliptic PDEs with High-Contrast Channels*. 29th International Domain Decomposition Conference (DD29), Milan, Italy.

POSTER PRESENTATIONS

2017 – *Asynchronous Optimized Schwarz Methods for Poisson's Equation in Rectangular Domains* - International Conference on Domain Decomposition Methods DD XXIV – Svalbard, Longyearbyen, Norway.

2017 – *Asynchronous Optimized Schwarz Methods for Poisson's Equation in Rectangular Domains* - SIAM Conference on Computational Science and Engineering – Atlanta, Georgia, USA.

2017 – *Asynchronous Optimized Schwarz Methods for Poisson's Equation in Rectangular Domains* - Householder Symposium XX on Numerical Linear Algebra – Blacksburg, Virginia, USA.

2018 – *Asynchronous Optimized Schwarz Methods for the Screened Poisson Equation in Rectangular Domains* - Celebrating 75 Years of Mathematics of Computation Symposium – Providence, Rhode Island, USA.

2019 – *Asynchronous Optimized Schwarz Methods for the Screened Poisson Equation in Rectangular Domains* - Parallel Solution Methods for Systems Arising from PDEs Workshop - Marseille, France.

2025 – *Hierarchical Super-Localized Orthogonal Decomposition Method* - Reduced-Order Modeling for Complex Engineering Problems – Institute for Mathematical and Statistical Innovation, Chicago, IL, USA.

PROFESSIONAL MEETINGS

2015 Gene Golub SIAM Summer School on RandNLA

June 2015

Delphi, Greece

School on Randomized Numerical Linear Algebra

2015 AARMS Workshop on Domain Decomposition Methods for PDEs

August 2015

Halifax, Nova Scotia, Canada

SIAM Conference on Applied Linear Algebra

October 2015

Atlanta, GA, United States

14th Copper Mountain Conference on Iterative Methods

March 2016

Copper Mountain, Colorado, United States

International Conference on Domain Decomposition Methods, DD XXIV

Feb. 2017

Svalbard, Longyearbyen, Norway

SIAM Conference on Computational Science and Engineering

February -
March 2017

Atlanta, Georgia, USA

Householder Symposium XX on Numerical Linear Algebra

June 2017

Blacksburg, Virginia, USA

15th Copper Mountain Conference on Iterative Methods

March 2018

Copper Mountain, Colorado, United States

SIAM Conference on Applied Linear Algebra

May 2018

Hong Kong

25th International Domain Decomposition Conference, DD XXV <i>St. John's, Newfoundland, Canada</i>	July 2018
Celebrating 75 Years of Mathematics of Computation Symposium <i>Providence, Rhode Island, USA</i>	Nov. 2018
The Fall 2018 Finite Element Circus <i>Newark, Delaware, USA</i>	Nov. 2018
Scientific Computing around Louisiana Meeting, SCALA 2019 <i>New Orleans, Louisiana, USA</i>	Feb. 2019
Oberwolfach Seminar: Beyond Numerical Homogenization <i>Oberwolfach, Germany</i>	June 2019
International Congress on Industrial and Applied Mathematics, ICIAM 2019 July 2019 <i>Valencia, Spain</i>	
Parallel Solution Methods for Systems Arising from PDEs Workshop <i>Marseille, France</i>	Sept. 2019
The Fall 2019 Finite Element Circus <i>Blacksburg, Virginia, USA</i>	Nov. 2019
Scientific Computing around Louisiana Meeting, SCALA 2020 <i>Baton Rouge, Louisiana, USA</i>	Feb. 2020
The Second Joint SIAM/CAIMS Annual Meeting (AN20) <i>Virtual Conference</i>	July 2020
50th Anniversary Finite Element Circus Meeting <i>Virtual Conference</i>	Nov. 2020
Broadening Participation: 2020 MPS Workshop for New Investigators <i>Virtual Workshop</i>	Nov. 2020
26th International Domain Decomposition Conference, DD XXVI <i>Virtual Conference</i>	Dec. 2020
SIAM Conference on Computational Science and Engineering (CSE21) <i>Virtual Conference</i>	March 2021
East Coast Optimization Meeting 2021 <i>Virtual Conference</i>	April 2021
Spring 2021 Finite Element Circus Meeting <i>Virtual Conference</i>	April 2021
Mathematical Congress of the Americas, MCA 2021 <i>Virtual Conference</i>	July 2021
Argonne Training Program on Extreme-Scale Computing, ATPESC 2021 August 2021 <i>Virtual Workshop</i>	
The Finite Element Circus Fall 2021 <i>State College, Pennsylvania, USA</i>	Nov. 2021
Summer School on Advanced Domain Decomposition Methods <i>Milan, Italy (virtual attendance)</i>	Nov. 2021
Latest Trends and Insights into Matrix Theory, Iterative Methods, and Preconditioning <i>Philadelphia, Pennsylvania, USA</i>	March 2022
East Coast Optimization Meeting 2022 <i>Virtual Conference</i>	March - April 2022
17th Copper Mountain Conference On Iterative Methods <i>Virtual Conference</i>	April 2022
The Spring 2022 Finite Element Circus	April 2022

Gainesville, Florida, USA

The Second International Conference on Computational Methods and Applications in Engineering, ICCMAE 2022

May 2022

Starkville, Mississippi, USA

2022 SIAM Annual Meeting (AN22)

July 2022

Pittsburgh, Pennsylvania, USA

The Fall 2022 Finite Element Circus

October 2022

Pittsburgh, Pennsylvania, USA

East Coast Optimization Meeting 2023

April 2023

Virtual Conference hosted by George Mason University

Jena-Augsburg-Meeting (JAM) on Numerical Analysis

June 2023

Augsburg, Germany

Workshop on Numerical Analysis of Nonlinear Schrödinger Equations

June 2023

Augsburg, Germany

The 29th Biennial Numerical Analysis Conference

June 2023

Glasgow, Scotland

Workshop on Numerical Analysis of Nonlinear Schrödinger Equations

June 2023

Augsburg, Germany

The 28th International Conference on Domain Decomposition Methods (DD28)

