

Akshay Rajhans | Curriculum Vitae

MathWorks – 1 Lakeside Campus Drive, Natick, MA 01760
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Professional Experience

MathWorks, Natick, MA

Principal Research Scientist

Senior Research Scientist

Jul 2013–

May 2018–

May 2016–Apr 2018

○ Key Responsibilities

- manages the company's **Research Collaborations Program**
Has **companywide responsibility** for the planning and execution of this **global** Program.
See <https://www.mathworks.com/academia/research/research-collaborations.html>.
- represents MathWorks in the in **Cyber-Physical Systems, Modeling & Simulation**, and **Formal Verification** research communities
- member of the **Patent Review Board** for all inventions in the entire Simulink product family
- review member on the **Research Publications Process** for all research publications authored by Engineering staff

○ Key Accomplishments

- grew the Research Collaborations Program **5x** in terms of number of annual approved projects and **3x** in terms of annual expenditure over the past five years
- currently represents MathWorks on the **Advisory Board** of MIT's Climate & Sustainability Consortium
See: <https://impactclimate.mit.edu/mathworks/>.
- organized and grew the **MathWorks Research Summit** in Boston and Tokyo, the flagship annual invite-only research and technology focused event by MathWorks
- two **keynote talks** and dozens of **invited talks, panels, research publications**, and **conference program committee** involvement and leadership on behalf of MathWorks over the past five years
See [Keynotes, Invited Talks, and Panels, Technical Community Service, and Publications] sections for details.
- as a **founding member**, co-developed the vision, mission, and operating principles for the new Advanced Research & Technology Office and helped recruit and mentor two research scientists and seven research interns

Senior Software Engineer

Jul 2013–Apr 2016

- C++ software development for core semantics of Simulink, particularly, *initialization* semantics, *conditional subsystems* semantics, and *Simulink in Stateflow* semantics for graphical modeling of hybrid dynamics. See [Publications C11, C12].

Bosch, Research and Technology Center, Pittsburgh, PA

Research Intern

Aug 2009–Dec 2009

- Developed a new approach to non-intrusive load monitoring using hybrid system state estimation. See [Patents].

University of Pennsylvania, Philadelphia, PA

Research Staff, General Robotics, Automation, Sensing, and Perception (GRASP) Lab

Jan 2008–Jun 2008

- Software toolbox development of STRONG, A MATLAB Toolbox for simulation-based formal verification of hybrid systems developed during my M.S. thesis. This toolbox formed the basis of the Ph.D. thesis of a student at Rensselaer Polytechnic Institute whose Thesis Committee I served on. See [Ph.D. Thesis Committee, Thesis T1, and Publication C9].

Cummins, Pune, India

Manager, Application Engineering, Industrial Business Unit (IBU)

Aug 2003–Dec 2005

- Application engineering for electronic control software and hardware for diesel engine applications in mining, marine, defense, rail, compressors, oil rigs, fire pumps, automotive and off-highway construction equipment. **One of only two** engineers in charge of electronic controls for all of IBU Applications across all of India.

Operations Management Program Participant in Research, Development, and Engineering

Aug 2003–Aug 2005

- Research, development and application engineering of electronic control software and hardware for diesel engines and their applications. **Quarterly Achievement Award from Vice President of Research, Development, and Engineering.**

Software Skills

Developer: Simulink, Stateflow, SimEvents (at MathWorks), STRONG (at University of Pennsylvania).

User: Formal methods tools SpaceEx, PHAVer, Breach, KeYmaera (at Carnegie Mellon University)

Languages: MATLAB and C++. Some C and Java in graduate coursework.

Education

Degrees

- **Ph.D.**, Electrical and Computer Engineering **May 2013**
Carnegie Mellon University, Pittsburgh, PA, U.S.A.
Advisor: Bruce H. Krogh
Thesis Committee: Ken Butts (Toyota), David Garlan, André Platzer
- **M.S.**, Electrical Engineering **Dec 2007**
University of Pennsylvania, Philadelphia, PA, U.S.A.
Advisor: George J. Pappas
- **B.E.**, Electronics and Telecommunication **May 2003**
University of Pune, Pune, India.

