

Jeromi G. López - Santiago

CONTACT INFORMATION

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SUMMARY

Mechanical Engineer specializing in additive manufacturing processes, microfluidic systems development, and computational analysis of complex systems. Technical expertise encompasses materials characterization, microfluidics, soft lithography and microfabrication fabrication, additive manufacturing, cellular mechanotransduction, and implementation of multi-physics simulations for multiple applications. Proficient in finite element analysis and advance computational methods. Experienced in experimental design and validation using advanced instrumentation, data acquisition systems, and statistical analysis tools for microfluidic device optimization. Demonstrated capability in translating research findings into practical engineering solutions through systematic literature review, rigorous experimental methodologies, and cross-functional collaboration.

PROFESSIONAL INTERESTS

Additive Manufacturing, Biomechanics, Composite Materials, Finite Element Analysis, Mechanobiology, Mechanotransduction, Microfabrication, Microfluidics

EDUCATION

University of Puerto Rico, Mayagüez, Puerto Rico

Department of Mechanical Engineering

Ph.D., Mechanical Engineering (Bio and Microscale Engineering), Expected: May 2025

Dissertation: Design and Characterization of a Rapidly Prototyped Pneumatic Microfluidic Device for the Study of Vinculin Expression at Focal Adhesions in Response to Continuous Mechanical Stimulation

Advisor: Dr. Paul A. Sundaram

University of Puerto Rico, Mayagüez, Puerto Rico

Department of Mechanical Engineering

M.Eng., Mechanical Engineering (Bio and Microscale Engineering), Completed: May 2019

University of Puerto Rico, Mayagüez, Puerto Rico

Department of Mechanical Engineering

B.Sc., Mechanical Engineering, Graduated: December 2015

RELEVANT COURSEWORK

Biomaterials, Biostatistical Analysis, Design of Microfluidic Systems, Finite Element Analysis, Fundamentals of Micro and Nanofabrication, Mathematical Methods for Chemical Engineers, Mechanical Fundamentals of Electronic Packaging, Mechanics of Composite Materials, Mechanobiology and Cell Mechanics, Molecular and Cellular Biology for Engineers, Numerical Optimization, Scientific Communication

CERTIFICATIONS

Google Project Management (*In progress*)

HONORS AND AWARDS

- Alfred P. Sloan Foundation - UPRM Ph.D. Enrichment Program Fellowship, 2021
- Extramural Research Enhancement Award (EREA) Fellow, 2016
- Transformational Initiative for Graduate Education and Research (TIGER) Fellow, 2016
- NIH RISE-2-BEST Fellow, 2014
- Puerto Rico Louis Stokes Alliance for Minority Participation Fellow, 2011

WORK
EXPERIENCE

U.S. Army Engineer Research and Development Center *Vicksburg, Mississippi, USA*
Information Technology Laboratory, Computational Science and Engineering Division,
Computational Analysis Branch
Mechanical Engineer **June 2023 - June 2024**

- Led a thermomechanical FEA study using Abaqus to predict shrinkage behavior in an idealized 3D-printed filament caused by thermal gradients to improve printing parameters to minimize warping in real-world parts.
- Critically reviewed literature on thermomechanical modeling of additive manufactured (AM) parts, enhancing understanding of complex thermal-mechanical interactions during the 3D printing process.
- Inspecting and repairing an aged sector gear at Cheatham Lock and Dam, identifying wear patterns and potential failure points, and documenting the repair process using a carbon fiber-reinforced polymer in a detailed technical report.

U.S. Army Engineer Research and Development Center *Vicksburg, Mississippi, USA*
Information Technology Laboratory, Computational Science and Engineering Division
Education and Research Internship Program (ERIP) **Summer 2022**
Advisor: Guillermo A. Riveros, Ph.D.

- Designed and conducted a preliminary thermomechanical analysis of an idealized 3D-printed filament using Abaqus to simulate the effects of shrinkage associated to thermal gradients.
- Streamlined part creation and model creation processes using Python scripting to enhance efficiency and automation in finite element analysis.
- Reviewed literature on thermomechanical modeling of additive manufactured parts, focusing on the latest advancements in predicting residual stresses, distortions, and microstructural evolution during the printing process.

