Lise-Marie Imbert-Gérard

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Current position

- Associate Professor (since 2020)
  Department of Mathematics, University of Arizona.
- Member of the Graduate Interdisciplinary Program in Applied Mathematics.
- Member of Sigma Xi, the scientific research honor society.

Education

- PhD (2013), Laboratoire J.-L. Lions, UPMC-Paris 6, supervised by Bruno Després.
  Thesis : Mathematical and numerical methods for some wave problems in magnetic plasmas.
- Ecole Normale Supérieure Cachan (2010).
- Agrégation de mathématiques (2008).

Previous positions

- 2018-2020. Assistant Professor,
  Department of Mathematics, University of Maryland College Park (Since January 2018).
  Center for Scientific Computation and Mathematical Modeling (CSCAMM).
  Institute for Physical Science and Technology (IPST).
- 2013-2017. Successively Post-doctoral researcher, Courant Instructor,
  and Cathleen Morawetz Post-doctoral Fellow,
  Courant Institute, NYU (Until December 2017).

Publications

1. *Three types of quasi-Trefftz functions for the 3D convected Helmholtz equation: construction and theoretical approximation properties.* LMIG, G. Sylvand.
   Accepted for publication after revision in IMA Journal of Numerical Analysis (arXiv:2201.12993).
2. *A space-time quasi-Trefftz DG method for the wave equation with piecewise-smooth coefficients.* LMIG, A. Moiola, P. Stocker.
   Math. Comp. (2022) DOI: 10.1090/mcom/3786.
3. *A roadmap for Generalized Plane Waves and their interpolation properties,* LMIG, G. Sylvand.
   Numerische Mathematik, 149 (2021) 1, pp. 87-137.
4. *Amplitude-based Generalized Plane Waves: new Quasi-Trefftz functions for scalar equations in 2D,* LMIG.
   SIAM J. Numer. Anal., 59 (2021) 3, pp. 1663–1686.

5. *Taylor States in Stellarators: A Fast High-order Boundary Integral Solver,* D. Malhotra, A. Cerfon, LMIG, M. O'Neil.

   Journal of Computational Physics 397 (2019) 108791.

6. *Integral equation methods for electrostatics, acoustics and electromagnetics in smoothly varying, anisotropic media,* LMIG, F. Vico, L. Greengard, M. Ferrando.

   SIAM J. Numer. Anal. 57-3 (2019), pp. 1020–1035.

7. *Pseudo-spectral methods for the Laplace-Beltrami equation and the Hodge decomposition on surfaces of genus one,* LMIG, L. Greengard.

   Numerical Methods for Partial Differential Equations (2017) 33-3, pp. 941–955.

8. *Numerical simulation of wave propagation in inhomogeneous media using Generalized Plane Waves,* LMIG, P. Monk.

   ESAIM: M2AN 51 (2017) pp. 1387–1406.

9. *Solutions to the cold plasma model at resonances,* B. Després, LMIG, O. Lafitte.

   Journal de l'École polytechnique – Mathématiques, 4 (2017), pp. 177–222.

10. *Fast, adaptive, high order accurate discretization of the Lippmann-Schwinger equation in two dimensions,* S. Ambikasaran, C. Borges, LMIG, L. Greengard.

    SIAM Journal of Scientific Computing, 38 (2016) 3, pp. A1770–A1787.

11. *A numerical study of the solution of X-mode equations around a hybrid resonance,* C. Caldini-Queiros, B. Després, LMIG, M. Kachanovska.

    ESAIM Proc., CEMRACS'14: Numerical modeling of plasmas, 53 (2016), pp. 1–21.

12. *Well-posedness and generalized plane waves simulations of a 2D mode conversion model,* LMIG.

    Journal of Computational Physics, 303 (2015), pp. 105–124.

13. *Interpolation properties of generalized plane waves,* LMIG.

    Numerische Mathematik, 131 (2015) 4, pp. 683–711.

14. *A generalized plane wave numerical method for smooth nonconstant coefficients,* LMIG, B. Després.

    IMA Journal of Numerical Analysis, 34 (2014), pp. 1072–1103.

15. *Hybrid resonance of Maxwell's equations in slab geometry,* B. Després LMIG, R. Weder.

