

Funding

- 2021–2023, NSF-DMS-2137305. “LEAPS-MPS: Hybridizable discontinuous Galerkin methods for non-linear integro-differential boundary value problems in magnetic plasma confinement”. \$250,000. USD.

Research Articles

- G. C. Hsiao, T. Sánchez-Vizuet, and W. L. Wendland. A boundary-field formulation for elastodynamic scattering. (*Submitted*), 2022. <https://arxiv.org/abs/2206.12587>.
- N. Sánchez, T. Sánchez-Vizuet, and M. E. Solano. Afternote to “Coupling at a distance”: Convergence analysis and a priori error estimates. *Computational Methods in Applied Mathematics*, 22(4):945–970, July 2022.
- H. C. Elman, J. Liang, and T. Sánchez-Vizuet. Surrogate approximation of the Grad–Shafranov free boundary problem via stochastic collocation on sparse grids. *Journal of Computational Physics*, 448:110699, 2021.
- N. Sánchez, T. Sánchez-Vizuet, and M. Solano. Error analysis of an unfitted HDG method for a class of non-linear elliptic problems. *Journal of Scientific Computing*, 90(3), Feb. 2022.
- G. C. Hsiao and T. Sánchez-Vizuet. Time-dependent wave-structure interaction revisited: Thermo-piezoelectric scatterers. *Fluids*, 6(3), 2021.
- G. C. Hsiao and T. Sánchez-Vizuet. Boundary integral formulations for transient linear thermoelasticity with combined-type boundary conditions. *SIAM Journal on Mathematical Analysis*, 53(4):3888–3911, 2021.
- N. Sánchez, T. Sánchez-Vizuet, and M. E. Solano. A priori and a posteriori error analysis of an unfitted HDG method for semi-linear elliptic problems. *Numerische Mathematik*, 148(4):919–958, Aug. 2021.
- T. Sánchez-Vizuet, M. E. Solano, and A. J. Cerfon. Adaptive hybridizable discontinuous Galerkin discretization of the Grad–Shafranov equation by extension from polygonal subdomains. *Computer Physics Communications*, 255:107239, 2020.
- G. C. Hsiao and T. Sánchez-Vizuet. Time-domain boundary integral methods in linear thermoelasticity. *SIAM Journal on Mathematical Analysis*, 52(3):2463–2490, 2020. Dedicated to the memory of Francisco-Javier Sayas.
- T. Sánchez-Vizuet and M. E. Solano. A Hybridizable Discontinuous Galerkin solver for the Grad–Shafranov equation. *Computer Physics Communications*, 235:120 – 132, 2019.
- G. C. Hsiao, T. Sánchez-Vizuet, F.-J. Sayas, and R. J. Weinacht. A time-dependent wave-thermoelastic solid interaction. *IMA Journal of Numerical Analysis*, 39(2):924–956, 04 2018.
- T. Sánchez-Vizuet and A. J. Cerfon. Pseudo-spectral collocation with Maxwell polynomials for kinetic equations with energy diffusion. *Plasma Physics and Controlled Fusion*, 60(2):025018, 2018.
- Brown, Thomas S., Sánchez-Vizuet, Tonatiuh, and Sayas, Francisco-Javier. Evolution of a semidiscrete system modeling the scattering of acoustic waves by a piezoelectric solid. *ESAIM: Mathematical Modeling and Numerical Analysis (M2AN)*, 52(2):423–455, 2018.
- T. Sánchez-Vizuet and F.-J. Sayas. Symmetric boundary-finite element discretization of time dependent acoustic scattering by elastic obstacles with piezoelectric behavior. *Journal of Scientific Computing*, 70(3):1290–1315, 2017.
- M. Hassell, T. Qiu, T. Sánchez-Vizuet, and F.-J. Sayas. A new and improved analysis of the time domain boundary integral operators for acoustics. *Journal of Integral Equations and Applications*, 29(1):107–136, 2017.
- G. C. Hsiao, T. Sánchez-Vizuet, and F.-J. Sayas. Boundary and coupled boundary-finite element methods for transient wave-structure interaction. *IMA Journal of Numerical Analysis*, 37(1):237–265, 2016.
- V. Domínguez, T. Sánchez-Vizuet, and F.-J. Sayas. A fully discrete Calderón calculus for the two-dimensional elastic wave equation. *Computers & Mathematics with Applications*, 69(7):620–635, 2015.

