Christian A. Fernández Soria

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Education

Bachelor of Science in Mechanical Engineering, Minor in Mathematics and Computer Science   Expected: May 2025
The University of Texas at El Paso (UTEP)   GPA: 3.94/4.00
Awards & Honors: Sidney Harman Vision Scholarship Program Academic Scholarship for Excellence (2022-2023 & 2024-2025) | Sunturians Endowed Scholarship (2020 - 2025) | UTEP's University Honors Program (2020 - 2024) | College of Engineering Dean's List (2020 - 2024)| Member - UTEP Society of Hispanic Professional Engineers (SHPE)

Research Experience

Lawrence Berkeley National Laboratory   **1 Cyclotron Road Berkeley, CA 94720**
Computing Science Internship - Scientific Machine Learning Intern   June 2023 – Aug 2023 & June 2024 – Aug 2024

- Assisted in post-processing data obtained from ferroelectric tests, employing Gaussian process regression and convolutional neural network to extract and analyze critical electrical properties.
- Collaborated on developing a utility to automate Adaptive Mesh Refinement Exascale (AMReX) pipelines for data generation in machine learning applications, efficiently executing approximately one thousand jobs per experiment on the high-performance Perlmutter supercomputer
- Inspected machine learning models, including Fourier Neural Operator, U-Net, and Convolutional Neural Network, which were subsequently integrated into the 3D micromagnetic solver for modeling magnetic materials (MagneX).
- Utilized numerical methods and computational simulations in FerroX software to analyze the behavior and response of micro-electronics under different ferroelectric and dielectric layers.
- Contributed to the Super-OOD-Bench project, testing the generalization capabilities of U-Net, Transformer, and FNO models across large datasets and presenting findings.

UTEP Energy Storage and Electronics 3D Printing Laboratory (ESTRELLA Lab.)   **UTEP, TX 79968**
Undergraduate Research Assistant   January 2023 – Present

- Formulated PEGDA-based compounds for gel polymer electrolytes (GPEs) and solid polymer electrolytes (SPEs) for sodium-ion and lithium-ion batteries, optimizing printing parameters for electrochemical performance.
- Designed complex lattice and battery structures for SLA and SLS 3D printing using Autodesk Fusion 360 and nTopology.
- Conducted mechanical characterization tests, following ASTM standards, and post-processed data to extract mechanical properties with Python.
- Leveraged Python automation scripts to analyze galvanostatic cycling and rate capability experiments, enhancing experimental efficiency.
- Employed Python to post-process data acquired from tensile tests, successfully extracting essential mechanical properties crucial for optimizing performance.

Advanced Modeling and Simulation Lab   **500 W University Ave, El Paso, TX 79968**
Undergraduate Research Assistant   November 2022 – Present

- Performed Stochastic modeling of temperature-dependent diffusion of liquids in one-dimensional pipes, investigating the impact of temperature parameters on the system behavior.
- Develop and implement Python-based simulations utilizing probability theory to analyze and address fluid mechanics challenges.
- Learn and utilize molecular dynamics simulations to analyze and visualize data, gaining valuable insights into the dynamic behavior of the oscillating heat pipes.
- Apply computational skills to process and visualize simulation data, aiding in the interpretation and validation of results.
- Build A* algorithm for the characterization of polarization domains in a 225-device grid, prioritizing computational efficiency.

University of Texas at El Paso 3D Lockheed Martin Lab   **500 W University Ave, El Paso, TX 79968**
Undergraduate Lab Assistant   Aug 2022 – December 2022

- Provided maintenance to the 3D printers in the lab by checking all the features worked properly and solving problems related to extruding, temperature, grinding filament, and probe issues, among other problems.
- Performed 3D printing of designs for research and mechanical students, using the PLA, PETG, and ABS filaments for the LulzBot TAZ 6, LulzBot Mini 2, and Raise3D as well as High Temp and Flexible Resin for the Formlabs Form 2, 3D printers.
- Supported Professor in various projects, executing tests, deploying additive manufacturing techniques, piloting new equipment, and performing data analysis.
- Prepare 3D printing machines set up to start the build process in PLA, PETG, and ABS materials, ensuring precision and build quality.
- Prepare the setup, provide material, and teach students about using equipment for lab tests such as tension/compression, mechanical impact, Jet Turbine performance, viscosity measurement, and heat exchanger machines.

