

Juan Camilo Osorio

osorio2@purdue.edu • +1 (765) 409-6605 • West Lafayette, IN

Postdoctoral research associate developing embodied mechanical intelligence in soft robots, metastructures, and programmable materials. I design nonlinear mechanical systems whose morphology can compute, sense, store memory, and control behavior through multistability, structural instabilities, and path-dependent mechanics. I combine finite element analysis, reduced-order and energy-based modeling, inverse co-design, optimization, and experimental prototyping to create soft machines that perform open-loop control, tactile classification, mechanical logic, and adaptive morphing in uncertain environments.

EDUCATION

Doctor of Philosophy (Ph.D.) in Mechanical Engineering 2017–2025

Purdue University, West Lafayette, IN

Master of Science (M.Sc.) in Mechanical Engineering 2017–2019

Universidad de los Andes, Bogotá, Colombia

Bachelor of Science (B.Sc.) in Mechanical Engineering 2013–2016

Universidad de los Andes, Bogotá, Colombia

EXPERIENCE

Postdoctoral Research Associate 08/2025–Present

Department of Mechanical Engineering, Purdue University

Developing mechanics-based models and design strategies for morphing structures that encode adaptive response, embodied control, and mechanical intelligence through structural nonlinearities, multistability, and geometry-programmed behavior.

Graduate Research Assistant 08/2020–08/2025

Department of Mechanical Engineering, Purdue University

Designed, modeled, and experimentally validated multistable soft robotic structures that embody control, mechanical logic, and programmable functionality through geometry, instability, and path-dependent mechanics. Developed FE-informed reduced-order models for inverse co-design of robot morphology, stiffness, stable-state position, and dynamic response. Demonstrated open-loop grasping, size/weight object classification, pick-and-place behavior, and locomotion using minimal sensing and single-input pneumatic actuation.

Visiting Research Scholar 01/2020–06/2020

Purdue University, Herrick Laboratories

Contributed to an Anheuser-Busch InBev partner project on bistable elements produced by the plastic deformation of metals; performed design and numerical analysis for smart packaging applications.

Researcher 12/2019–11/2020

Universidad de los Andes

Conducted failure analysis of munition systems under prestress and aerodynamic loads, including computational failure prediction under mechanically demanding conditions.

Graduate Research Assistant 06/2017–08/2019

Universidad de los Andes

Performed finite element simulations and optimization of machining processes as part of a Colciencias-funded project on ultra-fine grain size design, connecting process parameters, microstructure evolution,

and constitutive response.

TEACHING

Lecturer 08/2025–12/2025

Basic Mechanics I: Statics, Department of Mechanical Engineering, Purdue University

Graduate Teaching Assistant 05/2025

Bioinspired Materials and Structures, Study Abroad Program, Department of Mechanical Engineering, Purdue University

Graduate Teaching Assistant 08/2018–06/2019

Manufacturing Processes and Systems, Universidad de los Andes

I taught manufacturing processes and CAD tools to engineering students.

Graduate Teaching Assistant 01/2017–06/2017

Basic Mechanics of Materials, Universidad de los Andes

Taught stress analysis and basic design concepts to sophomore mechanical engineering students.

PUBLICATIONS

Journal Articles (* Indicates Equal Authorship):

- Rincon, J. S., **Osorio, J. C.**, & Arrieta, A. F. (2025). *Curvature Adaptable Robotic End Effector*. In preparation. 2026
- **Osorio, J. C.**, Rincon, J. S., & Arrieta, A. F. (2025). *Embodied Hybrid Automata for Control in Soft Machines*. In preparation. 2026
- **Osorio, J. C.**, Rincon, J. S., Morgan, H., & Arrieta, A. F. (2025). *Embodying Control in Soft Multistable Robots from Morphofunctional Co-design*. Advanced Science.
- Riley, K. S.*, Koner, S.*, **Osorio, J. C.***, Yu, Y., Morgan, H., Udani, J. P., Sarles, S. A., & Arrieta, A. F. (2022). *Neuromorphic Metamaterials for Mechanosensing and Perceptual Associative Learning*. Advanced Intelligent Systems.
- Boddapati, K., **Osorio, J. C.**, & Arrieta, A. F. (2024). *On maintaining bistability of prestressed laminates after clamping*. Composite Structures.
- **Osorio-Pinzon, J. C.**, Abolghasem, S., Marañón, A., et al. (2020). *Cutting parameter optimization of Al-6063-O using numerical simulations and particle swarm optimization*. International Journal of Advanced Manufacturing Technology, 111, 2507–2532.
- Abedrabbo, A. F., **Osorio, J. C.**, Abolghasem, S., Valencia, C., & Rojas, F. (2020). *Predicting subgrain size and dislocation density in machining-induced surface microstructure of nickel using supervised model-based learning*. Materials Today Communications, 30, 103162.
- Montenegro, C., Abolghasem, S., **Osorio-Pinzon, J. C.**, et al. (2020). *Microstructure prediction in low and high strain deformation of Al6063 using artificial neural network and finite element simulation*. International Journal of Advanced Manufacturing Technology, 106.
- **Osorio-Pinzon, J. C.**, Abolghasem, S., & Casas-Rodriguez, J. P. (2019). *Predicting the Johnson-Cook constitutive model constants using temperature rise distribution in plane strain machining*. International Journal of Advanced Manufacturing Technology, 105.