Conference proceedings and other publications

- I. Gamba, C. Sormani, T. Tao, L. Greengard, T. Sánchez-Vizuet, and K. R. Payne. The mathematics of Cathleen Synge Morawetz. *Notices of the American Mathematical Society*, 65(07):764–778, Aug 2018.
- G. C. Hsiao, T. Sánchez-Vizuet, F.-J. Sayas, and R. J. Weinacht. FEM-BEM coupling for transient acoustic scattering by thermoelastic obstacles. In *Proceedings 13th. International Conference on Mathematical and Numerical Aspects of Wave Propagation (University of Minnesota)*, 2017.
- Brown, Thomas S., Sánchez-Vizuet, Tonatiuh, and Sayas, Francisco-Javier. Semidiscrete evolution of elastic waves in a piezoelectric solid. In *Proceedings 13th. International Conference on Mathematical and Numerical Aspects of Wave Propagation (University of Minnesota)*, 2017.
- G. C. Hsiao, T. Sánchez-Vizuet, and F.-J. Sayas. A system of boundary integral equations for transient wave-structure interaction. In *Proceedings 12th. International Conference on Mathematical and Numerical Aspects of Wave Propagation (Karlsruhe Institute of Technology)*, 2015.

Talks & Presentations

- Upcoming. "Some mathematical and computational aspects of magnetic equilibrium in fusion reactors". Seminar on mathematical and computational engineering, University of Concepción, Chile. September 8, 2022.
- "Quantifying the effect of parameter variability in a free boundary problem from magnetic plasma confinement through surrogate models on sparse grids". Center for Computational and Applied Mathematics Seminar, Purdue University. April 11, 2022.
- "Some mathematical and computational aspects of magnetic equilibrium in fusion reactors". Seminar on mathematical and computational engineering, Pontifical Catholic University of Chile. November 23, 2021.
- "A high order Hybridizable Discontinuous Galerkin method for a free boundary problem arising in magnetic confinement of plasmas". 42nd Ibero-Latin-American Congress on Computational Methods in Engineering. Brazil, November 9-12, 2021.
- "A free boundary problem in magnetic plasma confinement: quantifying the effect of parameter variability through surrogate models on sparse grids". SIAM Annual Meeting. July 19-23, 2021.
- "Coupling BIE and HDG: an application to a free boundary problem from plasma physics." XXVI Congreso de Ecuaciones Diferenciales y Aplicaciones / XVI Congreso de Matemática Aplicada. Special minisymposium in memory of Francisco-Javier Sayas. Gijón, Spain, June 15-18, 2021.
- "The hybridizable discontinuous Galerkin method: an application to plasma equilibrium in fusion reactors". Applied Mathematics Research Training Group Seminar, University of Arizona. May 5th, 2021.
- "Boundary integral formulations in transient thermo-elasto dynamics". Analysis, Dynamics, and Applications Seminar, University of Arizona. May 4th, 2021.
- "A boundary integral formulation for transient thermo-elasto dynamics". SIAM conference in computational science and engineering (CSE21). March 1–5, 2021, Fort Worth, Texas.