Selected Coursework, Certificates, and Continuing Education

At MathWorks

- Leadership is Everyone's Business • Model-Based Design Labs

Independent

- Introduction to Marketing (Offered on Coursera by Wharton School of Management, University of Pennsylvania)

At Carnegie Mellon University

- Numerical Methods for Engineering Design and Optimization • Formal Languages Automata, Computability and Complexity • Real Analysis • Linear Systems • Architectures for Software Systems • Hybrid Systems Analysis and Theorem Proving • Introduction to Model Checking

At University of Pennsylvania

- Advanced Robotics: Motion Planning and Control • Advanced Artificial Intelligence and Machine Learning • Advanced Topics in ESE: Systems Biology • Digital Signal Processing • Introduction to Optimization • Artificial Intelligence and Machine Learning • Engineering Entrepreneurship • Hybrid Systems • Control of Systems

At Cummins

- Operations Management Program • Young Leadership Development Program • Common Approach to Continuous Improvement • Six Sigma • Seven Habits of Highly Effective People • Cummins Production System

Keynotes, Invited Talks, and Panels

Keynote Talks

- K2. "*Challenges and Opportunities in Design and Operation of Intelligent Cyber-Physical Systems*", 19th International Runtime Verification Conference (RV), Part of 3rd World Congress on Formal Methods, Porto, Portugal. October 2019. **Chairs:** Leonardo Mariani and Bernd Finkbeiner.
- K1. "*Multi-Paradigm Modeling for Design and Operation of Intelligent Cyber-Physical Systems*", First International Workshop on Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS), co-located with the MODELS Conference, Munich, Germany. September 2019. **Chairs:** Simon Van Mierlo and Hans Vangheluwe.

Invited Talks

- T16. "*Engineering Learning-Enabled Cyber-Physical Systems: Challenges and Opportunities*", Workshop on Machine Learning in Control (LEAC), Cyber-Physical Systems and Internet of Things (CPS-IoT) Week, remotely in

Nashville, TN. May 2021. **Hosts:** Rafal Wisniewski and Manuela-Luminita Bujorianu, Workshop Chairs.

- T15. *"Formal Methods for Real-World Cyber-Physical Systems: A personal perspective"*, Invited Guest Lecture, Brown University course on Logic for Systems (CS 171), remotely in Providence, RI. March 2021. **Hosts:** Tim Nelson and Shriram Krishnamurthi, Computer Science Professors.
- T14. "Cyber-Physical Systems", Independent Activities Period (IAP), Massachusetts Institute of Technology, remotely in Cambridge, MA. January 2021.
- T13. *"A Model-Based Design Perspective on Challenges and Opportunities in Automated Software Certification"*, 20th Software Certification Consortium (SCC) Steering Committee Meeting, Annapolis, MD. May 2019. **Hosts:** Alan Wassyng and Mark Lawford, Organizers.
- T12. *"Specification Formalisms for Cyber-Physical Systems: A Tools Perspective"*, Dagstuhl Workshop on Specification Formalisms for Modern Cyber-Physical Systems, Dagstuhl, Germany. February 2019. **Hosts:** Jyotirmoy Deshmukh, Oded Maler, Dejan Nickovic, Workshop Organizers.
- T11. *"Graphical Modeling of Hybrid Systems with Simulink and Stateflow"*, Workshop honoring the retirement of Prof. Bruce Krogh, Carnegie Mellon University, Pittsburgh, PA. May 2018. **Host:** Bruno Sinopoli, Workshop Chair.
- T10. *"A Vision for Application-Focused International Collaboration Networks in Cyber-Physical Systems"*, NSF Visioning Workshop on International Networks for Advancing CPS Research, Development, and Education Worldwide, part of CPS Week 2018, Porto, Portugal. April 2018. **Hosts:** Seta Bogosyan, Frankie King, Ralph Wachter, National Science Foundation (NSF).
- T9. *"Heterogeneous Model-Based Design of Tomorrow's Cyber-Physical Systems"*, ECE Department Colloquia, Tufts University, Medford, MA. November 2017. **Host:** Prof. Usman Khan.
- T8. *"Model-Based Design of Next Generation Cyber-Physical Systems"*, MIT LIDS, IDSS, MITeI, Lincoln Labs, NSF and IWR Workshop on Rethinking Modeling, Simulations and Control for the Changing Electric Energy Industry, Massachusetts Institute of Technology, Cambridge, MA, September 2017. **Hosts:** Prof. Marija Ilić and Prof. Ekaterina Kostina.
- T7. *"Challenges and Opportunities for Intelligent Transportation Systems"*, Robotica 2017, Newton, MA, June 2017. **Host:** Dr. Waseem Naqvi, AUVSI New England Chapter President (Chair).
- T6. *"Model-Based Design of Connected Autonomous Vehicles"*, 2nd IEEE Summer School on Connected and Autonomous Vehicles, Worcester Polytechnic Institute, Worcester, MA, May 2017. **Hosts:** Prof. Alexander Wyglinski and Prof. Raghvendra Cowlagi (Program Chairs).
- T5. *"Model-Based Design Challenges for Cyber-Physical Systems"*, Expeditions in Computer Augmented Program Engineering (ExCAPE) Principal Investigators' (PI) Meeting, University of Pennsylvania, Philadelphia, PA, May 2017. **Host:** Prof. Rajeev Alur (Principal Investigator).
- T4. *"Safety in Freely-Composed Cyber-Physical Systems—Challenges and Opportunities"*, with Pieter Mosterman, Exploring the Dimensions of Trustworthiness: Challenges and Opportunities Workshop, National Institute of Standards and Technology (NIST), Gaithersburg, MD, August, 2016. **Host:** Dr. Edward Griffor (Program Chair).
- T3. *"Recent Advancements in MathWorks Verification and Validation Tools and Techniques"*, CPS V&V I&F Workshop 2016, May 2016, Carnegie Mellon University. **Host:** Prof. André Platzer.
- T2. *"Verification of Systems Using Robust Temporal Logic Testing"*, Specification and Verification Center, School of Computer Science, Carnegie Mellon University, September 2008. **Host:** Prof. Ed Clarke.