    Journal de Mathématiques Pures et Appliquées (2014), 101-5 , pp. 623–659.

16. *Conservative numerical methods for a two-temperature resistive MHD model with self-generated magnetic field term,* M. Wolff, S. Jaouen, LMIG.

    ESAIM Proc., CEMRACS'10: Numerical modeling of fusion, 32 (2011) pp. 195–210.

17. *Magnetic Equations with FreeFem++: the Grad-Shafranov Equation and the Current Hole,* E. Deriaz, B. Despres, G. Faccanoni, K. P. Gostaf, LMIG, G. Sadaka and R. Sart.

    ESAIM Proc., CEMRACS'10: Numerical modeling of fusion, 32 (2011) pp. 76–94.

Book project

1. *An Introduction to Stellarators: From magnetic fields to symmetries and optimization,* LMIG, E. Paul, A. Wright.

   Under contract for publication with SIAM. Preliminary draft version (2020) (arxiv:1908.05360).

Selected Talks (*Invited)

- 06/17/2024, * **NAHOMCON 2024**, Dartmouth College NH.
- 02/22/2024, **Seminar of the Institute for Fusion Studies**, UT Austin TX.
- 01/19/2024, **Applied Mathematics colloquium**, UC Boulder CO.
- 12/13/2023, * **Mathematical Opportunities in Digital Twins workshop**, Fairfax VI.
- 11/30/2023, **Mathematics colloquium**, Tucson AZ.
- 11/03/2023, **Applied and Computational Mathematics Seminar**, Madison WI.
- 06/21/2023, * **Foundations of Computational Mathematics conference**, Paris (France).
- 06/15/2023, **Thematic day on the math. of stellarators & magnetic confinement**, Paris.
- 01/18/2023, **Applied Mathematics colloquium**, University of Waterloo, Waterloo (Canada).
- 12/16/2022, **Seminario de Ingeniería Civil Matemática**, U. de Concepción (Chile), online.
- 10/19/2022, **Numerical Analysis seminar**, Texas A&M, College Station TX.
- 07/25/2022, **WAVES conference 2022**, Palaiseau (France).
- 06/23/2022, **Solvers for freq.-domain wave pbs and app. ICMS workshop**, Glasgow (UK).
- 06/06/2022, **ECCOMS Congress 2022**, Oslo (Norway).
- 04/26/2022, **Center for Nonlinear Analysis seminar**, Carnegie Mellon University PA.
- 02/17/2022, **Modeling, Computation, Nonlinearity, Randomness and Waves Seminar**, University of Arizona AZ.
- 12/15/2021, **CAGE INRIA team seminar (Paris, France)**, online.
- 11/18/2021, **Numerical Analysis and PDE seminar (Nice, France)**, online.
- 10/07/2021, **Princeton Plasma Physics Lab (PPPL) theory seminar**, online.
- 08/19/2021, **PPPL Graduate Summer School**, online.
- 08/17/2021, **PPPL Graduate Summer School**, online.
- 07/19/2021, **SIAM annual meeting**, online.
- 06/08/2021, **Num. Meth. in Plasma Physics Sem.,** Max Planck IPP, Garching (Germany).
- 03/12/2021, **Applied Math. and Stat. Colloquium,** Colorado School of Mines, Golden CO.
- 03/01/2021, **SIAM CSE conference,** online.
- 01/13/2021, **WCCM conference,** online.
- 01/30/2020, ***Multiscale methods for dynamics workshop,** Geneva (Switzerland).

Invitations

- 01/2024, Kavli Korean-American Frontiers of Science symposium, Irvine CA.
- 10/2023, Kavli Japanese-American-German Frontiers of Science symposium, Dresden (Germany).
- 05/2022, Banff International Research Station-Casa Matematica Oaxaca
  Outstanding Challenges in Computational Methods for Integral Equations Workshop.
- 08/2021, Princeton Plasma Physics Laboratory Graduate summer school (online),
  Mini-tutorial on stellarators presented with E. Paul and A. Wright.
- 12/2018, Mathematisches Forschungsinstitut Oberwolfach (Germany),
  Mini-Workshop on Mathematical and Numerical Analysis of Maxwell's Equations.
- Summer 2018, Erwin Schrodinger International Institute for Mathematics and Physics (Austria),
  ESI Program on Numerical Analysis of Complex PDE Models in Sciences.
- 01/2017, Banff International Research Station (Canada),
  Workshop on Computational and Numerical Analysis of Transient Problems in Acoustics.
- 12/2016, Institute for Mathematics and its Applications (Minneapolis),
  Workshop on Mathematical and Numerical Modeling in Optics.

