

Cody A. Gonzalez

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Summary

- Assistant Professor with broad experience in multidisciplinary and collaborative research
- Substantial expertise in multifunctional material applications such as electrochemical actuators and energy harvesting devices
- Research interests: (1) Multifunctional materials for energy storage and generation; (2) Design optimization of multifunctional materials for soft robotics devices; (3) Soft robotics for rehabilitation applications

Education

Ph.D. in Mechanical Engineering, Pennsylvania State University (**PSU**) December 2021
Ph.D. Dissertation: “*Analytical Modeling and Design Optimization of Lithium Ion Battery Smart Actuators*”

Advisors:

Mary Frecker, Ph.D., Department of Mechanical Engineering, Pennsylvania State University
Christopher Rahn, Ph.D., Department of Mechanical Engineering, Pennsylvania State University

M.S. in Mechanical Engineering, Pennsylvania State University August 2021

B.S. in Mechanical Engineering, University of California, Riverside (**UCR**) June 2016
UCR Senior Honors Thesis: “*Investigation of The Cobalt Distribution in the Room Temperature Ferromagnetic Nanocomposite TiO₂-CO Thin Films*”

Advisor: Sandeep Kumar, Ph.D., Department of Mechanical Engineering, University of California, Riverside

A.S. in Math and Science, Riverside City College (**RCC**) June 2013

A.S. in A.A. Humanities, Arts, and Philosophy, Riverside City College (**RCC**) June 2013

Academic Positions

Assistant Professor 2023-Present

University of Texas at San Antonio, Department of Mechanical Engineering

- Directing two graduate students to perform research on energy harvesting and design optimization of electrochemical actuator metrics

Postdoctoral Scholar, Priya Lab 2021-2022

Pennsylvania State University Department of Materials Science and Engineering

- Investigating the wireless energy transfer for recharging of Unmanned Aerial Systems (UAS) to extend flight duration and enable more successful scouting missions
- Directing a multidisciplinary team of one graduate students, three industry researchers, and an undergraduate research assistant to investigate magneto-mechano electrical energy harvesters

Research Experience

Engineering Design and Optimization Lab & Mechatronics Research Lab (PSU) 2017-2021

Graduate Research Assistant under Dr. Mary Frecker and Dr. Christopher Rahn

- Contributed content and editorial assistance in two NSF proposals and annual reports for NSF projects.
- Modeled and simulated actuator metrics such as free deflection and actuator energy to improve design of actuators for upwards of **10-20% improved actuator energy** for less volume of actuator material.
- Modeled, designed, fabricated, and tested Li-ion cells with Si composite structures for harnessing of a Si-anode base lithium ion battery as an actuator with upwards of **1,000% more theoretical capacity** than commercial graphite anodes for improved battery performance.

Rotation in Interfacial Phenomena Lab (IPHEL) (PSU) 2017

PhD Student under Dr. Bladimir Ramos Alvarado

- Intermolecular Modeling of Graphite and Si (100) in LAMMPS

Rotation in Energy Nanostructure Research Group (PSU) 2017

PhD Student under Dr. Donghai Wang

- Fabrication and Testing of Lithium Ion Battery Coin Cells

Rotation in Terrones Research Group (PSU) 2016

PhD Student under Dr. Mauricio Terrones

- Synthesis of 2D material (MoS₂) using Chemical Vapor Deposition

Goddard Space Flight Center Intern Researcher (NASA) 2015

Intern Researcher under Manuel Balvin

- Performing microfabrication of MEMS Devices for In-Situ Missions to Solar System Primitive Bodies to enable sample capture and analysis.

Multi-Physics Laboratory (UCR) 2014-2016

Undergraduate Researcher under Dr. Sandeep Kumar

- Investigating of the cobalt distribution in the room temperature ferromagnetic nanocomposite TiO₂-Co thin films

- **NSF** funded research on *In Situ* TEM Observation of the Electrochemical Lithiation of Silicon Thin Films

Environmental Particle Fate and Transport Laboratory (UCR) 2013-2014

Undergraduate Researcher under Dr. Sharon Walker

- Began under **USDA** funded Building Bridges Grant from RCC to UCR with research on *Escherichia coli* and *Salmonella pullorum* Adherence to *Spinacia oleracea* Leaves

Teaching

Certificate on the Essentials of Online Teaching for Graduate Students Fall 2021

Learned implementation strategies for active learning techniques to encourage higher order thinking, developed instructional strategies for active online learning, and learned how to develop a rubric and how to give effective feedback.