- T1. "*Robustness of Temporal Logic Specifications for Testing of Signals*", Specification and Verification Center, School of Computer Science, Carnegie Mellon University, August 2008. **Host:** Prof. Ed Clarke.

Panels

- P7. "*Challenges in Satisfying the Need and Promotion of Modeling & Simulation Workforce*," Winter Simulation Conference, in hybrid mode at Phoenix, AZ, December 2021.
- P6. "*Control for Climate Change Mitigation and Adaptation*," IEEE CSS Workshop on Control for Societal Challenges, online. June 2021.
- P5. "*Future Challenges for Autonomous & Intelligent Transportation*," IEEE Situational Awareness for Emerging Transportation Systems (SAFENETS) Workshop, Lowell, MA, October 2019.
- P4. "*Hybrid simulation for cyber-physical systems—where are we, and where do we want to go?*," Spring Simulation Conference (SpringSim), Baltimore, MD, April 2018.
- P3. "*What are the challenges posed to CPS theory by modern applications?*," Joint Panel between the Hybrid Systems: Computation and Control Conference (HSCC) and the International Conference on Cyber-Physical Systems (ICCPs), part of CPS Week, Porto, Portugal, April 2018.
- P2. "*Why do we need holistic concern-driven engineering?*," CPS Framework Open Source Workshop, National Institute for Standards and Technology (NIST), Rockville, MD, September 2017.
- P1. "*Safety of connected autonomous vehicles*," First International Workshop on the Safety of Connected Autonomous Vehicles (SCAV), part of CPS Week, Pittsburgh, PA, May 2017.

Technical Community Service

Industry Advisory Committees and Boards

- **Impact Advisory Board**, MIT's Climate & Sustainability Consortium, 2021–.
See: <https://impactclimate.mit.edu/mathworks>.
- **Industry Advisory Committee on Autonomous Vehicles Curriculum**, Robotics Engineering Program at Worcester Polytechnic Institute, 2017–18.
- **Industry Vice Chair**, IFAC Conference on Analysis and Design of Hybrid Systems (ADHS), 2018.
- **Industry Advisory Board**, International Symposium on Circuits and Systems (ISCAS), 2018.
- **Global Professional Advisory Community**, Association for Computing Machinery (ACM), 2017.

Conference Program Committee (PC) Leadership

- **PC Chair**: • MathWorks Research Summits, Boston edition: 2017–, Tokyo edition: 2016– • Fourth International Workshop on Monitoring and Testing of CPS (MT-CPS), 2019 • Spring Simulation Conference (SpringSim) 2020 and 2019: CPS Track • Winter Simulation Conference (WSC) 2017: CPS Track
- **Artifact Evaluation Chair**: • Formal Modeling and Analysis of Timed Systems (FORMATS) 2022
- **Awards Chair**: • Hybrid Systems: Computation and Control (HSCC) 2018
- **Demo and Poster Chair**: • Hybrid Systems: Computation and Control (HSCC) 2017
- **PC Member**: • Annual Modeling and Simulation Conference (AnnSim) 2021– • Formal Methods (FM) 2021– • International Conference on Cyber-Physical Systems (ICCPs) 2020–, 2015 • Multi-Paradigm Modeling for Cyber-Physical Systems (MPM4CPS) 2020– • Hybrid Systems: Computation and Control (HSCC) 2016–19 • International Conference on Informatics in Control, Automation and Robotics (ICINCO) 2020, 2017–18 • Winter Simulation Conference (WSC) 2017– • Numerical Software Verification Workshop (NSV) 2018–19 • International Workshop on Formal Co-Simulation of Cyber-Physical Systems (CoSim-CPS) 2017– • Summer Simulation Multi-Conference (SummerSim) 2014– • Conference on Analysis and Design of Hybrid Systems (ADHS), 2015
- **Repeatability Evaluation Committee Member**: • Hybrid Systems: Computation and Control (HSCC) 2014

