

CARLOS PÉREZ ARANCIBIA

Curriculum Vitae

Drienerlolaan 5 ◊ 7522 NB Enschede ◊ The Netherlands
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Last updated May 28, 2024

RESEARCH INTERESTS

Scientific computing; high-order PDE solvers; fast algorithms; numerical analysis; boundary and volume integral equations; wave phenomena; computational electromagnetics; optical metamaterials.

EMPLOYMENT HISTORY

ASSISTANT PROFESSOR (UD-1, TENURED) Mathematics of Computational Science Department of Applied Mathematics University of Twente, Enschede, The Netherlands	9/21 - Present
ASSISTANT PROFESSOR Institute for Mathematical and Computational Engineering Pontificia Universidad Católica de Chile, Santiago, Chile	7/17 - 8/21
INSTRUCTOR IN APPLIED MATHEMATICS Department of Mathematics Massachusetts Institute of Technology, Cambridge, MA, USA	9/16 - 6/18

EDUCATION

CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CA, USA · Ph.D. in Applied & Computational Mathematics · Thesis supervisor: Oscar P. Bruno	8/16
PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE, SANTIAGO, CHILE · Diploma in Mathematical Engineering (with the highest distinction) · Master in Engineering Sciences (with the highest distinction) · Minor in Philosophy · Bachelor in Engineering Sciences	5/10 5/10 5/10 12/08

FUNDING

- NWO OPEN COMPETITION DOMAIN SCIENCE (M1) awarded by the Dutch Research Council, the Netherlands
Title: *Density interpolation methods for the fast and high-order evaluation of volume potentials in complex geometries*
Role: Principal investigator
Period: 2024 – 2028 (4 years)
Budget: €372,565 (~ \$405,209)
- STRATEGIC RESEARCH INITIATIVE awarded by the 4TU Applied Mathematics Institute, the Netherlands
Title: *Advancing mathematical methods for wave phenomena*
Role: Co-principal investigator
Period: 2024 – 2026 (2 years)
Budget: €20,000 (~ \$21,751)
- FONDECYT DE INICIACIÓN EN INVESTIGACIÓN awarded by Agencia Nacional de Investigación y Desarrollo, Chile
Title: *Fast and efficient method of moments for electromagnetic wave propagation and scattering in the presence of unbounded material interfaces*
Role: Principal investigator

Period: 2018 – 2021 (3 years)
Budget: CLP 61,298,000 (~ \$87,500)

· MISTI GLOBAL SEED FUNDS awarded by the Massachusetts Institute Technology and the Pontificia Universidad Católica de Chile

Title: *High-Contrast challenges in numerical wave scattering*
Role: Co-principal investigator
Period: 2016 – 2017 (2 years)

