Science and Engineering 2, 381
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Ayush Pandey

Employment

Fall 2023 – **Assistant Professor** (tenure-track, teaching) of Electrical Engineering, University of California, Merced

Spring 2022 **Adjunct Professor**, Harvey Mudd College, CA, United States.

Education

2018 – 2023 **California Institute of Technology**, Pasadena, CA, United States
Ph.D. in Control & Dynamical Systems
Advisor: *Dr. Richard M. Murray*
Committee: *Dr. John C. Doyle, Dr. Niles A. Pearce (Caltech) and Dr. Domitilla Del Vecchio (MIT)*
Thesis: Modeling Frameworks for Modular and Scalable Biocircuit Design

2017 – 2018 **California Institute of Technology**, Pasadena, CA, United States
Master's in Electrical Engineering

2012 – 2017 **Indian Institute of Technology (IIT)**, Kharagpur, India
Bachelor's in Instrumentation Engineering and Master's in Control Systems Engineering
Advisors: *Dr. Saurav Patra & Dr. Siddhartha Mukhopadhyay*

Research Grants

National Science Foundation — Co-PI and co-lead for project on "Adapting Design Thinking to Transform the Professional Development of Electrical Engineers in California's Central Valley" funded under the NSF Revolutionizing Engineering Departments (RED) program. The project PI, as required by the program, is the department chair of Electrical Engineering at UC Merced, Sarah Kurtz. Total award: $1,000,000

CITRIS-UC Institute — PI for project on "Safety guarantees in the context of generative artificial intelligence models" funded under the CITRIS Seed Grant program. This project is in collaboration with Gireeja Ranade at UC Berkeley. Total award: $60,000

UC Merced Senate — PI for project on "Safety guarantees for large language models" funded by the Committee on Research. Total award: $10,000

Caltech CEMI — Co-lead (graduate student grant) on "Model-Based Design of Microbial Self-Assembly Response to Environmental Conditions" awarded by Caltech CEMI. Total award: $30,000

UC Merced UROC — PI research grants awarded to lead specialized summer projects under the Undergradaute Research Opportunities Center (UROC). Total awards: $4,000 in 2024, $3000 in 2025.

Honors and Awards

Best Thesis — Awarded the best thesis in Instrumentation Engineering, IIT Kharagpur for the AY 2015-2016

Best Poster/Talk — (1) For our poster at IWBDA 2020 on BioCRNpyler – a modular software for compiling biological system models in diverse contexts, and (2) For an oral presentation (by student, Aizen Baidya) on our project at the CITRIS Workforce Innovation Program 2025

Top Innovator — Awarded $8000 at a national engineering innovation competition organized by KPIT, India for designing an autonomous bicycle with dual mode of locomotion

Research Fellowship — Awarded $6000 for a summer internship in the SURF program at Caltech in 2015

Travel Grants — Conference travel support grants – NSF Molecular Programming Flightplan (Committee Moderator), NSF NAIRR AI Unlocked Workshop 2025, Google CAHSI Ideation Workshop 2024, AI at Scale workshop at UC Riverside, INSPIRE 2024 by CA Learning Lab, COMBINE 2018, IWBDA 2019, 2022, Build-A-Cell (2019, 2021, 2022, 2025)

Peer-Reviewed Journal Publications

ACM TCPS 2025 — Inigo Incer, Apurva Badithela, Josefine Graebener, Piergiuseppe Mallozzi, **Ayush Pandey**, Sheng-Jung Yu, Albert Benveniste, Benoit Caillaud, Richard M Murray, Alberto Sangiovanni-Vincentelli, Sanjit A Seshia. "Pacti: Scaling Assume-Guarantee Reasoning for System Analysis and Design". ACM Transactions on Cyber Physical Systems (2025). DOI: 10.1145/3704736

ACM TCPS is one of the two top journals, rated Q2, in formal methods research alongside IEEE TICPS (source)

JOSS 2023 — **Ayush Pandey***, William Poole*, Anandh Swaminathan*, Victoria Hsiao, and Richard M. Murray. "Fast and flexible simulation and parameter estimation for synthetic biology using bioscrape." Journal of Open Source Software (JOSS), 2023. DOI: 10.21105.joss.05057

* denotes equal contribution

JOSS is the only major peer-reviewed journal dedicated specifically to publishing open-source research software that showcases industry-standard software engineering aimed at large-scale adoption in science.