Publications and Presentations

- Munoz, J. A., **Fernandez, C**., Kumar, P., Zeng, Y., Broad, J., Tritt, A., Nonaka, A., Griffin, S., Ramakrishnan, L., & Yao, Z. Negative capacitance of ferroelectric field-effect transistor gate stacks in design parameter space. *(Under Submission)*
- Soroco, M., Tang, Y., **Fernandez, C**., Totounferoush, A., Ren, P., Yao, J., Nonaka, A., Chen, W., & Mahoney, M. Super-OOD-Bench: Evaluating, Understanding, and Improving Out-of-Distribution Generalization of Neural Operators. *(Under Submission.)*
- Maurel, A., **Fernández, C. A**., Schiaffino, E. M., Mahmud, M. S., Delgado Ramos, K. L., Lin, Y., MacDonald, E., Merrill, L. C., Cardenas, J. A., & Martinez, A. C. (2024). The effect of polymer molecular weight in the electrochemical and mechanical performance of 3D printed solid polymer electrolytes. (Under Submission)
- Martinez, A. C., Schiaffino, E. M., Aranzola, A. P., **Fernandez, C**. A., Seol, M.-L., Sherrard, C. G., Jones, J., Huddleston, W. H., Dornbusch, D. A., Sreenivasan, S. T., Cortes, P., MacDonald, E., & Maurel, A. (2023). Multiprocess 3D printing of sodium-ion batteries via VAT photopolymerization and direct ink writing. *Journal of Physics: Energy, 5(4),* 045010. https://doi.org/10.1088/2515-7655/acf958
- **Fernandez, C**., Munoz, J., Zeng, Y., Kumar, P., Nonaka, A., & Yao, Z. J. (2024). Ferroelectricity-induced negative capacitance in microelectronic devices via phase-field simulations and machine learning. *Bulletin of the American Physical Society 2024, Session A02: Ferroelectrics, Multiferroics, and Domain Physics (Oral presentation).*
- **Fernandez, C**., Schiaffino, E., MacDonald, E., Merrill, L., Cardenas, J., Martinez, A., & Maurel, A. (2024). Digital Light Processing of Solid Polymer Electrolyte for Lithium-ion Batteries. *Solid Freeform Fabrication conference, Austin, Texas, August 2024*.
- **Fernandez C.**, Schiaffino E., Aranzola A., Martinez A.. Maurel A., MacDonald E. (2023) *Electrochemical Stability of 3D Printed Separators and Gaskets for Shape-conformable Lithium-ion Batteries. Solid Freeform Fabrication conference, Austin, Texas, August 2023.*

Technical Projects

NASA Lucy Student Pipeline Accelerator and Competency Enabler (L'SPACE) Mission Concept Academy
Undergraduate Assistant   *Aug 2022 – December 2022*
- Worked in a Preliminary Design Review (PDR) for NASA by calculating requirements, budget, systems, schedule, and risk management that were presented to the NASA engineers in December 2022.
- Collaborated with a group of 13 students from different universities in the United States to elaborate on the PDR.
- Attended weekly classes with NASA engineers to improve my science skills.
- Composed and given weekly progress of the project in which, we have to calculate the composition, mass, and density of a Near-Earth Object (NEO).

UTEP Rocket team   *Aug 2022 – December 2022*
structural aerodynamics sub-team member
- Designed 3D modeling to compute simulations to predict the rocket's behavior.
- Examined different types of materials to determine which has the best performance for the national competition.
- Assisted with the necessary calculations to be complemented with HyperWorks simulation results.

Skills

- **Proficient in:** Python Data Science Libraries (Pandas, NumPy, Matplotlib, scikit-learn, PyTorch), Java, nTopology, Autodesk Fusion 360, MATLAB, Microsoft Office, Computer reimaging, 3D modeling, Circuit Modeling, Bilingual Spanish, and English, machine shop manufacturing equipment.
- **Familiar with:** Siemens NX, Hyper works, Arduino nightly.