- "Coupling BIE and HDG: an application to a free boundary problem from plasma physics." Minisymposium: Recent advances in mixed and hybrid discontinuous Galerkin methods. 14th World Congress in Computational Mechanics. Paris, January 11–15, 2021.
- "Some challenges of the computational study of magnetic equilibrium in fusion reactors". Computational and Applied Mathematics Seminar. University of Tennessee, Knoxville. October 21, 2020.
- Outstanding Challenges in Computational Methods for Integral Equations. Banff International Research Station/Casa Matemática Oaxaca. Oaxaca, México. May 31 - June 5, 2020. (POSTPONED)
- "Quantifying the Uncertainty on Magnetic Equilibrium Computations for Tokamaks". SIAM Conference on Analysis of Partial Differential Equations. December 11, 2019. La Quinta, California.
- "Coupling Boundary Integral Equations and Partial Differential Equations: From wave-structure interaction to magnetic equilibrium in fusion reactors". Applied mathematics seminar. University of Toronto. September 27, 2019.
- "An un-fitted adaptive hybridizable discontinuous Galerkin solver for axisymmetric plasma equilibrium". Sherwood Fusion Theory Conference. Princeton Plasma Physics Laboratory. Princeton, New Jersey. April 15-17, 2019.
- "Computational mathematics: from wave-structure interaction to fusion reactors. Numerical analysis seminar". University of Maryland, College Park. February 12, 2019.
- "Adaptive HDG for semilinear Dirichlet boundary value problems in curved domains". Sixth Chilean Workshop on Numerical Analysis of Partial Differential Equations. University of Concepción, Chile. January 22, 2019.
- "Adaptive HDG for semilinear boundary value problems in curved domains: an application to plasma equilibrium". Applied and Computational Mathematics Seminar. George Mason University. November 30, 2018.
- "Adaptive HDG for semilinear boundary value problems in curved domains: an application to plasma equilibrium". Fluid Mechanics and Waves Seminar. New Jersey Institute of Technology. November 26, 2018.
- "An h-adaptive HDG solver for Dirichlet boundary value problems in curved domains using embedded polygonal grids: an application to plasma equilibrium". Advances in Numerical Approximation of Partial Differential Equations, AMS Sectional Meeting. University of Delaware. September 29-30, 2018.
- The hybridizable discontinuous Galerkin method: an application to plasma equilibrium in fusion reactors. Mexican Mathematicians in the World: Perspectives and Recent Contributions. Banff International Research Station/Casa Matemática Oaxaca. Oaxaca, México. June 10-15, 2018.
- "Hybridizable Discontinuous Galerkin tools for the Grad-Shafranov equation". Sherwood Fusion Theory Conference. Auburn University. Auburn, Alabama. April 23-25, 2018.
- "A Hybridizable Discontinuous Galerkin Solver for axisymmetric Plasma equilibrium". Applied mathematics seminar. University of Massachusetts, Lowell. April 8, 2018.
- "Hybridizable Discontinuous Galerkin tools for axisymmetric plasma equilibrium". Latinxs in the mathematical sciences, March 8-10, 2018. Institute of Pure and Applied Mathematics, University of California, Los Angeles.

