Ayush Pandey

1200 E. California Blvd. Pasadena, CA
Contact: 626-491-8376
apandey@caltech.edu
https://caltech.edu/~apandey

Education

2018 – now **California Institute of Technology**, Pasadena, CA, United States
Doctoral Student, Control and Dynamical Systems
Advisor: *Dr. Richard M. Murray*
Research: Towards forward design of synthetic biological circuits using control theory

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

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

Work Experience

2021 – now **Resident Associate**, Caltech, CA, United States.
RA for two undergraduate houses at Caltech.

Summer 2016 **Research Intern**, Caltech, CA, United States.
Project: Information and performance tradeoffs in control

2014 – 2016 **Research Group Leader**, *Autonomous Ground Vehicles (AGV), IIT Kharagpur*.
Project: Development of autonomous ground vehicle robots towards self-driving cars

Summer 2015 **Research Intern**, Caltech, CA, United States.
Project: Quantization noise in digital control systems of the LIGO detector

Teaching & Mentoring Experience

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

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

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

2020 – 2021 **Caltech SURF Program**, *SURF Research Mentor*.
Mentored three undergraduate interns for their summer internship projects in 2021 and six undergraduate interns in 2020.

Fall 2019 **Caltech**, *Teaching Assistant*, CA, United States.
TA for the Linear Systems Course for 32 graduate students at Caltech. Gave 4 lectures in addition to the regular office hours and grading work.

Spring 2017 **IIT Kharagpur**, *Teaching Assistant*, India.
TA for the Nonlinear Control course for graduate students at IIT Kharagpur. Designed and presented recitation material for students.

2017 – 2018 **IIT Kharagpur**, *Teaching Assistant*, India.
TA for two labs: Measurements and Instrumentation (Fall) and Control Systems (Spring).

Publications & Preprints

CDC 2021 **Ayush Pandey** and Richard M. Murray. "Robustness Guarantees for Structured Model Reduction of Dynamical Systems". To appear at 2021 IEEE Conference on Decision and Control. PDF.

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

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

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

BioCRNpyler 2020 William Poole, **Ayush Pandey**, Zoltan Tuza, Andrey Shur, and Richard M. Murray. "BioCRNpyler: Compiling chemical reaction networks from biomolecular parts in diverse contexts." bioRxiv (2020). DOI:10.1101/2020.08.02.233478

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

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

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

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

arXiv 2016 **Ayush Pandey** "Information Performance Tradeoffs in Control." arXiv preprint:(2016). DOI: 1611.01827v2

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

LIGO 2015 **Ayush Pandey**, Chirstopher Wipf, et al. "Quantization Noise Anlysis in Advanced LIGO Digital Control System". In: Technical Report, LIGO, Louisiana, USA. 2015. PDF.

Patent

2016 **Ayush Pandey**, Subhamoy Mahajan, et al. "Autonomous Two-Wheeler with Dual Mode of Locomotion". Indian Patent Under Review: 201631025904, Filed Oct. 2016

Honors and Awards

Best Poster For our poster at IWBDA 2020 on BioCRNpyler – a modular software compiler for modeling biological systems 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

Gold Award Won $8000 at a national engineering innovation competition organized by KPIT, India

Best Thesis Awarded the best senior thesis in Instrumentation Engineering, IIT Kharagpur for the academic year 2015-2016

Skills

Programing Python, MATLAB, C (Advanced Proficiency)

C++, Assembly Language, Web Development (Intermediate Proficiency)

Community Service

DEI Lab representative in the Biology and Biological Engineering Diversity, Equity, and Inclusion (DEI) committee.

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

Conferences 2021: CDC Volunteer

2021: IWBDA Workshop Organizer

Reviewer 2021: Journal of Open Source Software (JOSS)

Invited Talks

IBDRC 2021 On reduced models for gene expression and biological circuit design. Virtual.

ACC 2020	Lightning talk on a new converse Lyapunov theorem and its application for domain of attraction computation. Virtual.
q-Bio 2020	On Auto-Reduce – A Python toolbox for model reduction. At Hawaii, US.
IWBDA 2019	On an automated method for model reduction of synthetic biological circuits. At University of Cambridge, UK.
COMBINE 2018	On Sub-SBML – A software package to combine multiple models of biological systems using compartmentalization. At University of Boston, US.
IRC 2017	On modeling and control of an autonomous three-wheeled mobile robot with front steer. At Taichung, Taiwan (ROC).
ITEC 2015	On i-Bike – An autonomous bike with switchable modes of locomotion. At Chennai, India.