Editorial Duties

- **Associate Editor, Technology Conferences Editorial Board**, IEEE Control System Society, 2020–
- **Editorial Advisory Board** Member, “Resilience in Cyber-Physical Systems: From Risk Modelling to Threat Counteraction,” F. Flammini (Ed.), Springer Book in the Series Advanced Sciences and Technologies for Security Applications, A. J. Masys (Series Ed.)
- **Reviewer** for various journals and conferences in addition to those as a **PC Member**.

Technical Committees

- IEEE Technical Committee on Homeland Security

Publications and Patents

Theses

- T2. **Akshay Rajhans**, “*Multi-Model Heterogeneous Verification of Cyber-Physical Systems*”, Ph.D. Thesis, Department of Electrical and Computer Engineering, Carnegie Mellon University, 2013. **Advisor:** Prof. Bruce H. Krogh.
- T1. **Akshay Rajhans**, “*Development of a Robust Testing Toolbox for Hybrid Systems*”, M.S. Thesis, Department of Electrical and Systems Engineering, University of Pennsylvania, 2007. **Advisor:** Prof. George J. Pappas.

Patents

- PP1. Burton Andrews, Diego Benitez, Badri Raghunathan and **Akshay Rajhans**, “*Method for Non-Intrusive Load Monitoring using a Hybrid System State Estimation Approach*”, U.S., European, and International Patent, 2012.

Journal Papers

- J5. Manuel Rodriguez, Xiangxue Zhao, Hayley Song, Anastasia Mavrommati, Roberto G. Valenti, **Akshay Rajhans**, Pieter J. Mosterman, Yancy Diaz-Mercado, and Hosam Fathy, “*A Gradient-Based Approach for Coordinating Smart Vehicles and Traffic Lights at Intersections*”, IEEE Control Systems Letters (L-CSS), Volume: 5, Issue: 6.
- J4. Frank Allgöwer, João Borges de Sousa, James Kapinski, Pieter Mosterman, Jens Oehlerking, Patrick Panciatici, Maria Prandini, **Akshay Rajhans**, Paulo Tabuada, Philipp Wenzelburger, “*Position Paper on the Challenges Posed by Modern Applications to Cyber-Physical Systems Theory*”, Nonlinear Analysis: Hybrid Systems, Volume 34, Pages 147-165.
- J3. **Akshay Rajhans**, Ajinkya Bhave, Ivan Ruchkin, Bruce H. Krogh, David Garlan, André Platzer and Bradley Schmerl, “*Supporting Heterogeneity in Cyber-Physical System Architectures*”, IEEE Transactions on Automatic Control, Special issue on Cyber-Physical Systems, Volume 59, Issue 12, Pages 3178-3193.
- J2. Matthias Althoff, **Akshay Rajhans**, Bruce H. Krogh, Soner Yaldiz, Xin Li and Larry Pileggi, “*Formal Verification of Phase-Locked Loops Using Reachability Analysis and Continuization*”, Communications of the ACM, Volume 56, Issue 10, Pages 97-104. **Research Highlight**.
- J1. **Akshay Rajhans**, Shang-Wen Cheng, Bradley Schmerl, David Garlan, Bruce H. Krogh, Clarence Agbi, and Ajinkya Bhave, “*An Architectural Approach to the Design and Analysis of Cyber-Physical Systems*”, Electronic Communications of the EASST, Volume 21, 2009.

Book Chapters

- B2. Pieter J. Mosterman, **Akshay Rajhans**, Anastasia Mavrommati, Roberto G. Valenti, “*Simulation of Hybrid Dynamic Systems*”, in John Baillieul, Tariq Samad, editors, Encyclopedia of Systems and Control, Springer, Living Edition. First online: August 2020.
- B1. Sebastian Castro, Pieter J. Mosterman, **Akshay Rajhans**, and Roberto G. Valenti, “*Challenges in the Operation and Design of Intelligent Cyber-Physical Systems*”, in Saurabh Mittal and Andreas Tolk, editors, Complexity

Peer Reviewed Conference and Workshop Papers.....