- "A Hybridizable Discontinuous Galerkin solver for axisymmetric plasma equilibrium". Numerical Analysis and Scientific Computing Seminar. Courant Institute of Mathematical Sciences. December 15, 2017.
- "Pseudo-spectral collocation for kinetic equations with energy diffusion". Plasma Physics Seminar. University of Maryland. November 29, 2017.
- "A Hybridizable Discontinuous Galerkin solver for the Grad-Shafranov equation". Mid-Atlantic numerical analysis day. Temple University, Philadelphia, PA. November 3, 2017.
- "Pseudo-spectral collocation for kinetic equations with energy diffusion". Magneto fluid dynamics seminar. Courant Institute of Mathematical Sciences. September 26, 2017.
- "FEM-BEM coupling for transient acoustic scattering by thermoelastic obstacles". WAVES 2017. 13th International conference on mathematical and numerical aspects of wave propagation. University of Minnesota, May 18, 2017.
- "Pseudo-spectral collocation with Maxwell polynomials for kinetic equations with energy diffusion". The Sherwood Fusion Theory Conference 2017. May 1st-3rd, Annapolis, Maryland.
- "BEM/FEM Coupling for transient acoustic scattering by piezoelectric obstacles". SIAM 2016 annual meeting. Boston, Massachusetts. July 11, 2016.
- "Numerical simulation of transient acoustic scattering by a piezoelectric obstacle". DelMar Numerics Day. George Mason University. May 14, 2016.
- "BEM/FEM coupling for transient acoustic scattering by piezoelectric obstacles". Fifth Chilean Workshop on Numerical Analysis of Partial Differential Equations (WONAPDE), University of Concepción, Chile. January 11-15, 2016.
- "Numerical Methods for Time Domain Two-dimensional Wave-structure Interaction". SIAM Conference on Analysis of Partial Differential Equations. December 10, 2015. Arizona.
- "Symmetric BEM/FEM scheme for wave-structure interaction in the time domain". Mid-Atlantic numerical analysis day. Temple University, Philadelphia, Pennsylvania. November 13, 2015.
- "BEM/FEM coupling for transient wave-structure interaction". Finite Element Circus. University of Massachusetts, Dartmouth. October 17, 2015.
- "A system of boundary integral equations for transient wave-structure interaction". WAVES 2015. 12th International conference on mathematical and numerical aspects of wave propagation. Karlsruhe Institute of Technology, Karlsruhe, Germany. July 21, 2015.
- "Time-domain simulation of two-dimensional elastic scattering". SIAM conference on computational sciences and engineering. Salt Lake City, Utah. March 18, 2015.
- "Simulation of linear elastic waves with the Delta Boundary Element Method". Winter research symposium. University of Delaware. February 13, 2015.
- "Transient wave-structure interaction with the Delta Boundary Element method." Poster presentation at the Mid-Atlantic Numerical Analysis Day. Temple University. Philadelphia, Pennsylvania. November 7, 2014.
- "Time-domain Wave-structure interaction with the Delta Boundary Element method". Poster presentation at the Spanish-French School on numerical simulation in physics and engineering. Public University of Navarra. Pamplona, Spain. September, 2014.
- "Boundary integral equations 101". Hallenbeck graduate student seminar. University of Delaware. April 9, 2014.
- "Semi-discrete wave-structure interaction". Poster presentation at the Mid-Atlantic numerical analysis day. Temple University. Philadelphia, Pennsylvania. November 22, 2013.
- "The layman's account on full waveform inversion". Hallenbeck graduate student seminar. University of Delaware. October 23, 2013.
- "On finite volume methods for conservation laws". Hallenbeck graduate student seminar. University of Delaware. May 8, 2013.
- "Implementation of the equal area method for first order conservation laws in Chebfun". Poster presentation at the conference "Chebfun & beyond", University of Oxford. Oxford, United Kingdom. September 18, 2012.
- "Convergence and stability considerations on the numerical solution of transport equations". Mexican Geophysical Union, anual meeting 2010. Puerto Vallarta, México. November, 2010.

