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PERSONAL STATEMENT

Software and systems engineer specializing in real-time simulation, autonomous systems, and applied and agentic AI, with a Ph.D. in Electrical Engineering and Computer Science from UC Irvine. Own architecture decisions and deliver engineering capabilities from concept through operational deployment. At ADI, originated and led the generative AI initiative, defining hardware and software architecture, coordinating principal and software engineers, and developing LLM/RAG copilots and agentic workflows that connect AI to engineering tools. As ADI's primary technical representative at JetZero, hold broad technical responsibility for the Flying Qualities Lab (FQL) and Integration Test Facility (ITF), spanning electrical interfaces, software architecture, real-time infrastructure, aircraft model integration, and automated testing from initial laboratory design through operational deployment. Combine hands-on engineering with technical leadership and research expertise in formal verification of AI-enabled systems.

EDUCATION

- Ph.D. in Electrical Engineering & Computer Science**, University of California, Irvine. (Aug 2019 – Jun 2024)
Thesis: Formal Verification of Vision-Based Artificial Intelligence-Controlled Aircraft Landing.
- M.Sc. in Astronautics and Space Engineering**, Cranfield University. (Aug 2017 – Aug 2018)
Thesis: Predictive Networked Attitude Control of Fractionated Satellites.
- B.Sc. in Mechatronics Engineering**, Universidad Autónoma de Baja California. (Aug 2009 – Nov 2014)
Project: Motor control system based on stepper motors and EtherCAT PLC.
Exchange study: Technical University of Munich.

HONORS & ACHIEVEMENTS

- Finalist Award, Best Student Research Competition (Graduate Category), ACM SIGBED (2023).
- USA–Mexico government full fellowship (CONACYT) for Ph.D. study at UC Irvine (2019–2024).
- UK–Mexico government full fellowship (CONACYT) for M.Sc. study at Cranfield University (2017–2018).
- Mexico government award (CENEVAL) for outstanding Bachelor Exit Examination results (2015).
- German government scholarship (DAAD) for final year of B.Sc. at Technical University of Munich (2013–2014).

PUBLICATIONS

- **Santa Cruz, U., M. Elfar, and Y. Shoukry.** "Correct-by-Construction Vision-based Pose Estimation using Geometric Generative Models." *Submitted to IEEE Transactions on Robotics (T-RO). arXiv:2601.17556v2; first posted Jan. 24, 2026, revised Sep. 19, 2026.*
- **Santa Cruz, U. and Y. Shoukry.** "Certified Vision-based State Estimation for Auto Landing Systems using Monotone Reachability Analysis." *IEEE Conference on Decision and Control, 2023.*
- **Santa Cruz, U. and Y. Shoukry.** "NNLander-VeriF: A Neural Network Formal Verification Framework for Vision-Based Autonomous Aircraft Landing." *NASA Formal Methods Symposium, 2022.*
- **Santa Cruz, U., J. Ferlez, and Y. Shoukry.** "Safe-by-Repair: A Convex Optimization Approach for Repairing Unsafe TLL Neural Network Controllers." *IEEE Conference on Decision and Control, 2022.*
- **Sun, X., W. Fatnassi, U. Santa Cruz, and Y. Shoukry.** "Provably Safe Model-Based Meta Reinforcement Learning: An Abstraction-Based Approach." *IEEE Conference on Decision and Control, 2021.*
- **Morales, J., J. Khalife, U. Santa Cruz, and Z. Kassas.** "Orbit Modeling for Simultaneous Tracking and Navigation Using LEO Satellite Signals." *ION GNSS Conference, 2019.*
- **Kempf, F., J. Scharnagl, U. Santa Cruz, and K. Schilling.** "Networked and Distributed Cooperative Attitude Control of Fractionated Small Satellites." *International Astronautical Congress, 2018.*

PROFESSIONAL EXPERIENCE

Solutions Engineer | Applied Dynamics International (ADI), Irvine, CA Jun 2024 – Present