Awards & grant support

- Kavli Fellow 2023 (link)
- DOE-ASCR Early Career Research grant ($875,000), **Quasi-Trefftz methods for problems governed by vector-valued Partial Differential equation**, 2023-2028.
- NSF-DMS-2110407 grant (single PI, $334,752), **Novel Methods for Numerical Simulation of Wave Propagation in Inhomogeneous Media**, 2021-2024. (link)
- FACE foundation Thomas Jefferson fund (Collaboration with Charles Dapogny, $20,000), **Meshing techniques for the simulation of wave propagation in plasmas**, 2021-2023. (link)
- CSCAMM interdisciplinary research fund ($10,000), to fund collaboration with E. Paul, IREAP-UMD, and A. Wrigth, Australian National University, Fall 2019.
- Simons Foundation Mathematical and Physical Sciences collaborative grant (Founding PI for the University of Maryland, then for the University of Arizona, 20 collaborators, $8M + $6M), **Hidden Symmetries and Fusion Energy**, 2018-2022 + 2022-2025. (link)
- NSF-DMS-1818747/NSF-DMS 2105487 grant (single PI, $268,940), **Advances in num. methods for wave propagation problems in inhomogeneous media**, 2018-2023. (link)/ (link)
- 18th **IMA Leslie Fox Prize in Numerical Analysis**, second prize, 2017.
- NSF/AWM Travel Grant, International conference on Domain Decomposition, Svalbard (2017).
- Cathleen Morawetz Fellowship Award, 2016-2017.
- Foundation Pierre Ledoux grant for a three months visit to Peter Monk (University of Delaware) to implement a 2D code based on generalized plane waves, Spring 2012.
- Graduate Research Fellowship from ENS Cachan, 2010-2013.

Service and synergistic activities

- Member of the Organizing Committee for the Long Program on "Multi-Fidelity Methods for Fusion Energy" at UCLA's Institute for Pure and Applied Mathematics (IPAM), 2026.
- Organizer with Hélène Barucq, Ilaria Perugia and Virginia Selgas of a Trefftz workshop at the BIRS-Casa Matematica Oaxaca, 2024.
- Member of the program committee for the 2024 Sherwood fusion theory conference. Goal: *communicate recent results in the physics of controlled fusion energy.*
- Organizer with Myoungjean Bae of a session at the Korean-American Frontiers of Science symposium 2024. Goal: *bring together outstanding young scientists to discuss exciting advances and opportunities in a broad range of disciplines.*
- Invited speaker at the Mathematical Opportunities in Digital Twins workshop, December 11-13 2023. Goal: *This workshop brings together key experts working in many aspects of mathematics, key application fields, and industry with the goal to determine the ways in which mathematics can contribute to the research on Digital Twins and how Digital Twins can open up new mathematical directions, as well as to identify connections, synergies, and organizational efforts within the mathematical community, and to/with other disciplines.*
- Participant (by invitation only) and panel moderator, Fusion summit organized at Columbia University, February 2nd 2023. Goal: *To bring together technical experts and key opinion leaders from academia, government and the private sector (both for-profit and non-profit) to discuss mechanisms for three-way partnerships to advance fusion science in the public interest.*
- Personnel committee (hiring and hiring planning), 2023-ongoing.
- Faculty mentor for the local AWM student chapter, 2023-ungoing.
- Member of the scientific committee of the International Conference on Mathematical and Numerical Aspects of Waves Propagation, 2022-ongoing.
- 5-year administrative review Committee for the Department Head of the Department of Mathematics, 2022-2023.
- PhD committee member for the thesis of Margot Sirdey (U. Pau et Pays de l'Adour, France 2022).
- TA supervision, Fall 2022.
- Instructional Faculty Personnel Committee, Spring 2022- Spring 2023.
- MATH 589 qualifying committee, 2021-present.
- WISE program mentor, 2021-2022 and 2023-2024.
- Graduate Inter-Disciplinary Program in Applied Mathematics steering committee, 2021-present.
- International reviewer for the thesis of Nestor Sánchez (U. de Concepción, Chile, 2021).
- Thesis committee Nikki Holtzer (Summer 2021), Justin Crum (Spring 2022), Teddy Broeren (2022-ongoing). Master's committee Bud Denny (Summer 2021). Comprehensive exam committee William Gammel (Spring 2023).
- Organizing committee for the Mathematics colloquium, 2020-2021.
- Hiring committee for computational statistics, 2018-2019.
- Final oral examination committee Wenbo Li (2019), Tengfei Su (2019).
  Preliminary oral examination committee Shuo Yang (2018), Kayla Davie (2019).