Teaching Experience

Courses taught

- Fall 2022. Math 466 (Theory of statistics). Instructor. The University of Arizona.
- Fall 2022. Data 375 (Statistical computing). Instructor. The University of Arizona.
- Spring 2022. Math 363 (Introduction to statistical methods). Instructor. The University of Arizona.
- Fall 2021. Math 363 (Introduction to statistical methods). Instructor. The University of Arizona.
- Spring 2021. MATH 263 (Introduction to statistics and biostatistics). Instructor. The University of Arizona.
- Fall 2020. MATH 125 (Calculus I). Instructor. The University of Arizona.
- Spring 2016. MATH 242 (Calculus and Analytic Geometry B). Teaching assistant. University of Delaware.
- Fall 2015. MATH 241 (Calculus and Analytic Geometry A). Teaching assistant. University of Delaware.
- Fall 2015. MATH 221 (Business Calculus). Teaching assistant. University of Delaware.
- Fall 2014. MATH 512 (Contemporary applications of mathematics). Teaching assistant. University of Delaware.
- Fall 2013. MATH 512 (Contemporary applications of mathematics). Teaching assistant. University of Delaware.
- Spring 2013. MATH 241 (Calculus and Analytic Geometry A). Teaching assistant. University of Delaware.
- Fall 2012. MATH 460 (Introduction to systems biology). *Howard Hughes Teaching Assistant*. University of Delaware.
- Spring 2012. MATH 260 (Integrative seminar). *Howard Hughes Teaching Assistant*. University of Delaware.
- Fall 2011. MATH 241 (Calculus and Analytic Geometry A). Teaching assistant. University of Delaware.
- Fall 2011. Topics on theoretical & mathematical physics. Teaching assistant. National Autonomous University of México, School of Sciences.
- Fall 2011. Mathematics for Applied Sciences II. Teaching assistant. National Autonomous University of México, School of Sciences.
- Spring 2011. Topics on theoretical & mathematical physics. Teaching assistant. National Autonomous University of México, School of Sciences.
- Spring 2010. Vector Mechanics. Teaching assistant. National Autonomous University of México, School of Sciences.
- Fall 2009. Heat transfer, waves & fluids. Teaching assistant. National Autonomous University of México, School of Sciences.

Other teaching-related activities

- **Supervision of graduate research**

Doctoral

- Mr. Nestor Sánchez. Ph. D. in Mathematical Engineering., Universidad de Concepción, Chile, 2018–2021.
Thesis: Discontinuous Galerkin Methods for Non-Linear Problems in Plasma Physics.
Co-advised with Manuel Solano.
After graduation: Postdoctoral associate. Institute of Mathematics, National Autonomous University of México.
- Ms. Jiaying Liang. Ph. D. Applied Mathematics, University of Maryland, College Park. (Current).
Topic: Computational methods for uncertainty quantification in plasma equilibrium.
Co-advised with Howard Elman.

Masters

- Mr. Esteban Ignacio Henríquez Novoa. Mathematical engineering, University of Concepción, Chile. 2022–.
Thesis: An unfitted hybridizable discontinuous Galerkin method in shape optimization.
- Ms. Vianella Spaeth. Graduate Interdisciplinary Program in Applied Mathematics, University of Arizona 2021– .
Topic: Computational methods for guidance and interception.
- Ms. Jiaying Liang. M.S. Applied Mathematics, Courant Institute 2017-2018.
Thesis: Iterative methods for Finite Element discretizations of semilinear elliptic equations.
(Now in the Ph.D. program in Applied Mathematics and Scientific Computing. University of Maryland, College Park.)

- **Supervision of undergraduate research**

- Mr. Henry Prior. B.S. Economics and Mathematics, Courant Institute 2017-2018.
Topic: Newton-Krylov methods for Ill-posed problems / Machine learning methods for differential equations.
- Mr. Matthew Moye. B.S. Quantitative Biology, University of Delaware, 2012-2013.
(Now in the Ph. D. program in Applied Mathematics at the New Jersey Institute of Technology)
Topic: Spectral methods for hyperbolic conservation laws.