Smart Surface Designs, LLC *Manhattan, New York City, NY, USA*
Research and Development Engineer **Summer 2012**

- Reviewed and analyzed amputee-socket designs to enhance functionality and comfort, ensuring better fit and reduced discomfort for amputees. Developed protocols to quantify, reduce, and optimize the time spent creating 3D models from Computerized Tomography (CT) scans for finite element analysis, resulting in a 25% efficiency improvement.
- Optimized 3D meshes from transtibial amputees to fit custom variable volume sockets generated in Siemens NX using PTC Geomagics, ensuring precise and comfortable prosthetic solutions.

RESEARCH
EXPERIENCE

Biomechanics and Biomaterials Research Laboratory *Mayagüez, Puerto Rico*
Graduate Research Assistant **January 2016 - Present**
Advisor: Paul A. Sundaram, Ph.D.

- Designed and fabricated a custom PDMS microfluidic device for live-cell imaging under negative pressure, utilizing 3D printing technology to create a precise resin mold.
- Employed multiphysics software to comprehensively characterize, test, and simulate the device's performance, ensuring optimal functionality for live-cell experiments.
- Designed and troubleshooted complex cell-stretching experiments, demonstrating expertise in microfluidic device application and cell biology.
- Mentored and supervised undergraduate students, fostering their research skills and contributing to their development.
- Provided assistance to other projects to foster collaborations, enhancing interdisciplinary research and development within the university.
- Utilized Python for data analysis and conducted statistical analysis to support various projects.

Matrix Biology and Engineering Laboratory, University of Virginia *Charlottesville, Virginia, USA*
Visiting Researcher **February 2018 - December 2018**
Advisor: Thomas Barker, Ph.D.

- Investigated the effects of mechanical stress on vinculin in NIH/3T3 fibroblasts using a custom cell-stretching device for live-cell imaging.
- Upgraded and maintained cell-stretching equipment, ensuring optimal functionality and reliability.
- Provided engineering and technical support, including troubleshooting experiments and maintaining cell-stretching platforms to advance research capabilities.

Gladden Laboratory, MD Anderson Cancer Center *Houston, Texas, USA*
Graduate Research Assistant **June 2016 - July 2016**
Advisor: Andrew Gladden, Ph.D.

- Investigated the localization of vinculin, a critical adhesion protein, in MFC10A cells subjected to continuous mechanical stimulation.
- Analyzed and characterized the impacts of cyclic strain on cancerous cells, with a focus on resultant changes in cellular phenotype.
- Developed expertise in advanced microscopy techniques, genetic analysis, and molecular biology methodologies to support comprehensive cellular research.

Biomechanics and Biomaterials Research Laboratory *Mayagüez, Puerto Rico*
Undergraduate Research Assistant **January 2014 - December 2015**
Advisor: Paul A. Sundaram, Ph.D.

- Quantified the mechanical properties of partially mineralized collagen type I fascicles immersed in Simulated Body Fluid (SBF) under monotonic loading.
- Designed and conducted experiments to assess the mechanical behavior of collagen fascicles in simulated physiological conditions.
- Analyzed experimental data to derive meaningful insights into the mechanical properties and performance of collagen type I fascicles.
- Presented findings at national and international conferences, contributing to the broader scientific community.
- Published research outcomes in a peer-reviewed journal, demonstrating expertise in scientific communication and knowledge dissemination.

Orthopaedic Research Group *Mayagüez, Puerto Rico*
Undergraduate Research Assistant **May 2011 - December 2013**
Advisor: Christopher Papadopoulos, Ph.D.

- Developed a simplified femoral implant model using Siemens NX and NASTRAN to simulate the stress-shielding effect on the femur-implant interface under normal loading conditions.
- Led the design and simulation of the theoretical model for the femoral implant, ensuring accurate representation of biomechanical properties.
- Validated the proposed model using Finite Element Analysis (FEA), confirming its reliability and precision.

Ubaldo M. Córdova - Figueroa Research Group *Mayagüez, Puerto Rico*
Undergraduate Research Assistant **February 2010 - May 2011**
Advisor: Ubaldo M. Córdova - Figueroa, Ph.D.

- Studied the diffusivity due to metabolic activity of non-motile bacteria under different substrate

concentrations.

- Led the experimental design and task delegation among undergraduate researchers, ensuring efficient project management.
- Coordinated and supervised the research team to execute experiments and analyze data effectively.

