

Ayush Pandey

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Employment

Fall 2023 – **(Tenure-Track) Assistant Professor of Teaching**, University of California, Merced, CA

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. Domitilla Del Vecchio, and Dr. Niles A. Pearce*

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

CITRIS-UC Institute Lead 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.

UC Merced Academic Senate PI for project on "Safety guarantees for large language models" funded by the Committee on Research.

AFOSR MURI As a graduate student, I co-wrote with Richard M. Murray along with five other PIs from MIT and Northeastern University, a proposal that was funded by the Air Force Office of Scientific Research ([AFOSR](#)) MURI program. I helped write the proposed research to be conducted at Caltech as a part of this grant.

Caltech CEMI Co-wrote a grant with a graduate student on “Model-Based Design of Microbial Self-Assembly Response to Environmental Conditions” for Caltech for Environmental Microbial Interactions (CEMI) seed grant call.

Honors and Awards

- Best Thesis Awarded the best senior thesis in Instrumentation Engineering, IIT Kharagpur for the academic year 2015-2016
- Best Poster For our poster at IWBD 2020 on BioCRNpyler – a modular software for compiling biological system models in diverse contexts
- Ph.D. Fellowship Awarded by the Electrical Engineering Department at Caltech for the academic year 2017-2018
- Research Fellowship Awarded \$6000 for my summer internship in the SURF program at Caltech in 2015
- Best Engineering Design Won \$8000 at a national engineering innovation competition organized by KPIT, India for designing an autonomous bicycle with dual mode of locomotion
- Travel Grants For travel and lodging support at conferences – [Inspire 2024](#) by CA Learning Lab, [COMBINE 2018](#), [IWBD 2019](#), [2022](#), [Build-A-Cell](#) (2019, 2021, 2022)

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” arXiv (2023). ACM Transactions on Cyber Physical Systems (2025). .
- 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](https://doi.org/10.21105/joss.05057), [bioRxiv preprint](#).
- * denotes equal contribution
- 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](https://doi.org/10.1021/acssynbio.2c00534)
- 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.1009975](https://doi.org/10.1371/journal.pcbi.1009975)
- 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](https://doi.org/10.1002/rnc.6013)

Peer-Reviewed Conference Papers

- 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" IEEE Conference on Decision and Control (2024). Accepted as an oral presentation.
- 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 of Engineering Education Symposium (2024). Accepted as an oral presentation ([PDF](#)).
- 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](https://doi.org/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". 2021 IEEE Conference on Decision and Control. [PDF](#).
- ACC 2020 **Ayush Pandey** and Aaron D. Ames. "On a Converse theorem for Finite-time Lyapunov Functions to Estimate Domains of Attraction." In American Control Conference (ACC). IEEE, 2020. DOI: [10.23919/ACC45564.2020.9147709](https://doi.org/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." bioRxiv (2019). DOI: [10.1101/640276](https://doi.org/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). IEEE, 2017. DOI: [10.1109/IRC.2017.67](https://doi.org/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 International Transportation Electrification Conference (ITEC). IEEE, 2015. DOI: [10.1109/ITEC-India.2015.7386938](https://doi.org/10.1109/ITEC-India.2015.7386938)

Preprints

- UCM UG Journal 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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/10.1101/2020.02.15.950840)
- arXiv 2016 **Ayush Pandey** "Information Performance Tradeoffs in Control." arXiv preprint:(2016). DOI: [1611.01827v2](https://doi.org/10.1101/161101)
- LIGO 2015 **Ayush Pandey**, Christopher Wipf, et al. "Quantization Noise Analysis in Advanced LIGO Digital Control System". In: Technical Report, LIGO, Louisiana, USA. 2015. PDF.

