

TONATIUH SÁNCHEZ-VIZUET

- Numerical Analysis
 - Scientific Computing
 - Computational Physics
- Postdoctoral Associate
email: tonatiuh@cims.nyu.edu
website: <http://www.cims.nyu.edu/~tonatiuh>
address: NYU · Courant Institute of Mathematical Sciences
 251 Mercer Street · New York, NY · 10012-1185.



Education

Doctor of Philosophy:

Applied Mathematics, 2016.
 University of Delaware.
 Department of Mathematical Sciences.
 Thesis: "Integral and coupled integral-volume methods for transient problems in wave-structure interaction."
 Advisor: Prof. Francisco-Javier Sayas.



Master of Science:

Mathematics, 2011.
summa cum laude
 National Autonomous University of Mexico.
 Mathematics Institute.
 Thesis: "Numerical solution of the Euler equations for gas dynamics in 3D".
 Advisor: Prof. Antonio Capella-Kort.



Bachelor of Science:

Physics, 2010.
 National Autonomous University of Mexico.
 School of Sciences.
 Thesis: "Solutions to the transport equation: analytical and numerical properties".
 Advisor: Prof. Iouri N. Skiba.



Academic Distinctions & Fellowships

- [National System of Researchers](#). Member Level I, 2018. (National Council of Science and Technology, México).
- Departmental Fellowship. University of Delaware, 2014.
- Nomination for the "Excellence in teaching award". University of Delaware, 2012.
- Howard Hughes Medical Institute Teaching Assistant. University of Delaware, 2011-2012.
- Graduate Fellowship. CONACyT 2010-2011. (National Council of Science and Technology, México).
- Research Fellowship. National Autonomous University of Mexico. Center for Atmospheric Sciences, 2008-2009.
- Research Fellowship. National Autonomous University of Mexico. Institute of Nuclear Sciences, 2005.

Awards

- 2016, SIAM Early Career Travel Award to attend the 2016 SIAM Annual meeting in Boston, MA.
- 2016, University of Delaware Winter Research Symposium. Best Poster Award. \$1,000. USD to attend the 2016 Annual International Sherwood Fusion Theory Conference. Madison, WI.
- 2015, SIAM Student Travel Award to attend the 2015 SIAM conference on Analysis of Partial Differential Equations in Scottsdale, AZ.
- 2014, University of Delaware Professional Development Award. \$1,000. USD to attend the XVI School on Numerical Simulation in Physics and Engineering at the Public University of Navarra, Spain.
- 2012, University of Delaware Professional Development Award. \$1,000. USD to attend the conference "Chebfun and Beyond" at the University of Oxford, UK.
- 2012, NSF award to attend the workshop "The Boundary Element Method: Bridging Education and Industrial Applications" at the University of Minnesota.

Research Articles

- Néstor Sánchez, Tonatiuh Sánchez-Vizuet, and Manuel E. Solano. A priori and a posteriori error analysis of an HDG method for semi-linear elliptic problems in curved domains. (*In preparation*), 2018.
- Tonatiuh Sánchez-Vizuet, Manuel E. Solano, and Antoine J. Cerfon. Adaptive hybridizable discontinuous Galerkin discretization of the Grad-Shafranov equation by extension from subdomains. (*Submitted*), 2018.
- George C. Hsiao, Tonatiuh Sánchez-Vizuet, and Francisco-Javier Sayas. Time-domain boundary integral methods in linear thermoelasticity. (*In preparation*), 2018.
- Tonatiuh Sánchez-Vizuet and Manuel E. Solano. A Hybridizable Discontinuous Galerkin solver for the Grad-Shafranov equation. *Computer Physics Communications*, 235:120 – 132, 2019.
- George C. Hsiao, Tonatiuh Sánchez-Vizuet, Francisco-Javier Sayas, and Richard J. Weinacht. A time-dependent wave-thermoelastic solid interaction. *IMA Journal of Numerical Analysis*, April 2018. doi: 10.1093/imanum/dry016.
- Tonatiuh Sánchez-Vizuet and Antoine 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.
- Tonatiuh Sánchez-Vizuet and Francisco-Javier 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.
- Matthew Hassell, Tianyu Qiu, Tonatiuh Sánchez-Vizuet, and Francisco-Javier 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.
- George C. Hsiao, Tonatiuh Sánchez-Vizuet, and Francisco-Javier Sayas. Boundary and coupled boundary-finite element methods for transient wave-structure interaction. *IMA Journal of Numerical Analysis*, 37(1):237–265, 2016.
- Víctor Domínguez, Tonatiuh Sánchez-Vizuet, and Francisco-Javier 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