ACS 2022 — **Ayush Pandey**, Makena L. Rodriguez, William Poole, and Richard M. Murray. "Characterization of Integrase and Excisionase Activity in Cell-free Protein Expression System Using a Modeling and Analysis Pipeline" ACS Synthetic Biology (2023). DOI:10.1021/acssynbio.2c00534

ACS Synthetic Biology is the top experimental synthetic biology journal ranked top-tier Q1 by Scimago

PLoS 2022 — William Poole, **Ayush Pandey**, Zoltan Tuza, Andrey Shur, and Richard M. Murray. "BioCRNpyler: Compiling chemical reaction networks from biomolecular parts in diverse contexts." PLoS Computational Biology (2022). DOI:10.1371/journal.pcbi.100997S

PLOS Computational Biology is ranked top-tier (Q1) in computational systems biology by Scimago

IJRNC 2022 — **Ayush Pandey**, and Richard M. Murray. "Robustness guarantees for structured model reduction of dynamical systems with applications to biomolecular models." International Journal of Robust and Nonlinear Control (2022). DOI:10.1002/rnc.6013

Wiley's IJRNC is higly selective and ranked top-tier Q1 in this niche area by Scimago

Peer-Reviewed Conference Papers

CDC 2025 — **Ayush Pandey**. "Parameter Robustness in Data-Driven Estimation of Dynamical Systems" 64th IEEE Conference on Decision and Control (CDC) 2025. Accepted as an oral presentation (arXiv).

ASEE 2025 — S Shailja, Thomas Williams, and **Ayush Pandey**. "Self-efficacy of high school students after an AI-focused pre-college program: A two year impact study" American Society for Engineering Education Symposium (2025). Accepted as an oral presentation. DOI: 10.18260/1-2–57638 .

ASEE 2025 — Alex Frias, Shrivaikunth Krishnakumar, and **Ayush Pandey**. "FlexiGrader: an LLM-based personalized autograder to enable flexible and open-ended creative exploration in CS1" American Society for Engineering Education Symposium (2025). Accepted as an oral presentation. DOI: 10.18260/1-2–56580.

CDC 2024 Inigo Incer, **Ayush Pandey**, Nicholas Nolan, Emma L Peterman, Kate E Galloway, Eduardo D Sontag, Domitilla Del Vecchio. "Guaranteeing System-level Properties in Genetic Circuits Subject to Context Effects" 63rd IEEE Conference on Decision and Control (CDC) 2024. DOI:10.1109/CDC56724.2024.10886081.

ASEE 2024 Shailja, Satish Kumar, Arthur Caetano, and **Ayush Pandey**. "Scaffolding AI research projects increases self-efficacy of high school students in learning neural networks (Fundamental)" American Society for Engineering Education Symposium (2024). Accepted as an oral presentation DOI: 10.18260/1-2–47953.

IWBDA 2022 **Ayush Pandey***, Inigo Incer*, Alberto Sangiovanni-Vincentelli, and Richard M. Murray. "From Specification to Implementation: Assume-Guarantee Contracts for Synthetic Biology." International Workshop on Bio-Design Automation (2022). Accepted as a talk. DOI:10.1101/2022.04.08.487709

* denotes equal contribution

IWBDA 2022 **Ayush Pandey**, Makena L. Rodriguez, William Poole, and Richard M. Murray. "Characterization of integrase and excisionase activity in cell-free protein expression system using a modeling and analysis pipeline" International Workshop on Bio-Design Automation (2022). Accepted as a talk.

CDC 2021 **Ayush Pandey** and Richard M. Murray. "Robustness Guarantees for Structured Model Reduction of Dynamical Systems". 60th IEEE Conference on Decision and Control (CDC) 2021. DOI:10.1109/CDC45484.2021.9683298.

