Bio

Mathematical and computational engineering student with a strong background in applied mathematics and physics and trained in functional analysis,9 scientific computing, numerical analysis, data science, optimization and PDEs. I am motivated to use this knowledge to address complex problems in science and engineering, with emphasis in signal processing, machine learning and imaging.

Contact Information

iscontreras@uc.cl
ignacontreras.github.io

Education

Pontificia Universidad Católica de Chile
Master of Science in Engineering 2022-
Thesis: *Analysis of techniques for lifting to measure spaces for nonlinear inverse problems*
Advisor: Carlos A. Sing-Long

Pontificia Universidad Católica de Chile
Professional degree in Mathematical and Computational Engineering 2017-2022

Pontificia Universidad Católica de Chile
B.Sc. (Licenciatura) in Engineering 2017-2021
- Majored in Engineering Physics
- Minor in Applied Mathematics

Research Interests

Applied harmonic analysis, discrete inverse problems, mathematical optimization, scientific computing & mathematics of data science.

Research Experience

Master Thesis January 2022-Present
We investigate the *lifting-to-measure-spaces* techniques introduced for the problem of mathematical super resolution, using tools from reproducing kernel Hilbert spaces (RKHS) and with applications to magnetic resonance spectroscopy.

Undergraduate Research April 2021-December 2021
Atomic norm minimization for super resolution.
Mentor: Carlos A. Sing Long

Summer Research in Mathematics November 2020-January 2021
Adjoint-based method for shape optimization problems with boundary integral equation constraints.
Mentor: Carlos Pérez-Arancibia

Undergraduate Research August-December 2020
Comparison of lens distorsion models for close-range photogrammetry in MOONS project using Computer Vision.
Mentor: Clémentine Béchet

Summer Research in Physics January 2020
Inverse problems in Physics. Radon transform, Can one hear the shape of a drum? and Electrical impedance tomography.
Mentor: Rafael Benguria

Work Experience	**Capstone Project: Mathematical Engineering**	March-July 2022
	Topic: Sentiment analysis of large-scale social media and news data	
	Internship - European Southern Observatory (ESO).	January-March 2022
	Paranal Observatory. The Science Operations department.	
	Intern on the project "Clouds and Precipitation Detection using Water Vapor Radiometer data".	
Teaching Experience	**Teaching Assistant**	
	TA and grader for graduate and undergraduate courses for the Engineering, Mathematics and Physics faculty.	
	Advanced Optimization	March-July 2023
	Prof. Cristobal Guzmán	
	Engineering Applications of PDE's and Functional Analysis	March-July 2023
	Prof. Federico Fuentes	
	Topics in Inverse Problems	March-July 2023
	Prof. Carlos A. Sing-Long	
	Scientific Computing I	August-December 2022
	Prof. Federico Fuentes	
	Biomedical Imaging	August-December 2022
	Prof. Carlos A. Sing-Long	
	Topics in Inverse Problems	March-July 2022
	Prof. Carlos A. Sing-Long	
	Fourier Analysis	August-December 2021
	Prof. Carlos A. Sing-Long	
	Calculus III	March-July 2021
	Prof. Carlos Pérez-Arancibia	
	Electricity & Magnetism Laboratory	January 2021
	Scientific Computing I	March-July 2020
	Prof. Thomas Führer	
	Electricity & Magnetism (grader)	March-July 2020
Leadership & Service	**Organizer**	
	SIAM-PUC Summer School. 200 years of Fourier Analysis	January 2023
	Organizer	
	Mathematical Engineering National Meeting ENIM 2022	August 2022
	President	
	SIAM-PUC Student Chapter	August 2021-Present
	Student representative	
	Mathematical and computational engineering	April 2021-Present
	Student representative	
	Engineering Physics Major	April 2020-April 2021
	Vice president	
	SIAM-PUC Student Chapter	August 2020-August 2021
Attended Workshop and Conferences	**Workshop on Scientific Machine Learning**	November 2022
	Staff. Santiago, Chile.	
	Minimum Residual & Least-Squares Finite Element Methods	October 2022
	Santiago, Chile.	
	2022 SIAM Annual Meeting (AN22)	July 2022
	Pittsburgh, US. Student Representative from SIAM-PUC Student Chapter	
	Inverse Problems: Methods, Applications and Synergies IPMAS	January 2022

Campus San Joaquín PUC, Santiago, Chile.
2021 SIAM Annual Meeting (AN21, Online) July 2021
Student Representative from SIAM-PUC Student Chapter
Doctoral School in Applied Mathematics September-October 2020
Department of Mathematics, PUC.

Skills

Programming: Python (numpy, pandas, sklearn), Julia, Matlab, Mathematica, R, LaTeX, C++
Languages: Spanish (native), English (advanced)

Memberships

SIAM (student member)
IEEE (student member)

Coursework

Mathematics & Statistics
◦ **Graduate Level**
High-Dimensional Probability, Topics in Inverse Problems, Mathematical Foundations of Machine Learning, Advanced Optimization, Engineering Applications of PDE's and Functional Analysis, Computational Complexity, Foundations of Convex Geometry (audited)
◦ **Undergraduate Level**
Theory of Probability, Partial Differential Equations, Functional Analysis, Fourier Analysis, Measure Theory, Real Analysis, Scientific Computing II (numerical ODE's & PDE's)(audited), Scientific Computing I (intro to numerical analysis), Optimization Honors, Discrete Mathematics, Regression Analysis, Statistical Inference, Probability and Statistics

Physics
◦ **Undergraduate Level**
Quantum Physics I and II, Statistical Mechanics, Topics in Mathematical Physics (spectral theory in quantum physics), Electromagnetic Theory, Waves and Optics, Mathematical Methods in Physics II, Mathematical Methods in Physics I, Modern Physics (special relativity and intro to quantum physics), Classical Mechanics II (Analytical Mechanics), Electricity & Magnetism, Thermodynamics, Classical Mechanics

Science and Engineering
Biomedical Image Formation, Parallel Algorithms in Scientific Computing, Astronomy, Programming in Python, Scientific Communication