Exponent®
Engineering & Scientific Consulting

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Professional Profile

Dr. Guzman specializes in structural dynamics, acoustics, computational mechanics, and design optimization. He has extensive experience developing design tools for acoustic and mechanical systems, including analytical modelling, advanced simulations, and experimental testing. Dr. Guzman has applied his expertise in a wide variety of projects related to environmental noise, noise and vibration control, architectural and room acoustics, and wave propagation in complex structures.

Dr. Guzman is a multidisciplinary engineer with broad experience in acoustic and mechanical systems. His expertise spans the implementation of noise mitigation solutions, development of active and passive vibration control systems, root cause analysis in noise and vibration complaints, and product development for industrial, commercial, and research applications. He has contributed to projects ranging from the construction of theaters, shopping malls, and recording studios to applying advanced computational methods to the development of materials for sound and wave propagation control. His experience also includes automation of CAD systems for structural design, and he has conducted numerous laboratory and field tests, including acoustic characterization, material properties estimation, and vibration and sound analysis.

Prior to joining Exponent, Dr. Guzman was a postdoctoral researcher at the Ohio State University, where he led the development and integration of structural optimization and machine learning programs to advance AI-enabled design tools for automotive body structures. From 2016 to 2019, Dr. Guzman was the Co-founder and Lead Engineer of Veil Acustica, an acoustics consulting company where he created multiple business processes and strategies to help the company transition into a sustainable business operation, as well as supervising the execution of technical products and services.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Pennsylvania State University, 2024

M.Sc., Mechanical Engineering, National University of Colombia, Medellin, 2019

B.Sc., Sound Engineering, San Buenaventura University, 2014

1st place award in the Structural Acoustics and Vibrations Technical Committee competition at the 183rd Meeting of the Acoustical Society of America, 2022.

1st place award in the annual workshop of the Center for Acoustics and Vibration (CAV) poster competition at the Pennsylvania State University, 2020.

Outstanding master's thesis award for completing with high academic excellence all the degree requirements, completing with high performance all research objectives, and surpassing the master's degree scope, Awarded by the thesis committee members at the National University of Colombia,

Medellín, 2019.

Scholarship award for obtaining a high score in academic awards, honors, and academic performance. Awarded by the Superior University Council and the Council of the Faculty of Engineering, National University of Colombia, Medellín. July 2016.

Research excellence award “Guillermo de Occam” for participating in several local, national, and international academic conferences as a member of the Mobile Robotics Research Group. Awarded by the President, Academic Vice-President, and Director of Research and Graduate Programs of the San Buenaventura University, Medellín. November 2012.

Academic Appointments

Postdoctoral Researcher, The Ohio State University

Prior Experience

Research and Development Engineer, The Ohio State University, 2024-2045

Graduate Research Engineer, The Pennsylvania State University, 2020-2024

Co-founder and Lead Engineer, Veil Acustica, 2016-2019

Adjunct Faculty Instructor, Pascual Bravo University, 2019

Adjunct Faculty Instructor, National University of Colombia, 2017-2018

Acoustic Engineer, Acustica Aplicada SAS, 2014-2015

Engineering Acoustics Consultant, Independent, 2013-2014

Professional Affiliations

American Society of Mechanical Engineers

Acoustical Society of America

Languages

Spanish

Publications

Pillarisetti LSS, Giraldo Guzman D, Keirn J, Sridhar S, Clifford L, Frecker M, Shokouhi P. Frequency bandgap enhancement in locally resonant metasurfaces for S0 Lamb wave mode using topology optimized resonators. Journal of Applied Physics 2025; 137:043104. https://doi.org/10.1063/5.0244722

Giraldo Guzman D, Pillarisetti LSS, Frecker M, Clifford L, Shokouhi P. Surface wave propagation control with locally resonant metasurfaces using topology-optimized resonators. Journal of the Acoustical Society of America 2024; special issue on Wave phenomena in periodic, near-periodic, and locally resonant systems 155:3172–3182. https://doi.org/10.1121/10.0025989

Giraldo Guzman D, Clifford L, Shokouhi P, Frecker M. Topology optimization design of resonant structures based on antiresonance eigenfrequency matching informed by harmonic analysis. Journal of Mechanical Designn2023; 1-43. https://doi.org/10.1115/1.4062882

Giraldo Guzman D, Pillarisetti LSS, Sridhar S, Lissenden CJ, Frecker M, Shokouhi P. Design of resonant elastodynamic metasurfaces to control S 0 Lamb waves using topology optimization. JASA Express Letters 2022; 2(11):115601. https://doi.org/10.1121/10.0015123

Giraldo Guzman D, Silva EC, Rubio WM. Topology optimization of piezoelectric sensor and actuator layers for active vibration control. Smart Materials and Structures 2020; 29(8). https://doi.org/10.1088/1361-665X/ab9061

Presentations

Giraldo Guzman D, Sai Srinivas L, Keirn J, Shokouhi P, Frecker M. Topology optimization design of resonators for elastodynamic locally resonant metasurfaces. ASME IDETC-CIE International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, Washington DC, 2024.

Giraldo Guzman D, Sai Srinivas L, Shokouhi P, Frecker M. Design of elastodynamic metasurfaces for wave propagation control using topology optimized resonators. ASME IDETC-CIE International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, Boston, MA, 2023.

Giraldo Guzman D, Frecker M, Shokouhi P. Topology optimization design of elastodynamic metasurfaces based on resonance gaps and antiresonance matching. 183rd Meeting of the Acoustical Society of America, Nashville, TN, 2022.

