

EDUCATION

Ph.D. in Electrical Engineering with Computer Science Minor <i>University of Minnesota, Twin-Cities</i>	GPA: 3.789/4	Advisor: <i>Murti Salapaka</i>	Dec 2022 (Expected)
Master of Technology in Systems and Control <i>Indian Institute of Technology, Bombay</i>	GPA: 9.82/10	Advisor: <i>Paluri S V Nataraj</i>	2013
Bachelor of Engineering in Electrical Engineering <i>University of Mumbai</i>	GPA: 79.04/100		2011

RESEARCH EXPERIENCE

Performance Improvement of Non-equilibrium Experiments <i>Ph.D. Project</i>	JUN 2020 — PRESENT
<ul style="list-style-type: none">Developed algorithm for quantifying errors in non-equilibrium experimentsReleased Python based toolbox for error quantificationDevised proof of concept experiments using Optical Tweezers	
Modeling Nano-Mechanics of Muscle Proteins <i>Ph.D. Project</i>	JAN 2017 — PRESENT
<ul style="list-style-type: none">Collaborated with biochemists to design force spectroscopy experiments characterizing single molecules of utrophin and dystrophin (proteins that are linked to muscular dystrophy)Implemented robust force control in an atomic force microscopeDeveloped Monte Carlo methods to capture molecules' observed behaviorsDevised statistical tests to evaluate proteins for therapyConducted experiments revealing effect of expression system on proteinsAutomated experimental analysis, reducing processing time from 1 work day to 2 hours	
Change Detection Algorithm <i>Ph.D. Project</i>	JUL 2016 — JUL 2020
<ul style="list-style-type: none">Constructed a python-based toolbox for detecting abrupt jumps in system parameters under low signal to noise ratios using dynamic programmingExplained the behavior of a popular change detection algorithm and found its limits of performance	
Intelligent Identifier & Auto-Tuner <i>Master's Thesis</i>	JUL 2012 — JUN 2013
<ul style="list-style-type: none">Developed an expert system to start controlling a plant with limited human supervision from a cold startCreated algorithm that found models with >60% fit for a large class of systemsHigh performance controllers validated on hybrid tank, thermal & motor control systems	

PROFESSIONAL EXPERIENCE

Research Intern <i>Rhythm Management, Boston Scientific Inc.</i>	JUN 2021 — AUG 2021 <i>Arden Hills, MN</i>
<ul style="list-style-type: none">Deep Learning Performance Analysis: Identified limitations in the training dataset that lead to the prediction errorsData Augmentation: Created methods to augment limited training data for improved machine learning model performance	
Research Intern <i>Rhythm Management, Boston Scientific Inc.</i>	JUN 2019 — AUG 2019 <i>Arden Hills, MN</i>
<ul style="list-style-type: none">Rhythm Classification: Developed deep learning models to classify electrocardiograms from implantable devicesDeep Learning Automation: Built framework for hyper-parameter search (model optimization) and for using unlabeled data	
Systems Validation Engineer <i>Cypress Semiconductor Corporation</i>	SEPT 2013 — JUN 2015 <i>Bengaluru, India</i>
<ul style="list-style-type: none">Generic Automation Platform: Developed a generic test system which can be used for automated validation of all Programmable Systems on Chips (PSoC)Validation: Designed tests for functional validation of CAN and CapSense blocks and performed preliminary EMI/EMC certification of PSoCs	

Applications Engineer JUN 2013 — SEPT 2013
Cypress Semiconductor Corporation Bengaluru, India

- **CapSense Algorithm Development:** Developed firmware algorithms for auto-tuning capacitive touch sensors and gesture detection using 4 sensors

Intern JUL 2010 — APR 2011
Siemens Limited (Part Time) Mumbai, India

- Built a corona detector for finding electrical discharges in air to aid quality testing of transformers
- Diagnosed & reduced noise problems to achieve a detection range of 40m in air

PROJECTS

Deep Reinforcement Learning for Multi-Agent Interaction SEPT 2017 — DEC 2017

- Investigated conditions that promote agent-agent language evolution from scratch
- Measured performance improvements for bridge crossing when using agent derived communication

Robustness of Control Via Deep Reinforcement Learning JAN 2017 — MAY 2017

- Evaluated the robustness of control obtained via reinforcement learning
- Improved stability of derived controllers, validated on openAI Gym's unstable cart-pole system

Automating Deep Learning for Game Playing SEPT 2016 — DEC 2016

- Created an unsupervised agent that learned to play the game Super Hexagon using only video data
- Reinforcement learning used to train a neural network to achieve survival times 3x random actions

Conveyor Belt Tracking for on the Fly Machine Operations FEB 2012 — MAY 2012

- Developed digital PID controllers to enable machine tools to operate on moving objects, with the aim to reduce production time and energy wastage in assembly lines

Modeling & Control of Vehicle with Four Wheel Steering JAN 2012 — APR 2012

- Estimated dynamic models (ARX, ARMAX) for vehicle dynamics from input-output data
- Designed and simulated optimal pole placement controllers with Kalman filters for improved performance and safe operation

TEACHING EXPERIENCE

Teaching Assistant
University of Minnesota, Twin-Cities

Control Systems Lab Development JAN 2022 — SEPT 2022

- Coordinated with faculty, staff, and vendors to improve student experience of 2 lab courses
- Identified syllabus gaps and created 3 new experiments
- Modernized over 15 experiments and manuals
- Enabled Hardware-In-Loop control for 5 control plants such as DC Motors, Inverted Pendulums, Magnetic Levitation Systems
- Trained teaching assistants for the new labs