TEACHING
EXPERIENCE

***Department of Mechanical Engineering
Graduate Teaching Assistant***

Mayagüez, Puerto Rico
August 2020 - May 2023

- INME 4107 - Materials Science and Engineering Laboratory: Introduced students to fundamental MSE concepts, including statistical analysis and essential laboratory skills, providing a solid foundation for their engineering studies.
- INME 4235 - Mechatronics Laboratory: Taught students key Mechatronics principles and practical skills, equipping them with the theoretical and hands-on experience necessary for success in their studies.

MENTORING
EXPERIENCE

***Biomechanics and Biomaterials Laboratory
Graduate Research Assistant***

Mayagüez, Puerto Rico
August 2016 - Present

- Mentored multiple undergraduate students in the Biomechanics and Biomaterials Laboratory at the University of Puerto Rico - Mayagüez.
- Guided students through all stages of their research projects, from experimental design to data analysis and interpretation.
- Facilitated collaboration and hands-on experience within the laboratory, fostering a comprehensive understanding of biomaterials research.
- Assisted students in the preparation of their reports, providing academic support and technical expertise.

***Reconfigurable and Multifunctional Soft Materials REU
Pre-faculty Mentor***

Mayagüez, Puerto Rico
Summer 2015

- Mentored an undergraduate student in the Research Experience for Undergraduates (REU) program focused on Reconfigurable and Multifunctional Soft Materials at the University of Puerto Rico - Mayagüez.
- Facilitated collaboration between the student and the Biomechanics and Biomaterials Laboratory, fostering interdisciplinary research.
- Guided the student in conducting research in biomaterials, providing technical expertise and academic support.

VOLUNTEERING
EXPERIENCE

***Comprehensive Cat Census and Management Plan for the Mayagüez Pueblo Area: A
Citizen Based Strategy for Humane Population Control
Project Leader***

August 2024 - Present

- Spearheaded a comprehensive cat census project in Mayagüez, managing a diverse team of experts and volunteers to assess and address the cat population's wellbeing and its impact on public health.
- Reviewed literature on large-scale data collection efforts to estimate cat population size, identify areas of high cat density, and evaluate the effectiveness of population management strategies.
- Conducted preliminary field surveys to estimate free-roaming cat populations using line transect methods and initiated the development of an algorithm in R to predict population size based on counted cats, transect length, detection probability, and density.
- Designed community-based strategies to educate the public about responsible cat ownership, humane population control, and zoonotic disease prevention.

PUBLISHED PAPERS	López - Santiago, J. G., Rodríguez Martínez, O. M., and Sundaram, P. A. (2024) <i>3D printed microfluidic and millifluidic devices for cell culture and mechanotransduction studies: a review</i> . Journal of Micromanufacturing. DOI: 10.1177/25165984241286651 .
	López - Santiago, J. G., and Sundaram, P. A. (2022). <i>Mechanical Properties of Mineralized Collagen Type I Rat-Tail Tendon Fascicles</i> . European Journal of Dental and Oral Health, 3(4), 7-11. DOI: 10.24018/ejdent.2022.3.4.160 .
PAPERS IN PREPARATION	Herdocia - Lluberres, C. S., Jana, Z., Guo, K., Blanco, A., Elías, A., López - Santiago, J. G., and Chardón, A. <i>Fracture resistance of analog and computer-aided design/computer-aided manufacturing long-span fixed provisional restorations: An in-vitro experimental study</i> . Journal of Prosthodontics. JOPR-24-571 . Under Revision.
	López - Santiago, J. G., Ríos - López, W. N., Rodríguez - Martínez, O. M., and Sundaram, P. A. <i>Rapid prototyping of a microfluidic cell stretching platform for live-cell imaging from 3D-printed molds</i> . In preparation.
	López - Santiago, J. G., and Riveros, G.A. <i>Structural Rehabilitation of Sector Gear: Crack Repair Using Carbon Fiber Reinforced Polymer Composite Technology at Cheatham Lock and Dam</i> . In preparation.
ORAL PRESENTATIONS	J. López - Santiago and G. A. Riveros. Numerical Simulations of Thermal Stresses and Bond-Slippage in Parts Built via Fused Deposition (3D Printing). U.S. Army Engineer Research and Development Center Summer 2022 Final Briefings, Vicksburg, Mississippi, USA, August 2022.
	J. López - Santiago, A. Gladden, and P. Sundaram. Expression of Vinculin at Focal Adhesions in Response to Mechanical Stimulus of a Soft-Substrate. 2 nd Transformational Initiative for Graduate Education and Research Symposium, Mayagüez, Puerto Rico, September 2017.
	López - Santiago, J., B. Calcagno, and P. Sundaram. Mechanical Characterization of Mineralized Collagen Type I Fascicles from Rat-tail Tendon. American Chemical Society 39 th Senior Technical Meeting, Ponce, Puerto Rico, November 2015.
POSTER PRESENTATIONS	López - Santiago, A. Gladden, and P. Sundaram. Expression of Vinculin at Focal Adhesions in Response to Cyclical Loading of a Substrate in MCF10A Cells. 1 st Transformational Initiative for Graduate Education and Research Symposium, Mayagüez, Puerto Rico, September 2016.
	López - Santiago, J., B. Calcagno, and P. Sundaram. Mechanical Behavior of Collagen Type I Fascicles Extracted from Rat-Tail Tendon Immersed in Simulated Body Fluid. World Congress on Regenerative Medicine, Leipzig, Germany, October 2015.
	Santana - Monterrey, C., J. López - Santiago and P. Sundaram. Mechanical Behavior of Rat-Tail Tendon Immersed in Simulated Body Fluid. Research Experience for Undergraduates in Reconfigurable and Multi-functional Soft Materials Poster Session, Mayagüez, Puerto Rico, July 2015.
	López - Santiago, J. and P. Sundaram. Mechanical Behavior of Collagen Type I Fascicles Extracted from Rat-Tail Tendon Immersed in Simulated Body Fluid. Sigma Xi Poster Day, Mayagüez, Puerto Rico, April 2015.
	López - Santiago, J. and P. Sundaram. Mechanical Behavior of Collagen Type I Fascicles Extracted from Rat-Tail Tendon Immersed in Simulated Body Fluid. Emory University Laney Graduate School STEM Research and Career Symposium, Atlanta, Georgia, USA, March 2015.