Workshop: Planning a class session 09/14/2021

Interactive workshop presented by Chas Brua and John Elia of the Schreyer Institute for Teaching Excellence

Workshop: Handling Hot Moments in the Classroom 09/15/2021

Interactive workshop presented by Kris McLain and Beate Brunow of the Schreyer Institute for Teaching Excellence

PSU Multicultural Engineering Graduate Association: Facilitated peer-to-peer presentations

Cody Gonzalez, "*Analytical modeling and design optimization of lithium-ion battery actuators*," Virtual. 07/23/2021

Swapnil Sinha, "*Design for Embedding with Additive Manufacturing*," Virtual. 03/25/2021

Sintu Rongpipi, "*Effects of Matrix Polysaccharides on Cellulose Organization in Primary Cell Walls*," Virtual. 03/19/2021

Dynisty Wright, "*Genetics, Genomics, and Bioinformatics*," Virtual. 12/11/2020

Camilo Jaramillo, "*Laboratory Simulations of Solar Wind-Driven Space Weathering on Olivine Powder*," Virtual. 12/11/2020

Dynisty Wright, "*Genetics, Genomics, and Bioinformatics*," Virtual. 10/23/2020

Latisha Franklin, "*C. elegans as a model organism to understand muscle dysfunction associated with human diseases*." 03/27/2020

Adriyel Nieves, "*Implementation of Software Defined Radar System to support various techniques of measurement and detection of the ionosphere*." 03/27/2020

Elenz Zavala, "*Recovery of Highly Fragmented nDNA from Human Skeletal Material for SNP-based MPS analysis*." 04/05/2017

Roger Walker, “*Effects of Ionizing Radiation on the Layered Semiconductor Tungsten Diselenide.*” 03/22/2017

Roman Jaramillo, “*GCxGC thermodynamic modeling.*” 02/08/2017

Alyssa Rosas, “*The Application of Soft Chemical Reactions to Inorganic Layered Materials and the Characterization of the Thermodynamics using Isothermal Titration Calorimetry.*” 11/15/2016

Invited Talks

2022 – “A brief overview of low frequency energy harvesting mechanisms.” Université Gustave Eiffel. November 28th.

2022 – “A brief overview of low frequency energy harvesting mechanisms.” Technische Universiteit Delft. November 24th.

2022 – “A brief overview of low frequency energy harvesting mechanisms.” IX National Scientific Conference INNOVATION IN PRACTICE. Virtual. October 20th.

2021 - “Analytical Modeling of a Segmented Bimorph Lithium Ion Battery Actuator.” Future Leaders in Mechanical and Aerospace Engineering: Celebrating Diversity and Innovation. Virtual. February 10th

2019 - “Analytical Modeling of a Segmented Unimorph Lithium Ion Battery Actuator.” Mechanical and Nuclear Engineering Graduate Research Form of PSU. September 26th

Peer-Reviewed Publications

Gonzalez, C., Shan, S., Frecker, M., & Rahn, C. (2023). Multi-actuator lithium-ion battery shape matching design optimization. *Smart Materials and Structures*. In preparation.

Gonzalez, C., Shan, S., Frecker, M., & Rahn, C. (2023). Analytical modeling of a multilayer, multimorph lithium-ion battery actuator. *Journal of Intelligent Material Systems and Structures*. <https://doi.org/10.1177/1045389X221136540>

Gonzalez, C., Ma, J., Frecker, M., & Rahn, C. (2021). Analytical modeling and simulation of a multifunctional segmented lithium ion battery unimorph actuator. *Smart Materials and Structures*, 30(1), 015039. <https://doi.org/10.1088/1361-665X/abc7fb>

Ma, J., **Gonzalez, C.,** Huang, Q., Farese, J., Rahn, C., Frecker, M., and Wang, D., (2020). “Multifunctional Li(Ni 0.5 Co 0.2 Mn 0.3) O 2 -Si Batteries with Self-Actuation and Self-Sensing,” *J. Intell. Mater. Syst. Struct.*, 31(6), pp. 860–868.

Gonzalez, C., Kumar, S. (2016). Fabrication and Optical Microscopy Observation of the Electrochemical Lithiation of Polysilicon Thin Films. *UCR Undergraduate Research Journal*

Peer-Reviewed Conference Proceedings

*Presenting Author

Gonzalez, C.*, Shan, S., Frecker, M., & Rahn, C. (2021). 1D Shape Matching of a Lithium-Ion Battery Actuator. *ASME 2021 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*. <https://doi.org/10.1088/1361-665x/abc7fb>

Shan, S.*, **Gonzalez, C.**, Rahn, C., and Frecker, M., (2021), Experimental Study of NCM-Si Batteries With Bi-Directional Actuation,” *ASME 2021 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, American Society of Mechanical Engineers. <https://doi.org/10.1115/SMASIS2021-67596>

Gonzalez, C.*, Shan, S., Frecker, M., & Rahn, C. (2020). Analytical Modeling of a Segmented Bimorph Lithium Ion Battery Actuator. *ASME 2020 Conference on Smart Materials, Adaptive Structures and Intelligent Systems*. <https://doi.org/10.1115/SMASIS2020-2328>