ACC 2020 **Ayush Pandey** and Aaron D. Ames. "On a Converse theorem for Finite-time Lyapunov Functions to Estimate Domains of Attraction." In IEEE American Control Conference (ACC) 2020. DOI: 10.23919/ACC45564.2020.9147709

IWBDA 2019 **Ayush Pandey** and Richard M. Murray. "An automated model reduction tool to guide the design and analysis of synthetic biological circuits." In International Workshop on Bio-Design Automation (2019) DOI: 10.1101/640276

IRC 2017 **Ayush Pandey**, Siddharth Jha, and Debashish Chakravarty. "Modeling and control of an autonomous three wheeled mobile robot with front steer." In First IEEE International Conference on Robotic Computing (IRC) 2017. DOI: 10.1109/IRC.2017.67

ITEC 2015 **Ayush Pandey**, Subhamoy Mahajan et al. "Low cost autonomous navigation and control of a mechanically balanced bicycle with dual locomotion mode." In IEEE International Transportation Electrification Conference (ITEC) 2015. DOI: 10.1109/ITEC-India.2015.7386938

Preprints

SEED 2025 Zoila Jurado, **Ayush Pandey**, Richard M Murray."High-level membrane and transport descriptions for detailed multi-compartment chemical reaction network modeling of synthetic biological circuits" Poster at Synthetic Biology: Engineering, Evolution, & Design (SEED 2025).

URJ 2024 Saaketh Raghava (Advisor: **Ayush Pandey**)."Classification of Hallucinations in Large Language Models Using a Novel Weighted Metric." UC Merced Undergraduate Research Journal 17.1 (2024).

bioRxiv 2023 Zoila E. Jurado Quiroga, **Ayush Pandey**, Richard M Murray. "A pure chemical reaction network of PURE" bioRxiv (2023). DOI: 10.1101/2023.08.14.553301

IBDRC 2020 **Ayush Pandey** and Richard M. Murray. "A two-state ribosome and protein model can robustly capture the chemical reaction dynamics of gene expression." bioRxiv (2020). DOI: 10.1101/2020.11.25.399287

bioRxiv 2020 Liana N. Merk, Andrey S. Shur, **Ayush Pandey**, Richard M. Murray, and Leopold N. Green. "Engineering Logical Inflammation Sensing Circuit for Modulating Gut Conditions." bioRxiv (2020). DOI: 10.1101/2020.11.10.377085

SEED 2019 Reed D. McCardell, **Ayush Pandey**, and Richard M. Murray. "Control of density and composition in an engineered two-member bacterial community." bioRxiv (2019). DOI: 10.1101/632174

q-Bio 2020 **Ayush Pandey** and Richard M. Murray. "Model Reduction Tools For Phenomenological Modeling of Input-Controlled Biological Circuits." bioRxiv (2020). DOI: 10.1101/2020.02.15.950840

LIGO 2015 **Ayush Pandey**, Christopher Wipf, Jameson Graef Rollins, Rana Adhikari. "Quantization Noise Analysis in Advanced LIGO Digital Control System". In: Technical Report, LIGO Caltech, USA 2015. PDF.

Teaching Experience

2023 – **Assistant Professor**, *UC Merced*.

Course	Avg. Enroll.	Staff	Products	Evaluation (/7)
Fall '25 EE 102: Signal Processing & Linear Systems (open-source repo)	40 UG	1 TA	Upper-division active learning	Current
Spring '25 EE 005: Designing and Building EE Systems (syllabus)	80 UG	4 UG readers	Hands-on EE	6.3/7
Fall '24, '25 EE 021: Introduction to EE Programming (syllabus)	60 UG	1 Grad TA, 4 UG readers	CS1 for EE	6/7
Spring '24 USTU 020: Introduction to Problem Solving (syllabus)	40 UG	2 UG readers	Hands-on education	6.5/7
Fall '23 ME 021: Engineering Computing (syllabus)	200 UG	3 Grad TAs 1 UG reader	Personalized projects	6.1/7
Su '25, Fall '23 CSE 019: Introduction to Computing (syllabus)	60 UG	1 Grad TA	Flexigrader	6.1/7

2022 **Adjunct Professor**, *Harvey Mudd College*.

Course	Enrollment	Product	Evaluation
Spring '22 ENGR 163: Introduction to Biomedical Engineering	5	Interactive notebook-based design	6.6/7

Fall 2019 & Winter 2022 **Teaching Assistant**, *Caltech*.
(Winter 2022) TA for the Optimal Control and Estimation course. (Fall 2019) TA for the Linear Systems course

Fall 2021 & Fall 2022 **Workshop Organizer**, *International Workshop on Bio-Design Automation (IWBDA)*.
Organized a workshop at IWBDA 2021 and 2022 on modeling biological systems and using Bayesian inference to identify parameters from experimental data.