- Irene Gamba, Christina Sormani, Terence Tao, Leslie Greengard, Tonatiuh Sánchez-Vizuet, and Kevin R. Payne. The mathematics of Cathleen Synge Morawetz. *Notices of the American Mathematical Society*, 65(07):764–778, Aug 2018.
- George C. Hsiao, Tonatiuh Sánchez-Vizuet, Francisco-Javier Sayas, and Richard 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.
- George C. Hsiao, Tonatiuh Sánchez-Vizuet, and Francisco-Javier 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

- “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.

Schools & Workshops

- East Coast Optimization Meeting. George Mason University. Fairfax, Virginia. April 4-5, 2019.
- Simons Collaboration on Hidden Symmetries and Fusion Energy Annual Meeting, 2019. The Flat Iron Institute, New York. March 28-29, 2019.
- Workshop "Recent Advances and Challenges in Discontinuous Galerkin Methods and Related Approaches". Institute for Mathematics and its Applications, University of Minnesota. June 29-July 1, 2017.
- Workshop. "Computational and Numerical Analysis of Transient Problems in Acoustics, Elasticity, and Electromagnetism". Banff International Research Station. Banff, Canada. January 17-22, 2016.
- IMA Hot topics workshop. "Hydraulic fracturing: From modeling and simulation to reconstruction and characterization". Institute for Mathematics and its Applications. University of Minnesota. May, 2015.
- Jaques-Louis Lions Spanish-French School on numerical simulation in physics and engineering. Public University of Navarra. September, 2014.
- CBMS-NSF Conference "Fast direct solvers for elliptic PDE's". Dartmouth College. June, 2014.
- MSRI Summer School. "Introduction to the mathematics of seismic imaging". Mathematical Sciences Research Institute. University of California, Berkeley. July, 2013.
- NSF Workshop on the Boundary Element Method. " Bridging Education and Industrial Applications". University of Minnesota. May, 2012.
- Workshop on Multiscale Computing in Cloud Physics. University of Delaware. August, 2011.
- Summer school on Partial Differential Equations. National Autonomous University of Mexico, June 2011.
- Summer School on holomorphic foliations and dynamical systems. National Autonomous University of Mexico, June 2010.
- Summer school on averaging methods for periodic differential equations. National Autonomous University of Mexico, June 2009.
- Summer school on scientific computing and numerical relativity. CINVESTAV, 2005.

Teaching Experience

Courses taught

- 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 Mexico, School of Sciences.
- Fall 2011. Mathematics for Applied Sciences II. Teaching assistant. National Autonomous University of Mexico, School of Sciences.
- Spring 2011. Topics on theoretical & mathematical physics. Teaching assistant. National Autonomous University of Mexico, School of Sciences.
- Spring 2010. Vector Mechanics. Teaching assistant. National Autonomous University of Mexico, School of Sciences.
- Fall 2009. Heat transfer, waves & fluids. Teaching assistant. National Autonomous University of Mexico, School of Sciences.

Other teaching-related activities

- **Supervision of graduate research**

- Mr. Néstor Sánchez. Ph. D. Applied Mathematics, Universidad de Concepción, Chile. (Current).
Topic: Hybridizable discontinuous Galerkin methods for semilinear equations in domains with curved boundaries.
Co-advised with Manuel Solano.
- Ms. Jiaying Liang. M.S. Applied Mathematics, Courant Institute 2017-2018.
Topic: 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 (Current).
Topic: Newton-Krylov methods for Ill-posed problems / Machine learning methods for PDEs.
- 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.

- **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 Minisymposia

- "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.

Refereeing

- Applicable Analysis
- Computational and Applied Mathematics
- International Journal for Numerical Methods in Fluids
- Journal of Computational Physics
- Journal of Integral Equations and Applications
- Numerical Methods for Partial Differential Equations
- SIAM Journal of Numerical Analysis
- The Graduate Journal of Mathematics

Other

- Reviewer/Evaluator for the National Council of Science and Technology (CONACyT), Mexico.
- President of the University of Delaware SIAM student chapter. 2012/2013.