JOURNAL PAPERS¹

- 27.‡ V. Hojas, [C. Pérez-Arancibia](#) and M. A. Sánchez. Reflectionless discrete perfectly matched layers for higher-order finite difference schemes. Submitted, 2024.
- 26.† A.-S. Bonnet-Ben Dhia, L. Faria and [C. Pérez-Arancibia](#). A complex-scaled boundary integral equation for time-harmonic water waves. To appear in *SIAM Journal on Applied Mathematics*, 2024.
- 25.† T. G. Anderson, M. Bonnet, L. M. Faria and [C. Pérez-Arancibia](#). Fast, high-order accurate numerical evaluation of volume potentials via polynomial density interpolation. To appear in *Journal of Computational Physics*, 2024.
- 24.† T. G. Anderson, M. Bonnet, L. M. Faria, and [C. Pérez-Arancibia](#). Construction of polynomial particular solutions of linear constant-coefficient partial differential equations. *Comput. Math. Appl.*, 162, 94-103, 2024.
- 23.† L. Faria, [C. Pérez-Arancibia](#) and C. Turc. Combined field-only boundary integral equations for PEC electromagnetic scattering problem in spherical geometries. *SIAM J. Appl. Math.*, 84(1):1-38, 2024.
- 22.‡ T. Strauszer-Caussade, L. Faria, A. Fernandez-Lado and [C. Pérez-Arancibia](#). Windowed Green function method for wave scattering by periodic arrays of 2D obstacles. *Stud. Appl. Math.*, 150(1):277-315, 2023.
- 21.‡ R. Arrieta and [C. Pérez-Arancibia](#). Windowed Green function MoM for second-kind surface integral equation formulations of layered media electromagnetic scattering problems. *IEEE Trans. Antennas Propag.*, 70(12):11978-11989, 2022.
- 20.‡ V. Gómez and [C. Pérez-Arancibia](#). On the regularization of Cauchy-type integral operators via the density interpolation method and applications. *Comput. Math. Appl.*, 87:108-119, 2021.
19. L. Faria, [C. Pérez-Arancibia](#) and M. Bonnet. General-purpose kernel regularization of boundary integral equations via density interpolation. *Comput. Methods Appl. Mech. Engrg.*, 378(113703):1-29, 2021.
18. [C. Pérez-Arancibia](#), C. Turc, L. Faria and C. Sideris. Planewave density interpolation methods for the EFIE on simple and composite surfaces. *IEEE Trans. Antennas Propag.*, 69(1):317-331, 2021.
- 17.† D. Nicholls, [C. Pérez-Arancibia](#), and C. Turc. Sweeping preconditioners for the iterative solution of quasiperiodic Helmholtz transmission problems in layered media. *J. Sci. Comput.*, 82:44, 2020.
- 16.‡ I. Labarca, L. Faria and [C. Pérez-Arancibia](#). Convolution quadrature methods for time-domain scattering from unbounded penetrable interfaces. *Proc. R. Soc. A*, 2019.0029, 2019.
15. [C. Pérez-Arancibia](#), C. Turc and L. Faria. Planewave density interpolation methods for 3D Helmholtz boundary integral equations. *SIAM J. Sci. Comput.*, 41(4):A2065-A2087, 2019.
- 14.† [C. Pérez-Arancibia](#), S. Shipman, C. Turc and S. Venakides. Domain decomposition for quasi-periodic scattering by layered media via robust boundary-integral equations at all frequencies. *Commun. Comput. Phys.*, 26:265-310, 2019.
13. [C. Pérez-Arancibia](#), L. Faria and C. Turc. Harmonic density interpolation methods for high-order evaluation of Laplace layer potentials in 2D and 3D. *J. Comput. Phys.*, 376:411-434, 2019.
12. R. Pestourie, [C. Pérez-Arancibia](#), Z. Lin, W. Shin, F. Capasso and S. G. Johnson. Inverse design of large-area metasurfaces. *Opt. Express*, 26(26):33732-33747, 2018.

¹Papers marked with the symbol † follow the mathematical tradition of alphabetical authorship ordering, whereas those marked with ‡ denote work with mentored students.

11. C. Pérez-Arancibia, R. Pestourie and S. G. Johnson. Sideways adiabaticity: Beyond ray optics for slowly varying metasurfaces. *Opt. Express*, 26(23):30202-30230, 2018.
10. C. Pérez-Arancibia, E. Godoy and M. Durán. Modeling and simulation of an acoustic well stimulation method. *Wave Motion*, 77:214-228, 2018.
9. C. Pérez-Arancibia. A planewave singularity subtraction technique for the classical Dirichlet and Neumann combined field integral equations. *Appl. Numer. Math.*, 123:221-240, 2018.
- 8.† C. Jerez-Hanckes, C. Pérez-Arancibia and C. Turc. Multitrace/singletrace formulations and Domain Decomposition Methods for the solution of Helmholtz transmission problems for bounded composite scatterers. *J. Comput. Phys.*, 350:343-360, 2017.
- 7.† O. P. Bruno, E. Garza-Gonzalez and C. Pérez-Arancibia. Windowed Green Function method for nonuniform open-waveguide problems. *IEEE Trans. Antennas Propag.*, 65(9):4684-4692, 2017.
- 6.† O. P. Bruno and C. Pérez-Arancibia. Windowed Green Function method for the Helmholtz equation in presence of multiply layered media. *Proc. R. Soc. A*, 473(2202), 2017.
- 5.† O. P. Bruno, M. Lyon, C. Pérez-Arancibia and C. Turc. Windowed Green Function method for layered-media scattering. *SIAM J. Appl. Math.*, 76(5):1871-1898, 2016.
4. C. Pérez-Arancibia and O. Bruno. High-order integral equation methods for problems of scattering by bumps and cavities on half-planes. *J. Opt. Soc. Am. A*, 31(8):1738-1746, 2014.
3. C. Pérez-Arancibia, P. Zhang, O. P. Bruno and Y. Y. Lau. Electromagnetic power absorption due to bumps and trenches on flat surfaces. *J. Appl. Phys.*, 116(12):124904, 2014.
2. C. Pérez-Arancibia, P. Ramaciotti, R. Hein and M. Durán. Fast multipole boundary element method for the Laplace equation in a locally perturbed half-plane with a Robin boundary condition. *Comput. Methods Appl. Mech. Engrg.*, 233(1):152-163, 2012.
1. C. Pérez-Arancibia and M. Durán. On the Green's function for the Helmholtz operator in an impedance circular cylindrical waveguide. *J. Comput. Appl. Math.*, 235(1):244-262, 2010.