- Originated and led ADI's generative AI initiative, owning the technical vision, hardware selection and configuration, and software architecture; provided technical direction to a cross-functional team including principal engineers, a software director, and software engineers.
- Delivered an integrated AI engineering prototype combining open-source LLMs, RAG-based knowledge retrieval, and natural-language-to-Python copilots on local GPU infrastructure; developed the prototype into an offering sold to major aerospace companies.
- Defined LLM configuration and inference settings, including quantization, context limits, and sampling parameters, to balance response quality, computational requirements, and reliability for engineering applications.
- Implemented RAG pipelines with document chunking and MiniLM embeddings; developed classifiers and evaluation metrics to assess retrieval quality and reduce hallucinations, and tool-connected workflows using MCP and A2A.
- Communicated the AI vision and technical tradeoffs to colleagues; contributed technical white papers and pre-sales proposals with universities and for DoD, DARPA, DOE, and U.S. Space Force opportunities.

Simulation Engineer (Full-Time Contractor) | JetZero (through ADI), Long Beach, CA Jun 2024 – Present

- Serve as ADI's primary technical representative for JetZero's Blended Wing Body demonstrator; define real-time laboratory architecture and technical criteria for the Flying Qualities Lab (FQL) and Integration Test Facility (ITF), from initial design and laboratory buildout through operational deployment.
- Own PXI network architecture decisions and define real-time simulation integration using ADEPT, MATLAB/Simulink, and C/C++; deliver laboratory infrastructure to management on schedule, from architecture through deployment. Define model execution strategies, signal allocation, and distributed PXI communication for closed-loop flight-control development.
- Define HIL test methodology and automation architecture, including scripting logic, test sequencing, equipment readiness, and synchronized playback and recording for repeatable closed-loop testing.
- Design test infrastructure for newly acquired supplier equipment with limited interface documentation; reverse-engineer interface behavior and develop custom protocol sniffers, control GUIs, and real-time data recorders to characterize equipment behavior and establish repeatable integration and verification workflows.
- Lead real-time software integration across Linux, 6-DoF aircraft models, X-Plane, and avionics interfaces using ARINC, CAN, UDP, FPGA-based I/O, LVDT/RVDT, and analog/digital signals; coordinate cross-team integration activities.
- Integrate aircraft LRUs, including inertial reference systems (IRS), flight control computers (FCC), VPUs, DCUs, and fuel quantity computers (FQC); translate pedal, sidestick, throttle, and speed-brake specifications into I/O selections, signal mappings, scaling, limits, and thresholds, and verify closed-loop behavior against test requirements.
- Integrate sensor-fusion simulation with aircraft dynamics and flight management system (FMS) interfaces; develop Python and Bash automation for protocol decoding, data acquisition, and test execution, with Git source control.

Applied Scientist Intern | Amazon Web Services (AWS) AI Labs, Pasadena, CA Jun 2023 – Sep 2023

- Developed a vision-based liveness-security AI prototype using a physics-based model that combined variable-focus imagery for depth estimation and deep neural-network image classification.
- Integrated ArduCAM, Intel RealSense depth camera, and UWB radar with Raspberry Pi; used Python, MATLAB/Simulink, and Linux.

Graduate Research Assistant | Resilient CPS Lab, UC Irvine, Irvine, CA Feb 2020 – Jun 2024

- Conducted research in formal methods, machine learning, and autonomous systems; authored research publications and presented findings at international conferences.
- Developed a formal-verification framework for neural-network visual perception and control in aircraft landing, with safety guarantees for closed-loop behavior.
- Built learning and simulation tools for event-based camera imagery and vehicle control; integrated PX4, Raspberry Pi, ROS, state estimation, and autonomous vehicle testbeds.
- Supported undergraduate and master's-level Autonomous Systems courses: prepared and delivered instructional sessions, led coding exercises, and evaluated assignments.
- Supported Senior Design Projects (Capstone), guiding dozens of student teams through final engineering projects and design and test milestones, including PDR, CDR, and TRR.