Jan-Feb 2024

King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

10th International Conference on Computational Methods in Applied Mathematics (CMAM-10)

June 2024

Bonn, Germany

International Conference on Scientific Computation and Differential Equations (SciCADE 2024)

July 2024

National University of Singapore, Singapore

Follow-Up Workshop: “Multiscale Problems: Algorithms, Numerical Analysis and Computation”

August 2024

Hausdorff Research Institute for Mathematics, Bonn, Germany

GAMM Workshop on Numerical Analysis

Nov. 2024

University of Augsburg, Augsburg, Germany

Reduced-Order Modeling for Complex Engineering Problems

Jan-Feb 2025

Institute for Mathematical and Statistical Innovation, Chicago, IL, USA

15th International Conference on Large-Scale Scientific Computations

June 2025

Sozopol, Bulgaria

29th International Domain Decomposition Conference (DD29)

June 2025

Milan, Italy

WORK AND TEACHING EXPERIENCE

Postdoctoral Researcher

2023-Present

University of Augsburg (Supervisor: Daniel Peterseim)

Augsburg, Germany

- Developed a novel multiscale finite element method for the efficient solution of multiscale elliptic PDEs with rough coefficients, with state-of-the-art online computational complexity, deriving an innovative approximate solution space spanned by a hierarchical superlocalized basis and providing the corresponding numerical analysis.
- Mentored two doctoral students, providing advise on how to conduct collaborative research and sharing mathematical and algorithmic expertise.

Postdoctoral Researcher**2018-2022***Louisiana State University (Supervisor: Susanne Brenner) Baton Rouge, LA, USA*

- Developed and implemented in MATLAB a numerical solver for the solution of an elliptic PDE with rough coefficients based on a Localized Orthogonal Decomposition method.
- Developed and implemented a parallel solver for the solution of a multiscale elliptic optimal control problem with a Localized Orthogonal Decomposition method, writing a parallel code in C language which integrated the PETSc library and employing a supercomputer.

Research Assistant**2016-2017***Temple University (Supervisor: Daniel Szyld) Philadelphia, PA, USA*

- Conducted an analysis of an asynchronous domain decomposition iterative method to understand its convergence behavior using techniques from functional analysis, linear algebra and PDE theory. Designed and implemented a MATLAB program to compute the convergence rate of the method and the optimal parameter that minimizes this convergence rate.
- Explored ways to mathematically model the behavior of a non-Newtonian fluid observed in laboratory experiments by reviewing the literature on non-Newtonian fluids and evaluating ways of coupling empirical data with first principle equations. (*an interdisciplinary project with Prof. Tonia Hsieh from the Department of Biology at Temple University*)

Teaching Assistant for Numerical Analysis I**2015***Temple University Philadelphia, PA, USA*

- Led recitation sessions on the implementation of numerical methods with MATLAB for a class with 17 students, graded homework and exams, and tutored students during office hours, providing help on both the theoretical and programming aspects of the course.

Teaching Assistant for Mathematical Patterns**2012-2013***Temple University Philadelphia, PA, USA*

- Led recitation sessions, graded homework and exams, and helped students better understand course material during office hours.

HONORS AND AWARDS

2013-2015 - Scholarship for Graduate Studies from ITAIPU (ITAIPU R&D, an electricity generating government agency).

2015 - SIAM student travel award. Travel support to attend the SIAM Conference on Applied Linear Algebra 2015.

2018 - Doctoral Dissertation Completion Fellowship from Temple University.

2018 - SIAM student travel award. Travel support to attend the SIAM Conference on Applied Linear Algebra 2018.

2018 - Recipient of Chateaubriand Fellowship from the Embassy of France in the United States (declined).

2018 - NSF Travel Award to attend the 25th International Domain Decomposition Conference, DD XXV.

2018 - Travel award to attend the Celebrating 75 Years of Mathematics of Computation Symposium at ICERM.

2019 - SIAM Travel Award to attend the 9th International Congress on Industrial and Applied Mathematics (ICIAM 2019).

2021 - 2021 Mathematical Congress of the Americas (MCA) Travel Grant from AMS.

2022 - NSF Travel Award to attend The Second International Conference on Computational Methods and Applications in Engineering, ICCMAE 2022.

OUTREACH AND SERVICE

GAMM Workshop on Numerical Analysis

2024

Local Organizer

Workshop on Numerical Analysis of Nonlinear Schrödinger Equations

2023

Local Organizer

MATLAB tutorial sessions

2017

Instructor

- Instructed students preparing to compete in the Mathematical Contest in Modeling on basic MATLAB programming tools.
- Workshop organized by the Temple University SIAM Student Chapter.

Temple University SIAM Student Chapter

2016-2018

Officer

Mathematical Contest in Modeling

2015-2017

Graduate student advisor at Temple University

MEMBERSHIPS

Society for Industrial and Applied Mathematics (SIAM) - Since 2015.

SKILLS

<i>Languages</i>	Spanish (mother tongue), English (fluent).
<i>Programming Languages</i>	MATLAB, C/C++, Python.
<i>Software</i>	MATLAB, L ^A T _E X, Mathematica, Maple, PETSc (HPC library), deal.ii (HPC library), Git.
<i>Soft skills</i>	Communication, abstract and analytical thinking, problem solving, teamwork, organization, decision making, time management, leadership, presentation, creativity, versatility, independence.
<i>Other</i>	Basic knowledge of machine learning, prompt engineering for LLMs.