CONFERENCE (PEER-REVIEWED) PAPERS

- R. Arrieta, L. Faria, C. Pérez-Arancibia, and C. Turc. A high-order density-interpolation-based Nyström method for three-dimensional electromagnetic boundary integral equations. *WAVES 2022: The 15th International Conference on Mathematical and Numerical Aspects of Wave Propagation*, July 24–29 2022, Palaiseau, France.
- J. Hu, E. Garza, C. Pérez-Arancibia and C. Sideris. High-Order accurate integral equation based mode solver for layered nanophotonic waveguides. *International Microwave Symposium*, June 6–11 2021, Atlanta, GA, USA.
- C. Pérez-Arancibia and O. P. Bruno. A high-order integral equation solver for problems of electromagnetic scattering by three-dimensional open surfaces. *WAVES 2015: The 12th International Conference on Mathematical and Numerical Aspects of Wave Propagation*, July 20–24 2015, Karlsruhe, Germany.

THESES

- Windowed integral equation methods for problems of scattering by defects and obstacles in layered media. Ph.D. thesis, California Institute of Technology, Pasadena, CA, USA, 2016.
- Modeling and simulation of time-harmonic wave propagation in cylindrical impedance waveguides: Application to an oil well stimulation technology. Master's thesis, Escuela de Ingeniería, Pontificia Universidad Católica de Chile, Santiago, Chile, 2010.

SELECTED TALKS AND PRESENTATIONS

- International Conference on Applied Mathematics (ICAM 2024), City University of Hong Kong, Hong Kong, May 28 – June 1, 2024 (invited speaker).
- Institute of Computational Mathematics and Scientific Computing Seminar, Chinese Academy of Sciences, May 7, 2024 (invited talk online).

- Seminars in Numerical Analysis, Delft University of Technology, Delft, March 16, 2024 (invited talk).
- The 10th International Congress on Industrial and Applied Mathematics (ICIAM 2023), Tokyo, Japan, August 20–25, 2023 (invited talk).
- Workshop on Computational Methods for Multiple Scattering. Isaac Newton Institute, Cambridge, UK, April 17–21, 2023 (invited talk). Link to video [↗](#).
- SIAM Conference on Computational Science and Engineering, Amsterdam, The Netherlands, March 1, 2023.
- The 12th International Conference on Mathematical and Numerical Aspects of Wave Propagation (WAVES 2023), Palaiseau, France, July 25–29, 2023.
- IEEE GRSS-APS Joint Student Chapter, University of Southern California, Los Angeles, CA, USA, April 7, 2022 (invited talk online).
- Conference on Mathematics of Wave Phenomena, Karlsruhe, Germany, February 14–18, 2022 (invited talk online).
- Applied Mathematics Colloquium, University of Colorado at Boulder, January 21, 2022 (invited talk online).
- International Conference on Spectral and High Order Methods (ICOSAHOM 2020+1), Vienna, Austria, July 12–16, 2021.
- POEMS Seminar, ENSTA Paris, Palaiseau, France, April 15, 2021 (invited talk online).
- Numerical Analysis of Electromagnetic Problems, Oberwolfach Mathematical Research Institute, Germany, March 23, 2021 (invited talk online).
- Applied Mathematics Colloquium, New Jersey Institute of Technology, Newark, NJ, USA, January 31, 2020 (invited talk).
- Numerical Methods for Partial Differential Equations Seminar, MIT, Cambridge, MA, USA, January 29, 2020 (invited talk).
- Applied Mathematics and Scientific Computing Seminar, Temple University, Philadelphia, PA, USA, January 27, 2020 (invited talk).
- French Latin-American Conference on New Trends in Applied Mathematics, Center for Mathematical Modeling, Universidad de Chile, Santiago, Chile, November 5–8, 2019 (invited talk).
- PUC-Bath Workshop on PDE's and Applications, Santiago, Chile, September 12, 2019 (invited talk).
- Coloquio del Departamento de Ingeniería Matemática, Universidad de Concepción, Chile, May 23, 2019 (invited talk).
- SIAM Conference on Computational Science and Engineering, Spokane, Washington, WA, USA, March 1, 2019 (invited talk).
- The 6th Chilean Workshop on Numerical Analysis of Partial Differential Equations (WONAPDE 2019), Concepción, Chile, January 22, 2019.
- The 2nd Chilean Symposium on Boundary Element Methods, Universidad Federico Santa María, Valparaíso, Chile, December 14, 2018 (invited talk).
- Mathematical Sciences Colloquium, University of Massachusetts at Lowell, MA, USA, October 13, 2017 (invited talk).
- Institute for Mathematical and Computational Engineering Seminar, PUC, Santiago, Chile, August 24, 2017 (invited talk).
- Caleta Numérica, Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile, August 18, 2017 (invited talk).
- The 9th Meeting on Numerical Analysis of Partial Differential Equations (Santiago Numérico III), Santiago, Chile, June–28–30, 2017.
- Numerical Methods for Partial Differential Equations Seminar, MIT, Cambridge, MA, USA, April 19, 2017 (invited talk).

