Juan Camilo Osorio

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RESEARCH INTERESTS

My research advances structural nonlinearity and smart structures, with an emphasis on introducing and exploiting nonlinear behavior to achieve new functionalities in engineering systems. By combining fundamental mechanics, computational tools, and bio-inspired design, I harness complex nonlinearities to enable robust, efficient, and adaptive performance in engineered systems.

EDUCATION

Aug 2025 **Doctor of Philosophy (Ph.D.) in Mechanical Engineering**
Purdue University
West Lafayette, IN

Aug 2019 **Master of Science (M.Sc.) in Mechanical Engineering**
Universidad de los Andes
Bogotá, Colombia

Dec 2016 **Bachelor of Science (B.Sc.) in Mechanical Engineering**
Universidad de los Andes
Bogotá, Colombia

RESEARCH EXPERIENCE

08/2025–Present **Postdoctoral Research Associate**
Department of Mechanical Engineering, Purdue University
Developing mechanical models for morphing structures and matching their response to aerodynamic loads.

08/2020–08/2025 **Graduate Research Assistant**
Department of Mechanical Engineering, Purdue University
Designed and analyzed bistable elements for soft robotic systems; developed analytical models of multistable structures.

01/2020–06/2020 **Visiting Research Scholar**
Purdue University, Herrick Laboratories
Contributed to an Anheuser-Busch InBev partner project on bistable elements produced by plastic deformation of metals; performed design and numerical analysis for smart packaging applications.

12/2019–11/2020 **Researcher**
Universidad de los Andes
Conducted failure analysis of the Mk82 munition system for Colombia's defense department (INDUMIL), including failure prediction based on prestress and aerodynamic loads.

06/2017–08/2019 **Graduate Research Assistant**
Universidad de los Andes
Performed finite element simulations of machining processes as part of a Colciencias-funded project on ultra-fine grain size design.

TEACHING EXPERIENCE

08/2025–12/2025 **Lecturer**
Basic Mechanics I: Statics, Department of Mechanical Engineering, Purdue University

05/2025 **Graduate Teaching Assistant**
Bioinspired Materials and Structures, Study Abroad Program, Department of Mechanical Engineering, Purdue University

08/2018–06/2019 **Graduate Teaching Assistant**
Manufacturing Processes and Systems, Universidad de los Andes
Taught manufacturing processes and CAD tools to engineering students.

01/2017–06/2017 **Graduate Teaching Assistant**
Basic Mechanics of Materials, Universidad de los Andes
Taught stress analysis and basic design concepts to sophomore mechanical engineering students.

PUBLICATIONS

Journal Articles

First-author / Lead-author Publications:

1. **Osorio, J. C.**, Rincon, J. S., Morgan, H., & Arrieta, A. F. (2025). *Embodying Control in Soft Multistable Robots from Morphofunctional Co-design.* Advanced Science.
2. 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.
3. **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.
4. **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.

Co-authored Publications:

1. Boddapati, K., **Osorio, J. C.**, & Arrieta, A. F. (2024). *On maintaining bistability of prestressed laminates after clamping.* Composite Structures.
2. 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.
3. 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.

Conference Papers

First-author / Lead-author Publications:

1. **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.
2. **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.
3. **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.

Co-authored Publications:

1. 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.
2. 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.
3. 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.

PATENTS

Patent Applications

11/2025 *Conformable vacuum gripper with series-triggered pneumatic actuators.*
11/2025 *Conformable vacuum gripper with parallel-triggered pneumatic actuator array.*

Provisional Patent

04/2025 *Interactive surface reconfiguration device and methods of using same.* PRF Ref.: 70976-01.

FELLOWSHIPS, AWARDS, AND HONORS

09/2025 SMASIS Conference Best Student Hardware Competition, 1st Place, *Curvature Adaptable Robotic End-Effector.*
07/2025 Trailblazers in Engineering Fellow.
03/2025 APS DSOFT Emerging Soft Matter Excellence Award Finalist.
01/2025 2025 Complex Active and Adaptive Material Systems Gordon Research Conference Best Poster Award, *Finite-state mechanologic from geometrical frustration in soft machines.*
09/2024 SMASIS Conference Best Student Hardware Competition, 3rd Place, *Multistable Morphing Surface for Interactive Reconfiguration.*
05/2024 Future Leaders in Aerospace Symposium 2024.
01/2024 AIAA American Society for Composites Student Paper Award, *On the loss of stability of bistable laminates due to clamping.*
01/2024 Bilsland Dissertation Fellowship, Purdue University, 2024–2025.