Conference Papers:

- Kosterit, G., **Osorio, J. C.**, Boston, D. M., Grasinger, M., Buskohl, P., Hertlein, N., & Arrieta, A. F. (2026). *Surface Morphing from Pneumatically Actuated Metastrips*. AIAA SCITECH 2026 Forum, Orlando, Florida.
- **Osorio, J. C.**, Tinsley, C., Tinsley, K., & Arrieta, A. F. (2023). *Manta Ray inspired multistable soft robot*. 2023 IEEE International Conference on Soft Robotics (RoboSoft), Singapore.
- Morgan, H., **Osorio, J. C.**, & Arrieta, A. F. (2023). *Towards open loop control of soft multistable grippers from energy-based modeling*. 2023 IEEE International Conference on Soft Robotics (RoboSoft), Singapore.
- Boddapati, K., **Osorio, J. C.**, and Arrieta, A. F. (2024). *On the Loss of Stability of Bistable Laminates due to Clamping*. AIAA SCITECH 2024 Forum, Orlando, FL, January 7–12, 2024.
- **Osorio, J. C.**, Morgan, H., & Arrieta, A. F. (2022). *Programmable Multistable Soft Grippers*. 2022 IEEE 5th International Conference on Soft Robotics (RoboSoft), Edinburgh, United Kingdom.
- **Osorio, J. C.**, Abolghasem, S., and Casas Rodriguez, J. P. (2018). *Determination of Microstructure-Based Constitutive Models Using Temperature Rise Distribution in Plane Strain Machining. Characterization of Minerals, Metals, and Materials 2018*, TMS 2018, pp. 227–237. Springer, Cham.

PATENTS

11/2025	<i>Conformable vacuum gripper with series-triggered pneumatic actuators</i> . (Application)
11/2025	<i>Conformable vacuum gripper with parallel-triggered pneumatic actuator array</i> . (Application)
04/2025	<i>Interactive surface reconfiguration device and methods of using same</i> . PRF Ref.: 70976-01. (Provisional)

HONORS

09/2025	SMASIS Conference Best Student Hardware Competition, 1st Place, <i>Curvature Adaptable Robotic End-Effector</i> .
07/2025	Trailblazers in Engineering Fellow.
03/2025	APS DSOFTEmerging Soft Matter Excellence Award Finalist.
01/2025	Complex Active and Adaptive Material Systems Gordon Research Conference Best Poster Award, <i>Finite-state mechanologic from geometrical frustration in soft machines</i> .
09/2024	SMASIS Conference Best Student Hardware Competition, 3rd Place, <i>Multistable Morphing Surface for Interactive Reconfiguration</i> .
05/2024	Future Leaders in Aerospace Symposium 2024.
01/2024	AIAA American Society for Composites Student Paper Award, <i>On the loss of stability of bistable laminates due to clamping</i> .
01/2024	Bilsland Dissertation Fellowship, Purdue University, 2024–2025.
09/2023	SMASIS Division Level Best Paper Award in Mechanics and Material Systems, <i>Neuromorphic Metamaterials for Mechanosensing and Perceptual Associative Learning</i> .
09/2023	SMASIS Division Best Paper in Bioinspired Materials and Structures, <i>Neuromorphic Metamaterials for Mechanosensing and Perceptual Associative Learning</i> .
03/2022	APS March Meeting DSOFTEmerging Soft Matter Division Best Poster Award, <i>Exploiting Geometrical Frustration in Multistable Soft Robots Part 2: Finite-State Mechanologic</i> .