- Reviewer for the NSF Division of Mathematical Sciences, for the DOE-ASCR program, for the Austrian Science Fund (FWF), for the German Research Foundation (DFG), for the French National Research Agency (ANR) and for the ORAU Powe award.
- Reviewer for Journal of Computational Physics, Computer Physics Communications, Journal of Nonlinear Science, Research in the Mathematical Sciences, Mathematics of Computation, Numerical Algorithms, Computer Methods in Applied Mechanics and Engineering, Mathematical Reviews, International Journal for Numerical Methods in Engineering, Waves in Random and Complex Media, SIAM Journal of Numerical Analysis.
- Organizer of mini-symposia: at WAVES 2019 with A. Moiola and E. Spence, at ICIAM 2019 with Yunqing Huang and Jichun Li, at WONAPDE 2019 with F. Sayas, at ICOSAHOM 2018 and WAVES 2015 with B. Després, at SIAM CSE with L. Zepeda-Nuñez (2017) and A. Gillman (2015), at SIAM APDE 2015 with H. Antil.
- Organizer of a summer school on waves and plasmas, with Martin Campos-Pinto (CNRS), Bruno Després (UPMC-Paris 6), Eric Sonnendrücker (Technische Universität München). Summer 2017.
- Organizer of a reading seminar focused on basic modeling of waves in plasma, at Courant, with Jacob Bedrossian (University of Maryland). Spring 2015, Fall 2016.

Research supervision

- Valeriia Cherepanova, AMSC research project (UMD), summer project: Investigating the interpolation properties of Generalized Plane Waves in the high frequency regime.
- José Fernando Núñez (NYU), undergraduate research project: Construction Generalized Plane Waves in 3D for the Helmholtz equation.
- Jean-Francois Fritsch (master student, ENSTA), summer research project at UMD: Design and Interpolation properties of Generalized Plane Waves: Scalar and vector-valued equations in 3D.
- Thierry Antoun (master student, ENSTA), summer research project at UMD: Design and Interpolation properties of Generalized Plane Waves for Maxwell's equation in 3D.
- Mathieu Lise (master student, Ecole Polytechnique), summer research project: exploring quasi-Trefftz functions for Maxwell's equation in 3D.

Teaching experience

- University of Arizona.
  Calculus I (Fall 2020), Calculus II (Fall 2022), Introduction to Linear Algebra (Spring 2021, Fall 2021), Applied PDEs (Spring 2022), Mathematical principles of Numerical Analysis (Fall 2022, Fall 2023), Theory of Complex variable (Spring 2024).
- University of Maryland.
  Introduction to Numerical Analysis (Undergraduate - Spring 2018), Scientific computing I (Graduate - Fall 2018, Fall 2019), Scientific computing II (Graduate - Spring 2019, Spring 2020).
- Courant Institute: 2014-2016.
  Calculus 1 (Fall 2014); Mathematics for Economics 1 (Spring 2015); Calculus 3 (Fall 2015); Analysis (Undergraduate - Spring 2016).
- Université Paris 6: 2010-2013 Teaching assistant.
  Analysis and Algebra (2nd year), Topology and Differential Calculus (3rd year), Introduction to Numerical Analysis (3rd year).

- Cayenne (French Guyana): 2008-2009.
  Training course for adults preparing the French "CAPES interne", national ranking exam to become teacher. Full time high school teacher, Lycée Félix Eboué (Fall 2008).

Languages

French (native language), English (fluent), Spanish (fluent).