09/2023 SMASIS Division Level Best Paper Award in Mechanics and Material Systems, *Neuromorphic Metamaterials for Mechanosensing and Perceptual Associative Learning.*

09/2023 SMASIS Division Best Paper in Bioinspired Materials and Structures, *Neuromorphic Metamaterials for Mechanosensing and Perceptual Associative Learning.*

03/2022 APS March Meeting DSOFT Division Best Poster Award, *Exploiting Geometrical Frustration in Multistable Soft Robots Part 2: Finite-State Mechanologic.*

ABSTRACTS AND PRESENTATIONS

Oral Presentations (Selected)

01/2026 Multifunctional Materials and Structures Gordon Research Seminar: *Embodied Hybrid Automata for Control in Soft Machines.*

10/2025 SES Annual Technical Meeting 2025: *Finite-state mechanologic for embodied control in soft machines.*

04/2025 IEEE International Conference on Soft Robotics (RoboSoft 2025): *Embodying Control in Soft Multistable Robots from Morphofunctional Co-design.*

03/2025 American Physical Society March Meeting 2025: *Modeling and Design of Non-Abelian Multistable Soft Metastructures.*

05/2024 SIAM 2024, Invited Talk: *Programmable metastructures from combinatorial stable states.*

05/2024 Future Leaders in Aerospace Symposium 2024: *Embodying mechanical intelligence from mechanical instabilities.*

10/2023 SES Annual Technical Meeting 2023: *Multistable soft gripper with embedded mechanical logic.*

03/2023 American Physical Society March Meeting 2023: *Reduced order modeling of soft hierarchical multistable metasheets with applications.*

10/2022 SES Annual Technical Meeting 2022: *Computing with Multistable Metastructures.*

03/2022 American Physical Society March Meeting 2022: *The Role of Symmetry and Patterning in Hierarchical Multistable Metasheets.*

09/2020 ASME 2020 Conference: *Effect of Boundary Conditions on Multistability of Tape Springs.*

09/2019 XV International Conference on Computational Plasticity (COMPLAS 2019): *Comparison between phenomenological and entropy-based damage models in large strain machining.*

07/2018 13th World Congress on Computational Mechanics (WCCM 2018): *Strain-Rate and Temperature Effects in Ductile Damage and Element Removal Threshold in FEM Orthogonal Cutting Simulations.*

Poster Presentations (Selected)

01/2026 Multifunctional Materials and Structures Gordon Research Conference: *Embodied Hybrid Automata for Control in Soft Machines.*

10/2025 SES Annual Technical Meeting 2025: *Modelling and Design of Multistable Soft Metastructures.* Future Faculty Symposium

01/2025 Complex Active and Adaptive Material Systems Gordon Research Conference: *Finite-state mechanologic from geometrical frustration in soft machines.*

01/2025 Complex Active and Adaptive Material Systems Gordon Research Conference: *Embodying Control in Soft Multistable Grippers from Morphofunctional Co-design.*

01/2024	Multifunctional Materials and Structures Gordon Research Conference: *Computation from geometrical frustration: Metamaterials for tactile sensing and object classification.*
04/2023	IEEE International Conference on Soft Robotics (RoboSoft 2023): *Manta Ray inspired multistable soft robot.*
04/2023	IEEE International Conference on Soft Robotics (RoboSoft 2023): *Towards open loop control of soft multistable grippers from energy-based modeling.*
07/2022	Multifunctional Materials and Structures Gordon Research Conference: *Programmable multistable soft grippers with embedded logic.*
04/2022	IEEE International Conference on Soft Robotics (RoboSoft 2022): *Programmable multistable soft grippers.*
03/2022	American Physical Society March Meeting 2022: *Exploiting Geometrical Frustration in Multistable Soft Robots Part 2: Finite-State Mechanologic.*

PROFESSIONAL SERVICE

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

MENTORING

2024	Mentor, Summer Undergraduate Research Fellowship (SURF), Purdue University. Paul Loughlin, *Flexible Mechanical Sensors.*
2023	Mentor, Master of Science research project, Purdue University. Harith Morgan, *Towards open loop control of soft multistable grippers from energy-based modeling.*
2022	Mentor, undergraduate research project, Purdue University. Chelsea Tinsley and Kendal Tinsley, *Manta Ray inspired multistable soft robot.*
2019	Mentor, undergraduate degree project, Universidad de los Andes. Carlos Andres Montenegro, *Finite element modeling of microstructural changes in Al6063-O based on BP neural network.*