Gonzalez, C.*, Ma, J., Frecker, M., & Rahn, C. (2019). Analytical modeling and simulation of the blocked force and large deformation of multifunctional segmented Lithium ion battery unimorph actuator. In *ASME 2019 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, SMASIS 2019*. <https://doi.org/10.1115/SMASIS2019-5560>

Gonzalez, C.*, Ma, J., Frecker, M., & Rahn, C. (2018). Analytical Modeling of a Multifunctional Segmented Lithium Ion Battery Unimorph Actuator. In *ASME 2018 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, SMASIS 2018* (Vol. 2, p. V002T06A009). <https://doi.org/10.1115/smasis2018-8123>

Ma, J.*, **Gonzalez, C.**, Rahn, C., Frecker, M., & Wang, D. (2018). Experimental Study of Multifunctional NCM-Si Batteries with Self-Actuation. In *ASME 2018 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, SMASIS 2018* (Vol. 1, p. V001T01A009). <https://doi.org/10.1115/smasis2018-8004>

Reports, Presentations, and Posters

- Energy Harvesting Society (EHS), “A brief overview of low frequency energy harvesting mechanisms.” 2022
- Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2018-2021
- College of Engineering Research Symposium 2021
- Industry Exchange Poster PSU 2018
- Center for Acoustics and Vibration (CAV) Spring Workshop PSU 2018
- UCR Undergraduate Research Symposium 2015-2016
2015 (Perfect Score and Best Poster), 2016 (Oral Presentation)
- Statewide California Alliance of Minority Participation (CAMP) Symposium 2015-2016
2015 (Honorable Mention), 2016 Honorable Mention
- Investigation of the cobalt distribution in the room temperature ferromagnetic nanocomposite TiO₂-Co thin films *UCR Undergraduate Honors Capstone Project* 2016

Patents

U.S. Patent Pending 63/119,920, Goyal, N., Zacharia, B., Frecker, M., Hanks, B., Gonzalez, C., Khurana, J. Apparatus to seal the nasal, oral, and ear cavities during sinonasal, skull base, transoral, and otologic surgery (2020)

Academic Service

Session Chair, Energy Harvesting Society, Baltimore, MD 2022

Postdocs of Earth and Mineral Science (PoEMS at Penn State), Founding Member 2021-2022
Center for Engineering Outreach and Inclusion (CEOI) Advisory Board member 2021

Multicultural Engineering Graduate Association at PSU (MEGA)

Chair, Alumni Relations 2021-2022
President 2020-2021
Vice-President 2018-2020
Secretary 2017-2018

American Society of Mechanical Engineers (ASME)

Student organizer, Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) Conference 2021
National Member 2014-Present
President, University of California, Riverside student chapter 2015-2016

Institutional Outreach and Leadership

GO-Fest Summer Camp “What is a Piezoelectric?” Talk Jun 6-10, 2022
Judge for Penn State Postdoc Society (PSPS) Outstanding Postdoc and Postdoc Mentor Awards 2022
Center for Engineering Outreach and Inclusion Advisory Board 2022
Panelist: Center for Engineering Outreach and Inclusion (CEOI): Alumni Panel March 1, 2022
Panelist: Center for Engineering Outreach and Inclusion (CEOI): Welcome Workshop (Virtual) January 12, 2022
Advisory group for the Office of Graduate Educational Equity Programs (OGEEP) 2021
Council of College Multicultural Leadership/Advisory Committee for Graduate Education (CCML/ACGE) 2021
Engineering Ambassador Project: Northern Cambria Middle School, PA Feb 3, 2018

A soft robotics concept was demonstrated with balloons and tapes to students at Northern Cambria Middle School, PA. The students were shown how soft robotics work by applying tension and compression. They also made and tested prototypes themselves.

Fellowships, Awards, and Honors

- Trailblazers in Engineering (TBE) Fellow, Purdue University 2021
- Outstanding Graduate Student Leader (PSU CEOI) 2021
- Outstanding Graduate Student (GE) 2021
- Harry G. Miller Fellowship in Engineering for excellence in research field 2020

- ASME SMASIS Best Student Paper Conference 2019
- Sloan Scholar, Alfred P. Sloan Foundation's Minority Ph.D. (MPHD) Program 2019
- PSU Bunton-Waller Assistantship; Robert W. Graham Endowed Fellowship 2016
- UCR Chancellor's Research Fellow 2015
- ASME John & Else Gracik Scholarship Recipient 2015
- Best Poster Presentation UCR Undergraduate Research Symposium 2015
- HSI-STEM Grant **US Dept. of Education (USDE)**; CAMP Stipend (**NSF**) F14, W15, S15
- Southern California Edison Sponsored HENAAC Scholarship; HENAAC Scholar 2014