Linear Control Systems Lab SEPT 2016 — PRESENT

- Instructed students in successfully implementing linear control algorithms
- Mentored students on technical writing
- Trained 3 new teaching assistants
- Consistently rated more than 5 out of 6 in student feedback

State Space Control Systems Lab JAN 2017 — MAY 2020

- Taught techniques to implement advanced control
- Guided students with reports and technical writing
- Developed remote experiments for COVID-19 safety
- Mentored 4 new teaching assistants
- Consistently rated more than 5 out of 6 in student feedback

Non-linear Systems MAR 2020 — JUN 2020

- Graded assignments and exams

Linear Systems & Optimal Control SEPT 2019 — DEC 2019

- Graded assignments and exams, held office hours

Intro to Circuits & Electronics

- Graded assignments, held office hours

JUN 2017 — AUG 2017

Teaching Assistant

IIT Bombay

Automation & Feedback Control

- Developed lecture notes, graded assignments

JAN 2013 — MAY 2013

Systems & Control Lab

- Developed exercises for 2-Degree of Freedom helicopter control

MAY 2012 — DEC 2012

SKILLS

Technical Communication	Python, MATLAB, Simulink, Labview, C, C++, R English, Hindi, Tamil
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PUBLICATIONS

JOURNALS

In preparation

Rajaganapathy, S., Hua, C. and Salapaka, M.V., “Quantifying Errors in the Jarzynski Estimator.” (*In preparation*)

Ramirez, M.P., **Rajaganapathy, S.**, Hagerty, A.R., Hua, C., Vavra, J., Gordon, W.R., Salapaka, M.V. and Ervasti, J.M., “Phosphorylation alters the mechanical stiffness of a model utrophin fragment.” (*In preparation*)

Published

Rajaganapathy, S., Melbourne, J. and Salapaka, M.V., “Change detection using an iterative algorithm with guarantees.” *Automatica*, 136, p.110075, 2022.

Rajaganapathy, S., McCourt, J.L., Ghosal, S., Lindsay, A., McCourt, P.M., Lowe, D.A., Ervasti, J.M. and Salapaka, M.V., “Distinct mechanical properties in homologous spectrin-like repeats of utrophin.” *Scientific reports*, 9(1), pp.1-11, 2019.

CONFERENCES

Rigorous Peer Review

Rajaganapathy, S., Melbourne, J., Aggarwal, T., Shrivastava, R. and Salapaka, M.V., “Learning and estimation of single molecule behavior.” In 2018 Annual American Control Conference (ACC) (pp. 5125-5130). IEEE, June, 2018.

TALKS, PRESENTATIONS, AND POSTERS

Rajaganapathy, S., Hua, C. and Salapaka, M., “Confidence bounds for the Jarzynski estimator.” In APS March Meeting Abstracts (Vol. 2022, pp. S09-007), 2022.

Lopez, M.P.R., **Rajaganapathy, S.**, Gordon, W.R., Salapaka, M.V. and Ervasti, J.M., “The Mechanical Properties of a Utrophin Construct Encoding the Tandem CH Actin Binding Domain through Spectrin Repeat 3 is Altered by the Cell Expression System through Post-Translational Modifications.” *Biophysical Journal*, 118(3), pp.257a-258a, 2020.

Shrivastava, R., Bhaban, S., Melbourne, J., **Rajaganapathy, S.** and Salapaka, M., “A Semi-Analytical Model to Investigate Cargo Transport by Bi-Directional Molecular Motor Ensemble.” In APS March Meeting Abstracts (Vol. 2019, pp. R64-006), 2019.

Rajaganapathy, S., Shrivastava, R., Jaro, J., Ghosal, S., Salapaka, M.V., “Robust Force Control for Single Molecule Force Spectroscopy.” Poster at International Scanning Probe Microscopy, Tempe, AZ, 2018.

Shrivastava, R., Bhaban, S., **Rajaganapathy, S.**, Li, M., Hays, T.S. and Salapaka, M.V., “Transport Properties of Molecular Motor Ensemble with Bi-Directional Motors: A Computational Approach.” In MOLECULAR BIOLOGY OF THE CELL (Vol. 29, No. 26, pp. 109-110). 8120 WOODMONT AVE, STE 750, BETHESDA, MD 20814-2755 USA: AMER SOC CELL BIOLOGY, December, 2018.

HONORS AND AWARDS

John Bowers Excellence in Teaching Assistance Award	2020
Electrical & Computer Engineering Department Fellowship, University of Minnesota	2015-2016
Institute Silver Medal, Systems & Control Engineering, Indian Institute of Technology, Bombay	2013
J.R.D. Tata Trust Scholarship, University of Mumbai	2010-2011

INSTITUTIONAL SERVICE

Lab Safety Officer <i>Salapaka Lab University of Minnesota, Twin-Cities</i>	SEPT 2018 — PRESENT
Graduate Student Mentor <i>Electrical and Computer Engineering University of Minnesota, Twin-Cities</i>	MAR 2022 — PRESENT
Grants Review Committee <i>Council of Graduate Students University of Minnesota, Twin-Cities</i>	MAR 2021 — AUG 2022
Alumni Student Mentor <i>Alumni Association IIT Bombay</i>	MAY 2018 — MAY 2020
Department Placement Coordinator <i>Career Cell IIT Bombay</i>	JUL 2012 — MAY 2013
Chair <i>IEEE Students' Chapter Fr. C.R.I.T, University of Mumbai</i>	JUL 2012 — MAY 2013

REVIEWS

Reviewed for contributed articles in:

- American Control Conference
- Control and Decision Conference
- Indian Control Conference