López - Santiago, J. and P. Sundaram. Mechanical Behavior of Collagen Fascicles Immersed in Simulated Body Fluid. 8th NEA Science Day, Mayagüez, Puerto Rico, March 2015.

López - Santiago, J. and P. Sundaram. Mechanical Behavior of Collagen Type I Fascicles Tested at Varying Strain Rates. Sigma Xi Poster Day, Mayagüez, Puerto Rico, April 2014.

L. Medina, W. Rivera, M. Díaz, J. Soto, **J. López**, M. López, R. Cortés, L. Ríos-Hernández, and U. M. Córdova-Figueroa. Intracellular metabolism of substrates enhances single-cell diffusion in *Enterococcus faecalis* a non-motile bacterium. PRISM 2011, Interamerican University - Bayamón, Puerto Rico, March 2011.

M. Díaz, J. Soto - Rodríguez, M. Hidalgo - Santiago, **J. López - Santiago**, L. Ríos - Hernández, and U. M. Córdova - Figueroa. Intracellular metabolism of substrates enhances single-cell diffusion in *Enterococcus faecalis* a non-motile bacterium. AIChE Annual Meeting, Salt Lake City, Utah, USA November 2010.

M. Hidalgo, **J. López**, J. Soto, M. Díaz, L. Ríos - Hernández, and U. M. Córdova - Figueroa. Intracellular metabolism enhances single-cell diffusion in *Enterococcus faecalis* a non-motile bacterium. PR - LSAMP 5th Transdisciplinary Research Conference, San Juan, Puerto Rico, May 2010.

ACADEMIC
SERVICE

Reviewer for Journal of Micromanufacturing (*Sage Journals*)

SKILLS

- Languages: Fluent in both English and Spanish
- Engineering: Additive Manufacturing, Fiber Reinforced Composites, Finite Element Analysis, Mechanical Testing, Data Analysis, Microfabrication, Thermomechanical Analysis, Project Management
- Programming Languages: Python, Julia, R
- Design and Simulation Software: Abaqus, SolidWorks, AutoCAD and Fusion 360, COMSOL Multiphysics, Ansys, FreeCAD, Elmer FEM
- Image Analysis and Visualization Software: ImageJ, Paraview, SciDAVis
- Mathematics Software: MATLAB, Minitab
- Graphic Design Software: GIMP, Inkscape
- Geographic Information Systems Software: QGIS
- Laboratory Techniques: Mechanical Testing, Material Sample Preparation, Microscopy, Microfabrication, Soft Lithography, Cell Culture, Immunocytochemistry (ICC)
- Applications: L^AT_EX