Graduate Research Assistant | ASPIN Navigation Lab, UC Irvine, Irvine, CA Sep 2019 – Feb 2020

- Developed MATLAB orbit models for LEO satellite signals to support tracking and navigation of drones in GPS-challenged environments.

Quality Engineer | Safran Electronics & Defense, Mexicali, Mexico Feb 2019 – Jul 2019

- Defined electromechanical-system quality requirements for commercial and military flight-deck controls; supported a repair and overhaul facility and supervised 15+ technicians.
- Trained technicians on updated quality standards and inspection methods.

Visiting Research Student | Zentrum für Telematik, Würzburg, Germany

Apr 2018 – Sep 2018

- Designed a 6-DoF nanosatellite plant model in Simulink including reaction wheels, magnetorquers, sun sensors, inertial units, and environmental perturbations for the UWE satellite program.
- Developed feedback-linearization and Lyapunov attitude-control algorithms and simulated model-predictive control for a cluster of nanosatellites.
- Integrated the controller with the Orekit attitude propagator for hardware-in-the-loop tests under packet loss and data delay; established robust stability guarantees for practical scenarios.

Test Engineer | Honeywell Aerospace, Mexicali, Mexico

Aug 2015 – Sep 2017

- Developed LabVIEW applications for control, monitoring, and test execution in a Systems Integration Lab supporting Airbus A350 and Boeing 777X aircraft systems.
- Supported operation and troubleshooting of a distributed network of 12 NI PXI systems connected over fiber optics, including startup/shutdown procedures, signal monitoring, and instrumentation integration.
- Developed the LabVIEW operator interface and state-machine logic for a new Boeing 777X ram air turbine (RAT) wind-tunnel test facility, coordinating facility operation and test sequences.
- Contributed to MATLAB/Simulink and Stateflow-based testing and supported Airbus A350 pressure- and temperature-control system test campaigns.
- Developed automated manufacturing test programs for high-potential (hipot) electrical insulation testing using the test equipment's programming language.
- Created and maintained electrical CAD drawings documenting laboratory PXI systems, wiring, and cable interconnections, including drawing updates and revision control.
- Prepared engineering deliverables for Preliminary Design Reviews (PDR), Critical Design Reviews (CDR), and Test Readiness Reviews (TRR), supporting integration and test readiness.

Test Engineer Intern | Max Planck Institute for Physics, Munich, Germany

Mar 2014 – Aug 2014

- Supported transition of an electromechanical adaptive-optics control system for the European Very Large Telescope (ERIS program) from development to qualification for operation from ambient to cryo-vacuum conditions.
- Developed LabVIEW data-acquisition workflows to validate position, velocity, temperature, and torque measurements over RS-232, GPIB, and DAQ interfaces.
- Characterized cryogenic stepper motors, tuned PID control, configured instrumentation, and programmed an EtherCAT PLC; authored qualification test procedures.

SKILLS

Languages: Fluent English (TOEFL iBT 99), basic German (Goethe B1), and native Spanish.

Programming and Scripting: Python, C/C++, MATLAB, Bash, LabVIEW.

Real-Time Simulation and Test: ADEPT, Simulink, Stateflow, NI PXI, Speedgoat, hardware-in-the-loop (HIL), software-in-the-loop (SIL), test automation.

AI and Machine Learning: Large language Models (LLMs), Retrieval Augmented Generation (RAG), Agentic AI, MCP, A2A. PyTorch, TensorFlow/Keras, OpenCV.

Systems and Interfaces: Linux, Git, ROS, ARINC 429, CAN, UDP.

Engineering Design: AutoCAD Electrical, SolidWorks.

CERTIFICATES

Design for Six Sigma Green Belt;
SolidWorks Associate in Mechanical Design (CSWA);
NI LabVIEW Core I & II and TestStand;
Project Management Diploma, Tecnológico de Monterrey.