Professional Development

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|----------------------------|---|
| 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 Initiative | 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 Program Assessment | Eight professional development hours for participation in the ABET Fundamentals of Program Assessment Workshop |

Teaching Experience

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

Course	Enrollment	Staff	Products (in progress)	Evaluation (/7)
Fall '24 EE 021: Introduction to EE Programming (syllabus)	80 UG	1 Grad TA, 4 UG readers	CS1 with an EE flavor	5.9 ± 1.1
Spring '24 USTU 020: Introduction to Problem Solving (syllabus)	40 UG	2 UG readers	Hands-on engineering education	6.47 ± 0.25
Fall '23 ME 021: Engineering Computing (syllabus)	207 UG	3 Grad TAs, 1 UG reader	Personalized open-ended Python projects	6.1 ± 1.3
Fall '23 CSE 019: Introduction to Computing (syllabus)	57 UG	1 Grad TA	Active learning in CSE	6.1 ± 1.3

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

Course	Products	Evaluation
Spring '22 ENGR 163: Introduction to Biomedical Engineering	New interactive notebook-based course design	6.59/7

Fall 2019 & **Teaching Assistant**, *Caltech*.

Winter 2022 (Winter 2022) TA for the [Optimal Control and Estimation](#) course. (Fall 2019) TA for the [Linear Systems](#) course

Fall 2021 & **Workshop Organizer**, *International Workshop on Bio-Design Automation (IWBDA)*.

Fall 2022 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)

Mentoring Experience

2022 – Graduate Students.

Name	University	Role	Next Position
Alex Frias	UC Merced	Research Specialist	–
Zoila Jurado Quiroga	Caltech	Ph.D. Committee Member	–
Harikrishnan R. Namboothiri	Texas A&M University	Ph.D. Committee Member	–

2023 – Undergraduate Students, UC Merced.

Name	Year/Program	Project	Next Position
Alex Frias	CSE Senior (2023-24)	LLM-based autograder	Research Specialist, UC Merced
Prerana Somarapu	CSE Junior (2024-)	Autonomous Vehicles	–
Saaketh Raghava	CSE Freshman (Summer 2024-)	Evaluation of LLMs	–
Jasper Morgal	CSE Senior (Fall 2024)	Autonomous Vehicles	–
Axel Muniz Tello	Applied Math Junior (2024-)	Kalman filters and LLMs	–
Shri Krishnakumar	CSE Senior (2024-)	Autograder	SJSU Grad Student
Thomas Williams	EE Freshman (2024-)	Thematic analysis	–
Randy Serrano	ME Senior (2023-24)	PURE modeling web app	–
Max Fu	CSE Freshman (2023-24)	LLM-based autograder	–
Mahanth Mohan	CSE Freshman (2023-24)	EE education	UCSD transfer
Aksheen Rathod	CSE Freshman (2023-24)	LLM-based autograder	–
Sy Wallace	CSE Sophomore (Summer 2024, CV PATH)	PURE modeling web app	–
Anirudh Kaushal	CSE Sophomore (Summer 2024, CV PATH)	Autograders for CS1 assessment	–
Alan Barrios	CSE Sophomore (Summer 2024, Cal-Bridge)	Cost analysis of an autograder	–

2023 – High School Students, UC Merced.

Rachit Jaiswal	High school (Summer 2024)	LLMs for navigation	–
William Yang	High school (Summer 2024)	Evaluation of LLMs	–
Mohit Ramesh Kumar	High school (Summer 2024)	Autograders for CS1 assessment	–

2017 – 2023 Undergraduate Students, Caltech.

Name	Year	Project	Next Position
Makena Rodriguez	Senior Biology and Biological Engineering (2021-22)	Model-guided biocircuit design. Manuscript published in ACS Synthetic Biology .	–
Anthony Chiang	Caltech SURF 2022	Cell-free modeling	–
Robert Hansen Jagrelius	Caltech SURF 2022	Metabolic modeling	–
Bridget Yang	Caltech SURF 2021	Synthetic cell modeling	–
Pranay Satya	Caltech SURF 2021	Synthetic cell modeling	–
Halle Holzbauer	Caltech SURF 2021	Synthetic cell modeling	–
Katherine Pan	Caltech SURF 2020	–	Harvard (Med School)
Ankita Roychudhary	Caltech SURF and Senior Thesis 2020	Metabolic modeling	Northwestern (Grad)
Liana Merk	Caltech SURF 2020	Biocircuit modeling	Harvard (Grad)
Nazmus Sadaat	Caltech SURF 2020	Biocircuit modeling	–
Agrima Deedwania	Caltech SURF 2020	Biocircuit modeling	–
Hope Arnett	Caltech Freshman Summer Research Institute (FSRI) 2020	Biocircuit modeling	–

2022 Undergraduate Students, Harvey Mudd College.

Name	Year	Project	Next Position
Spencer Uyematsu	Senior, Pomona College (2022-23)	Stem-cell differentiation modeling	–
Trenton Weasley	Senior, Computational Biology (2022)	Stochastic cell-fate simulations	–

2023 – Co-adviser of the IEEE Student Chapter, UC Merced.