Spring 2020 **Lecturer**, *Caltech BE240 – Open Source Tools for Biological Circuit Design*.
Gave 4 lectures and organized tutorial sessions for graduate and undergraduate students enrolled for the BE240 course at Caltech.

Summer 2020 **Organizer & Lecturer**, *YouTube Tutorial Series on Modeling & Analysis of Biological Systems*.
Organized a bootcamp for summer undergraduate research fellows (SURF) at Caltech and members of the Build-A-Cell consortium. The video lectures from the series were later published as tutorials on YouTube.

2017 – 2018 **Teaching Assistant**, *IIT Kharagpur*.
TA for the Nonlinear Control course for graduate students. TA for two lab courses for undergraduates: Measurements and Instrumentation (Fall) and Control Systems (Spring)

Patent

2016 **Ayush Pandey** (lead inventor), Subhamoy Mahajan, et al. "Autonomous Two-Wheeler with Dual Mode of Locomotion". Indian Patent **Granted**: 558183 (2025)

University Service

EE Curriculum Design — Co-designed a novel curriculum with four unique emphasis areas for the newly established Electrical Engineering department in the School of Engineering, UC Merced.

Curriculum Committee — Member of the curriculum founding committee for the new Electrical Engineering department at UC Merced. Participated in the development of three new Electrical Engineering courses and reviewed the proposed curriculum for 12 courses in total.

Enrollment Outreach — Participated in various outreach activities in an effort to expand enrollment at the university and in the Electrical Engineering program in the School of Engineering at UC Merced: Bobcat Day Tabling 2024, Bobcat Day Lecture 2025

Faculty participant in the "Experience UC Merced" program where I demonstrated UC Merced classroom teaching to prospective students

Participated in a faculty panel at the UC Merced Admissions' Office reception event for newly admitted students and their parents.

Faculty participant in the high school educators tour where I consulted with educators and counselors from across California about unique aspects of UC Merced.

Mentor: AIAA, IEEE, and Data Science — Faculty mentor for the CITRIS aviation team, AIAA club, IEEE student chapter, and the Data Science Society at UC Merced.

Broadening Participation — Participated in a faculty panel at the Fiat Lux Scholars Program designed to promote networking among eligible first-generation undergraduate students at UC Merced.

Faculty mentor in the Cal-Bridge Summer program and the Central Valley Pathways into Academic, Teaching, and Higher Education program

Resident Associate for two undergraduate dorms at the California Institute of Technology.

Mentor in the Freshman Summer Research Institute (FSRI) program at Caltech designed to introduce scientific research to underrepresented minorities in STEM.

Academic Community Service

Guest Editor — Virtual Special Issue on IWBDA 2022 in ACS Synthetic Biology. Published editorial: DOI:10.1021/acssynbio.4c00340

Executive Editor — Member of the executive editorial board for the Art of Molecular Programming book leading the problem set team. The goal of the team is to review, edit, and add problem sets so that they are pedagogically consistent.

Publication Chair — Part of the core organizing team and the publication chair for the 14th International Workshop on Bio-Design Automation (IWBDA)

Session Chair — American Society for Engineering Education (ASEE) Symposium 2024, 2025 (Evaluating Engineering Excellence, Evaluating Pre-college Impact, AI at the Pre-College), IEEE Conference on Decision and Control (CDC) 2021, International Workshop on Bio-Design Automation (Software and Pipelines)

Panel Review — NSF panel on Graduate Research Fellowship Program (GRFP) 2024-25

Reviewer — IEEE Transactions on Automatic Control (2 papers)

Conference on Decision and Control (5 papers)

Wiley International Journal of Robust and Nonlinear Control (2 papers)

ACM Special Interest Group on Computer Science Education (6 papers; 3 assignments)

ASEE: Data Science and Analytics Division (3 papers), Pre-College Engineering Education Division (6 papers), Equity Division (2 papers)

IEEE EDUCON Conference (3 papers)

IEEE Frontiers in Education Conference (3 papers)

ACS Synthetic Biology (4 papers)

International Journal of Control (1 paper)

Nature Scientific Reports (2 papers)

International Workshop on Bio-Design Automation (8 papers)

Journal of Open Source Software (JOSS) (4 papers)

Educational Advances in Artificial Intelligence (EAAI) (3 papers)

Panel Speaker

Invited panelist at a career panel for Postdoctoral Fellows of Engineering Excellence at MIT

Panelist at UC Merced Admissions Office Bay area reception for newly admitted students and parents.