- The 10th International Conference on Scientific Computing and Applications, Fields Institute, Toronto, Canada, June 6-10, 2016 (invited talk).
- The 13th Annual Conference on Frontiers in Applied and Computational Mathematics (FACM 2016), Newark, NJ, USA, June 3-4, 2016 (invited talk).
- Applied and Computational Mathematics Seminar, University of California, Irvine, CA, USA, February 22, 2016 (invited talk).
- Applied and Computational Mathematics Seminar, University of California, Merced, CA, USA, February 2, 2016 (invited talk).
- The 12th International Conference on Mathematical and Numerical Aspects of Wave Propagation (WAVES 2015), Karlsruhe, Germany, July 20-24, 2015.
- AMMCS-CAIMS Congress, Waterloo, Ontario, Canada, June 7-12, 2015 (invited talk).
- SIAM Conference on Computational Science and Engineering, Salt Lake City, Utah, USA, March 14-18, 2015 (invited talk).
- International Conference on Spectral and High Order Methods (ICOSAHOM 2014), Salt Lake City, UT, USA, June 23-27, 2014.
- NSF Workshop on the BEM, University of Minnesota, Minneapolis, MN, USA, April 23-26, 2012 (poster).
- Valparaíso's Mathematics and its Applications Days, Pontificia Universidad Católica de Valparaíso, Valparaíso, Chile, December 12-14, 2012 (invited talk).

TEACHING EXPERIENCE

UNIVERSITY OF TWENTE

9/21 - Present

Lecturer

- Analysis I, 1st term, 2022 and 2023.
- Analysis II, 2nd term, 2022 and 2023.

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE

6/18 - 8/21

Lecturer

- Calculus III (MAT1630), 1st semester of 2020 (~240 students) and 2021 (~190 students).
- Engineering Applications of PDEs and Functional Analysis (IMT3130/3773), 1st semester of 2019, 2020, and 2021.
- Scientific Computing II (MAT2615), 2nd semester 2020.
- Scientific Computing I (MAT2605), 2nd semester 2019.
- Advanced Topics in Numerical Analysis (IMT3810), 2nd semester 2019.
- Capstone Course on Mathematical and Computational Engineering (IMT3500), 2nd semester 2018.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

9/16 - 6/18

Lecturer

- Fast Methods for Partial Differential and Integral Equations (18.336J/6.335J), Fall 2016 and 2017 (link to the course's website [↗](#)).
- Linear Partial Differential Equations: Analysis and Numerics (18.303), Spring 2018.

CALIFORNIA INSTITUTE OF TECHNOLOGY

9/12 - 6/16

Teaching Assistant

- Methods of Applied Mathematics A (ACM101A), Fall 2014 and 2015.
- Methods of Applied Mathematics B (ACM101B), Winter 2015 and 2016.
- Introductory Methods of Applied Mathematics A (ACM100A), Fall 2012, 2013 and 2014.
- Introductory Methods of Applied Mathematics B (ACM100B), Winter Term 2013.
- Introductory Methods of Applied Mathematics C (ACM100C), Spring 2013, 2014 and 2015.
- Introductory Methods of Computational Mathematics B (ACM106B), Winter 2014.

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
Lecturer

8/10 - 12/10

- Mathematical Methods Applied to Engineering (IMM2650), 2nd Semester 2010.

PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
Teaching Assistant

3/06 - 12/09

- Numerical Analysis of Partial Differential Equations, 2nd semester 2009.
- Introduction to Numerical Analysis of Partial Differential Equations, 1st semester 2009.
- Calculus II, 2nd semester 2008.
- Calculus III, 2nd semester 2008.
- Partial Differential Equations, 1st semester 2007 and 2008.
- Calculus I (Maple laboratory), 1st semester 2008.
- Differential Equations, 1st semester 2006 and 2nd semester 2007.
- Linear Algebra, 1st and 2nd semesters 2006.

AWARDS

- TOP CHINA UC SANTANDER FELLOWSHIP, December 2018.
- ICES POSTDOCTORAL FELLOWSHIP, UNIVERSITY OF TEXAS AT AUSTIN, February 2016 (declined).
- IMA POSTDOCTORAL FELLOWSHIP, UNIVERSITY OF MINNESOTA, January 2016 (declined).
- PIMS POSTDOCTORAL FELLOWSHIP (CANADA), December 2015 (declined).
- AMMCS-CAIMS STUDENT TRAVEL AWARD, June 2015.
- SIAM STUDENT TRAVEL AWARD, March 2015.
- STUDENT TRAVEL AWARD, NSF Workshop on the BEM, University of Minnesota, April 2012.
- CALTECH INSTITUTE FELLOWSHIP, September 2011.
- CONICYT SCHOLARSHIP FOR MASTER'S STUDIES IN CHILE, January 2009.
- PADRE ALBERTO HURTADO AWARD, Pontificia Universidad Católica de Chile, March 2003.

SERVICE

JOURNAL PAPER REVIEW

- Journal of Computational Physics (2015, 2018, 2019, 2022)
- SIAM Journal on Applied Mathematics (2018, 2020, 2022)
- SIAM Journal on Scientific Computing (2017)
- SIAM Journal on Numerical Analysis (2018)
- Computers and Mathematics with Applications (2019)
- Advances in Computational Mathematics (2023)
- IMA Journal of Applied Mathematics (2022)
- IMA Journal of Numerical Analysis (2020)
- SN Partial Differential Equations and Applications (2020)
- IEEE Transactions on Antennas and Propagation (2021)
- Engineering Optimization (2017)
- International Journal for Numerical Methods in Engineering (2015)
- Journal of Algorithms and Optimization (2014)
- Progress in Electromagnetic Research PERS (2011, 2012, 2014)
- International Journal on Geomathematics (2022)

SEMINAR AND MINISYMPOSIUM ORGANIZATION

- Recent Advances on Integral Equation and Spectral Methods for Inhomogeneous Problems (with Thomas G. Anderson, Rice University). Minisymposium at SIAM CSE 2023, March 2023.
- Time-Evolution and Frequency-Domain Methods for Partial Differential Equations (with David Shirokoff, NJIT). Minisymposium at WONAPDE 2019, January 2019.
- Seminar of the Institute for Mathematical and Computational Engineering. Weekly research seminar for graduate and undergraduate applied mathematics students at PUC Chile. 2020 academic year.
- Numerical Methods for Partial Differential Equations Seminar (with Manuel A. Sánchez, PUC). PUC Chile, 2nd Semester 2018.

MEMBERSHIPS

- Applied Mathematics Programme Committee, University of Twente (since September 2023).
- Society of Industrial and Applied Mathematics (SIAM).
- Institute of Electrical and Electronics Engineers (IEEE).

PARTICIPATION IN PH.D. COMMITTEES

- Erli Wind-Andersen, Ph.D. in Mathematical Sciences, New Jersey Institute of Technology.
- Ruben Ailwyn. Ph.D. in Electrical Engineering, PUC Chile.

RESEARCH SUPERVISION

GRADUATE STUDENTS MENTORSHIP

- Vicente Hojas: PUC Chile, master's thesis (Ph.D. student at Caltech).
- Rodrigo Arrieta: PUC Chile, master's thesis (Ph.D. student at MIT).
- Thomas Strauszer: PUC Chile, master's thesis (Ph.D. student at University College London).
- Ignacio Labarca: PUC Chile, master's thesis (Ph.D. from ETH Zürich).

UNDERGRADUATE STUDENTS MENTORSHIP

- Gernt Hanskamp: University of Twente, The Netherlands. Bachelor's thesis.
- Jelle Boon: University of Twente, The Netherlands. Bachelor's thesis.
- Guilhem Penet: ENSTA Paris, France. Research internship.
- Vicente Gomez: PUC Chile (Ph.D. student at NYU Courant Institute).