- **Evaluation of Doctoral dissertations**
 - Mr. Paulo Andrés Zúñiga. Ph. D. in Applied Sciences focused on Mathematical Engineering. Title: "*High-order mixed methods in continuum mechanics*". Universidad de Concepción, Chile (2019).
- **Evaluation of Masters theses**
 - Mr. Bud Denny. Mathematics. Title "*Extended Finite-Difference Time-Domain Method for Dynamics in Ferrite Material*". University of Arizona (2021).
 - Mr. Ömer Aktepe. Applied Mathematics. Title "*Discontinuous Galerkin methods for one and two dimensional Schrödinger equations*". University of Arizona (2021).
 - Ms. Ruchi Dahiya. Applied Mathematics. Title: "*Splines, Bezier Curves and Schoenberg Problem*". University of Arizona (2021).
 - Mr. Fernando Peña. Mathematical Engineering. Title: "*A discontinuous Galerkin method for the heat equation in non polygonal domains*". Universidad de Concepción, Chile (2020).
- **Graduate review sessions:** Instructor for five week long review sessions for incoming doctoral students at the Department of Mathematical Sciences, University of Delaware. Ordinary differential equations (Summer 2014) and Analysis (Summer 2015).
- **Graduate qualifier preparation sessions:** Instructor for a five week-long review session for first and second year graduate students preparing to take the doctoral qualifying examinations. Analysis (Winter 2015).
- **Orientation for incoming Teaching Assistants:** As part of a University-wide orientation for incoming teaching assistants. Representative for the Department of Mathematical Sciences for the 2015 and 2016 sessions.

Professional Service

Organization of Conferences

- Member of the Selection Committee for the [Fifth Meeting of Mexican Mathematicians in the World](#). Banff International Research Station / Casa Matemática Oaxaca, December 2021.

Organization of Minisymposia

- "Advances in numerical methods for partial differential equations". Annual meeting of the Mexican Mathematical Society. October 2022, Guadalajara, México. In collaboration with Nestor Sánchez Goycochea.
- "Computational methods in applied mathematics". Annual meeting of the Mexican Mathematical Society. October 2022, Guadalajara, México. In collaboration with Nestor Sánchez Goycochea.
- "Mathematical Challenges in Computational Plasma Physics". SIAM—Analysis of Partial Differential Equations. December 11—14, 2019. La Quinta, CA. In collaboration with Antoine Cerfon.
- "Discontinuous Galerkin approximations in plasma physics: building bridges between theory and applications". Sixth Chilean Workshop on Numerical Analysis of Partial Differential Equations, University of Concepción, Chile. January 21-25, 2019. In collaboration with Antoine Cerfon.

Seminar and colloquium organization

- Organizer of the University of Arizona Mathematics Colloquium (Academic Year 2021-2022).
- Organizer of the "Modelling and computation" seminar. University of Arizona (2021 – Present).

Funding evaluator

- Reviewer/Evaluator for the National Research and Development Agency (ANID) of the Ministry of Science, Technology, Knowledge and Innovation of Chile.
 - Initiation to research FONDECYT grant, 2023.
- Reviewer/Evaluator for the National Council of Science and Technology (CONACyT), México.
 - National Postdoctoral Fellowship program, 2020, 2021, 2022. (Estancias posdoctorales por México).
 - Frontier science grant program, 2019. (Ciencia de frontera).
 - Department of Energy postdoctoral program, 2018. (SENER Estancias posdoctorales hidrocarburos en México).

Refereeing

- Advances in Computational Mathematics
- AMS-Mathematical Reviews
- Applicable Analysis
- Communications in Computational Physics
- Computational and Applied Mathematics
- Computational Methods in Applied Mathematics
- Computer Physics Communications
- Electronic Transactions on Numerical Analysis
- Engineering Analysis with Boundary Elements
- IMA Journal of Numerical Analysis
- Indian Journal of Physics
- International Journal of Numerical Analysis and Modeling
- International Journal for Numerical Methods in Fluids
- Journal of Computational Physics
- Journal of Computational and Applied Mathematics
- Journal of Scientific Computing
- Journal of Integral Equations and Applications
- Journal of Mathematical Analysis and Applications
- Mathematics and Mechanics of Solids
- Mathematics of Computation
- Numerical Methods for Partial Differential Equations
- SIAM Journal of Applied Mathematics
- SIAM Journal of Numerical Analysis
- SIAM Journal of Scientific Computing
- The Graduate Journal of Mathematics

Other

- President of the University of Delaware SIAM student chapter. 2012/2013.