Faculty panelist at AIAA UC Merced Student Chapter's panel on graduate education

Workshop Organizer

(2025) Organized a bootcamp on Github for summer students at UC Merced; (2025) Co-organized a bio-modeling workshop for Caltech-ERDC; (2022) Organized a modeling workshop at the 13th International Workshop on Bio-Design Automation (IWBDA) conference

Professional Development Grants

AI for Education

Selected to participate in the professional development workshop on designing courses to use AI as an ally. Awarded $2000 for this Course Design Institute.

Faculty Success

Awarded $3000 by the School of Engineering, UC Merced for participation in the Faculty Success Initiative – Extramural Funding Fellowship.

Scientific Teaching

Awarded $300 professional development funds for participation in UC Merced's 3rd Mobile Summer Institute on Scientific Teaching (MoSIST).

Early Career Mentorship

Selected to participate in the early career faculty mentorship program to participate in the ACM Technical Symposium on Computer Science Education (TS SIGCSE 2024). Awarded $1500 for this mentoring program.

ABET

Eight professional development hours for participation in the ABET Fundamentals of Program Assessment Workshop. PD funded by the Electrical Engineering department at UC Merced

Contributed & Invited Talks

LLNL 2025

"Can AI guarantee safety and robustness in controlling unstable systems?". Invited talk at the Lawrence Livermore National Lab (LLNL) workshop on AI for Power Systems

ASEE 2025

"Automated thematic analysis to quantify educational outcomes". 2025 American Society for Engineering Education (ASEE) Annual Symposium, Pre-College Engineering Education Division.

AI at UCM 2025

"Open-ended assessments in CS1 education". Symposium on Education and AI at UC Merced

ASEE 2024

"Can high school students learn neural networks?". 2024 American Society for Engineering Education (ASEE) Annual Symposium, Pre-College Engineering Education Division.

UROC, UC Merced

"Measuring the hallucinations of ChatGPT". Undergraduate Research Opportunities Center (UROC), Faculty Flash Talks, University of California, Merced.

Data Science, Berkeley	"Enhancing Student Learning and Research with Open-Source Tools for Data Science". Data Science Seminar, Electrical Engineering and Computer Science, University of California, Berkeley.
Colloquium, UCR	"Empowering Interdisciplinary Learning and Research with Open-Source Tools for Computational Biology". Computer Science Colloquium, University of California, Riverside.
IWBDA 2022	"Characterization of integrase and excisionase activity in cell-free protein expression system using a modeling and analysis pipeline". International Workshop on Bio-Design Automation held with iGEM Jamboree, in Paris, France.
IWBDA 2022	"From Specification to Implementation: Assume-Guarantee Contracts for Synthetic Biology". International Workshop on Bio-Design Automation held with iGEM Jamboree, in Paris, France.
IBDRC 2021	"On reduced models for gene expression and biological circuit design". International Bio-Design Research Conference (IBDRC), Virtual.
Build-A-Cell 2020	"On biosensors and synthetic biology". Build-A-Cell Seminar Series, Virtual.
ACC 2020	"On a new converse Lyapunov theorem and its application for domain of attraction computation". American Control Conference, Virtual.
q-Bio 2020	"On Auto-Reduce – A Python toolbox for model reduction". Quantitative Biology at Hawaii, US.
Imperial College	"On an automated method for model reduction of synthetic biological circuits". At Imperial College London, July 2019.
IWBDA 2019	"On an automated method for model reduction of synthetic biological circuits". International Workshop on Bio-Design Automation at University of Cambridge, UK.
COMBINE 2018	"On Sub-SBML – A software package to combine multiple models of biological systems using compartmentalization". COMBINE at University of Boston, US.
IRC 2017	"On modeling and control of an autonomous three-wheeled mobile robot with front steer". International Robotics Conference at Taichung, Taiwan (ROC).
ITEC 2015	"On i-Bike – An autonomous bike with switchable modes of locomotion". International Transportation Electrification Conference at Chennai, India.