Handford A, Giraldo Guzman D, Lissenden C, Frecker M, Shokouhi P. Topology Optimization Design of Metasurfaces to Control Wave Propagation, Center for Acoustics and Vibration (CAV) annual workshop, State College, PA, 2022.

Giraldo Guzman D, Lissenden C, Frecker M, Shokouhi P. Topology optimization design of metasurfaces to control Lamb wave propagation. 181st Meeting of the Acoustical Society of America, Seattle, WA, 2021.

Giraldo Guzman D, Lissenden C, Frecker M, Shokouhi P. Topology optimization design of metasurfaces to control Lamb wave propagation. Poster presentation, Center for Acoustics and Vibration (CAV) annual workshop, State College, PA, 2021.

Giraldo Guzman D, Lissenden C, Shokouhi P, Frecker M. Topology optimization design of structures based on eigenfrequency matching. ASME IDETC-CIE International Design Engineering Technical Conferences and Computers and Information in Engineering Conference, 2021.

Giraldo Guzman D, Montealegre Rubio W. Optimal configuration of piezoelectric transducers for active control of mechanical vibrations using topological optimization method. XIV International Symposium on Energy Expotecnologica, Medellin, Colombia, 2018.

Giraldo Guzman D, Montealegre Rubio W. Finite element modeling of piezoelectric structures. National Symposium on Mechanics of Materials and Continuous Structures, Cartagena, Colombia, 2018.

Gil JD, Giraldo Guzman D, Cordoba ER, Cardenas AM. Measurement system for acoustic characterization of materials at normal sound incidence. XVII Symposium of Image, Signal Processing, and Artificial Vision (STSIVA), Medellin, Colombia, 2012.

Project Experience

Noise and Vibration

- Designed and supervised the construction of noise barriers for multiple electrical substations to mitigate noise emission outside of the substations' limits. Performed verification measurements to certify compliance with noise emission standards.
- Designed and supervised the manufacturing and installation of sound insulation enclosures for industrial machinery, including diesel generators, heating, ventilation, and air conditioning (HVAC) units, and water pumps in residential and commercial buildings. Assessed enclosure performance in-situ during machinery operational conditions.
- Evaluated technical data of vibration and damping mechanisms for commercial or industrial applications to determine their correct use in specific scenarios. Developed algorithms to autonomously evaluate and select the appropriate number and type of vibration control mechanisms, given a particular use case and design requirements.

Environmental Noise

- Participated in the creation of a noise map for an international airport, intended to evaluate potential human harshness and regulatory violations resulting from aircraft noise in residential, commercial, and nature protected areas. Conducted noise emission, temperature, wind, and humidity measurements according to standards, and processed data for georeferencing during map construction.
- Led and conducted noise emission measurements for projects related to noise complaints in residential and commercial buildings, industrial facilities, construction sites, music performance venues, recreational and fitness facilities, restaurants, hotels, and classroom and study spaces.

Building and Room Acoustics

- Supervised the design and construction/renovation of multiple performance venues and recording studios, focusing on architectural acoustics and systems integration. Key project requirements included design and installation of sound insulation in walls, ceilings, floors, doors, windows, and modified HVAC systems for noise and vibration, as well as the integration of audio, video, and electrical networks with other acoustic and architectural components.
- Contributed to the development and manufacturing of commercial products used in architectural and acoustic engineering applications, including acoustic diffusers, absorption panels, bass traps, acoustic resonators, baffles, and specialized furniture.
- Served as engineering consultant to multiple civil engineering and architectural firms in designing theaters, venues, shopping malls, schools, and residential buildings.
- Conducted root cause analyses in residential buildings related to noise and vibration complaints resulting from commercial, industrial, construction, and other activities. Evaluated sound and vibration transmission paths, identified and quantified internal and external sources, and proposed action plans to mitigate the impact on residents and their buildings, and to meet regulatory requirements.
- Conducted laboratory and field measurements to assess the sound transmission of multiple construction or architectural components such as doors, windows, panels, masonry walls, and drywall partitions.

Non-destructive Testing and Evaluation

- Performed laboratory assessment of material properties using Resonant Ultrasound Spectroscopy (RUS).
- Conducted in-situ evaluation of material properties, including acoustic absorption, impedance, and sound intensity using commercial pressure and particle velocity probes (PU-probes).
- Designed, manufactured, and instrumented impedance tube measurement systems for laboratory tests.
- Conducted laboratory measurements to characterize products for commercialization in anechoic, transmission, and reverberant chambers. Reported product characterization data according to technical standards.
- Conceived, planned, and executed experimental tests to characterize surface and plate wave propagation in plastics, metals, and granular materials using Laser Doppler Vibrometer (LDV) sensors and ultrasonic transducers. Developed testing protocols, including instrumentation, signal processing equipment and algorithms, and measurement procedures.

Computational Mechanics

- Developed simulation programs to predict structural dynamic responses of elastic and piezoelectric materials, including their integration with commercial finite element analysis (FEA) software, while ensuring compatibility with high-performance cluster computing.
- Developed automation CAD and generative surface design (GSD) programs to assist automotive engineers in devising non-intuitive and complex structural car body components.
- Developed topology optimization design methodologies for active and passive vibration control systems, as well as for wave propagation of surface and plate waves in different media such as metals, plastic, or soil.
- Developed prediction tools for sound transmission loss in single, double, and composed partitions using typical construction materials. Validated prediction estimates with published laboratory tests.

Peer Reviews

ASME Journal of Mechanical Design