INVITED TALKS

Oral Presentations (Selected):

- Multifunctional Materials and Structures Gordon Research Seminar (01/2026): *Embodied Hybrid Automata for Control in Soft Machines*.
- SES Annual Technical Meeting 2025 (10/2025): *Finite-state mechanologic for embodied control in soft machines*.
- IEEE International Conference on Soft Robotics, RoboSoft 2025 (04/2025): *Embodying Control in Soft Multistable Robots from Morphofunctional Co-design*.
- American Physical Society March Meeting 2025 (03/2025): *Modeling and Design of Non-Abelian Multistable Soft Metastructures*.
- SIAM 2024, Invited Talk (05/2024): *Programmable metastructures from combinatorial stable states*.
- Future Leaders in Aerospace Symposium 2024 (05/2024): *Embodying mechanical intelligence from mechanical instabilities*.
- SES Annual Technical Meeting 2023 (10/2023): *Multistable soft gripper with embedded mechanical logic*.
- American Physical Society March Meeting 2023 (03/2023): *Reduced order modeling of soft hierarchical multistable metasheets with applications*.
- SES Annual Technical Meeting 2022 (10/2022): *Computing with Multistable Metastructures*.
- American Physical Society March Meeting 2022 (03/2022): *The Role of Symmetry and Patterning in Hierarchical Multistable Metasheets*.
- ASME 2020 Conference (09/2020): *Effect of Boundary Conditions on Multistability of Tape Springs*.
- XV International Conference on Computational Plasticity, COMPLAS 2019 (09/2019): *Comparison between phenomenological and entropy-based damage models in large strain machining*.
- 13th World Congress on Computational Mechanics, WCCM 2018 (07/2018): *Strain-Rate and Temperature Effects in Ductile Damage and Element Removal Threshold in FEM Orthogonal Cutting Simulations*.

Poster Presentations (Selected):

- Multifunctional Materials and Structures Gordon Research Conference (01/2026): *Embodied Hybrid Automata for Control in Soft Machines*.
- SES Annual Technical Meeting 2025, Future Faculty Symposium (10/2025): *Modelling and Design of Multistable Soft Metastructures*.
- Complex Active and Adaptive Material Systems Gordon Research Conference (01/2025): *Finite-state mechanologic from geometrical frustration in soft machines*.
- Complex Active and Adaptive Material Systems Gordon Research Conference (01/2025): *Embodying Control in Soft Multistable Grippers from Morphofunctional Co-design*.
- Multifunctional Materials and Structures Gordon Research Conference (01/2024): *Computation from geometrical frustration: Metamaterials for tactile sensing and object classification*.
- IEEE International Conference on Soft Robotics, RoboSoft 2023 (04/2023): *Manta Ray inspired multi-stable soft robot*.

- IEEE International Conference on Soft Robotics, RoboSoft 2023 (04/2023): *Towards open loop control of soft multistable grippers from energy-based modeling.*
- Multifunctional Materials and Structures Gordon Research Conference (07/2022): *Programmable multistable soft grippers with embedded logic.*
- IEEE International Conference on Soft Robotics, RoboSoft 2022 (04/2022): *Programmable multistable soft grippers.*
- American Physical Society March Meeting 2022 (03/2022): *Exploiting Geometrical Frustration in Multistable Soft Robots Part 2: Finite-State Mechanologic.*

SERVICE

2026	Reviewer: Nature Communications.
2026	Reviewer: International Journal of Solids and Structures.
2025	Reviewer: Advanced Materials Technologies.
2024–2025	Treasurer, Official Mechanical Engineering Graduate Association at Purdue (OMEGA).

LEADERSHIP & OUTREACH

2026	Mentor, Summer Undergraduate Research Fellowship (SURF), Purdue University. Camila Uribe, <i>Design and Fabrication of Untethered Soft Robots.</i>
2026	Mentor, Summer Undergraduate Research Fellowship (SURF), Purdue University. Juan Pablo Monge, <i>Physically intelligent underactuated Structures.</i>
2024	Mentor, Summer Undergraduate Research Fellowship (SURF), Purdue University. Paul Loughlin, <i>Flexible Mechanical Sensors.</i>
2023	Mentor, Master of Science research project, Purdue University. Harith Morgan, <i>Towards open loop control of soft multistable grippers from energy-based modeling.</i>
2022	Mentor, undergraduate research project, Purdue University. Chelsea Tinsley and Kendal Tinsley, <i>Manta Ray inspired multistable soft robot.</i>
2019	Mentor, undergraduate degree project, Universidad de los Andes. Carlos Andres Montenegro, <i>Finite element modeling of microstructural changes in Al6063-O based on BP neural network.</i>