The IEEE Student Chapter at UC Merced is leading hands-on undergraduate projects.

2013 Workshop Leader, IEEE Sponsored Robotics Workshop.

Hands-on tutorial for robotics and 20 lectures on electronic circuit design for mobile robots.

Patent

- 2016 **Ayush Pandey**, 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.

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.

Bobcat day tabling to promote the new EE major among newly admitted students.

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

AIAA Student Chapter Mentoring the AIAA student chapter at UC Merced in their research activities related to aviation and control. Faculty mentor for the CITRIS aviation prize team of AIAA club.

IEEE Chapter Faculty co-advisor to the IEEE student chapter at UC Merced, part of the IEEE Oakland East Bay section. Organized outreach activities such as a soldering workshop, events in collaboration with the UC Merced makerspace lab, and robotics competitions.

DEI Activities 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 Central Valley Pathways into Academic, Teaching, and Higher Education program

Faculty mentor in the Cal-Bridge Summer program where I mentored a scholar from Fresno State University on a research project.

Lab representative for Diversity, Equity, and Inclusion (DEI) in Biology and Biological Engineering at California Institute of Technology.

Resident Associate for two undergraduate dorms at 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.

Awareness drive in the undergraduate housing at Caltech as a part of Black History Month.

Academic Community Service

Guest Editor Virtual Special Issue on IWBD A 2022 in ACS Synthetic Biology. Published editorial: [DOI:10.1021/acssynbio.4c00340](https://doi.org/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 ([IWBD A](#))

Session Chair American Society for Engineering Education (ASEE) Symposium ([Session W133: Evaluating Engineering Excellence](#))
International Workshop on Bio-Design Automation ([Session 4: Softwares and Pipelines](#))

Panel Review	NSF Graduate Research Fellowship Program 2024-25
Reviewer	<p>IEEE Transactions on Automatic Control (2 papers)</p> <p>Conference on Decision and Control (3 papers)</p> <p>Wiley International Journal of Robust and Nonlinear Control (2 papers)</p> <p>ACM Special Interest Group on Computer Science Education (3 papers; 3 assignments)</p> <p>ASEE Data Science and Analytics Division (3 papers)</p> <p>ASEE Pre-College Engineering Education Division (3 papers)</p> <p>IEEE EDUCON Conference (3 papers)</p> <p>ACS Synthetic Biology (4 papers)</p> <p>International Journal of Control (1 paper)</p> <p>Nature Scientific Reports (2 papers)</p> <p>International Workshop on Bio-Design Automation (7 papers)</p> <p>Journal of Open Source Software (JOSS) (4 papers)</p>
Volunteer	Conference on Decision and Control (CDC), 2021 Volunteer
Panel Speaker	<p>Invited panelist at the career panel for the Postdoctoral Fellowship Program for Engineering Excellence at MIT</p> <p>Faculty panelist at UC Merced Admissions Office Bay area reception for newly admitted students and parents.</p> <p>Faculty panelist at AIAA UC Merced Student Chapter's panel on graduate education</p>
Workshop Organizer	Organized a modeling workshop at the 13th International Workshop on Bio-Design Automation (IWBDa) conference

Contributed & Invited Talks

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.

Workshops & Certifications

- Inclusion Certificate on Anti-Racist pedagogy, awarded by the Division of Equity, Justice, & Inclusive Excellence at UC Merced
- Teaching Attended the "Mobile Summer Institute on Scientific Teaching" workshop organized by UC Merced Teaching and Learning Commons and the Howard Hughes Medical Institute (HHMI) Inclusive Excellence Grant.
- Teaching Received the "Certificate of Interest in Teaching" organized by Caltech Project for Effective Teaching (CPET)
- Teaching Attended workshops on teaching pedagogy and teaching accessibility organized by Caltech Center for Teaching, Learning, and Outreach (CTLO) office
- Student Wellness Certificate workshop on suicide prevention at Caltech