- C20. **Akshay Rajhans**, Anastasia Mavrommati, Pieter J. Mosterman, and Roberto G. Valenti, "*Specification and Runtime Verification of Temporal Assessments in Simulink*", 21st International Conference on Runtime Verification (RV) 2021.
- C19. Anastasia Mavrommati, Carlos Osario, Roberto G. Valenti, **Akshay Rajhans**, and Pieter J. Mosterman, "*An Application of Model Predictive Control to Reactive Motion Planning of Robot Manipulators*," 17th IEEE International Conference on Automation Science and Engineering (CASE) 2021.
- C18. Manuel Rodriguez, Xiangxue Zhao, Hayley Song, Anastasia Mavrommati, Roberto G. Valenti, **Akshay Rajhans**, Pieter J. Mosterman, Yancy Diaz-Mercado, and Hosam Fathy, "*A Gradient-Based Approach for Coordinating Smart Vehicles and Traffic Lights at Intersections*", American Control Conference (ACC) 2021.
- C17. Nikita Visnevski, Teresa Hubscher-Younger, **Akshay Rajhans**, and Baoluo Meng, "*Automatic Synthesis of Information Flow Driven Execution Managers for Embedded Software Applications*", AIAA/IEEE Digital Avionics Systems Conference (DASC) 2020. **Best in Session Award.**
- C16. Zhan Tu, Anastasios Dimas, Mehmet N. Kurt, Anastasia Mavrommati, Pieter J. Mosterman, **Akshay Rajhans**, and Roberto G. Valenti, "*A Simulator for trading traffic privileges by selfish driving cars*", Spring Simulation Conference, 2020.
- C15. Jean-Francois Kempf, Khoo Yit Phang, and **Akshay Rajhans**, "*Specification and Assessment of Temporal Requirements using Simulink Test*", Fourth International Workshop on Monitoring and Testing of Cyber-Physical Systems (MT-CPS 2019), part of CPS-IoT Week 2019.
- C14. Akshay Rajhans and Dan Lluch, "*A Digital Twin Approach to Online Monitoring in Industrial Internet of Things Applications*", Fourth International Workshop on Monitoring and Testing of Cyber-Physical Systems (MT-CPS 2019), part of CPS-IoT Week 2019.
- C13. Andreas Tolk, Fernando Barros, Andrea D'Ambrogio, **Akshay Rajhans**, Pieter J. Mosterman, Sachin S. Shetty, Mamadou K. Traoré, Hans Vangheluwe, and Levent Yilmaz, "*Hybrid Simulation for Cyber-Physical Systems—A Panel on Where we are Going Regarding Complexity, Intelligence, and Adaptability of CPS Using Simulation*", Spring Simulation Multi-Conference, 2018.
- C12. **Akshay Rajhans**, Srinath Avadhanula, Alongkrit Chutinan, Pieter J. Mosterman, and Fu Zhang, "*Graphical Hybrid Automata with Simulink and Stateflow*", 21st ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2018.
- C11. **Akshay Rajhans**, Srinath Avadhanula, Alongkrit Chutinan, Pieter J. Mosterman, and Fu Zhang, "*Graphical Modeling of Hybrid Dynamics with Simulink and Stateflow*", 21st ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2018. **Best Repeatability Evaluation Award Finalist.**
- C10. **Akshay Rajhans** and Pieter J. Mosterman, "*A Vision for Application-Focused International Collaboration Networks in Cyber-Physical Systems*", NSF Visioning Workshop for International Collaborations for Advancing CPS Research, Development, and Education Worldwide, part of CPS Week 2018.
- C9. Yi Deng, **Akshay Rajhans**, and A. Agung Julius, "*STRONG: A Trajectory-Based Verification Toolbox for Hybrid Systems*", 10th International Conference on Quantitative Evaluation of SysTems (QEST) 2013.
- C8. **Akshay Rajhans** and Bruce H. Krogh, "*Compositional Heterogeneous Abstraction*", 16th ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2013.

- C7. **Akshay Rajhans** and Bruce H. Krogh, “*Heterogeneous verification of cyber-physical systems using behavior relations*”, 15th ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2012.
- C6. **Akshay Rajhans**, Ajinkya Bhave, Sarah Loos, Bruce H. Krogh, André Platzer, and David Garlan, “*Using Parameters in Architectural Views to Support Heterogeneous Design and Verification*”, IEEE Conference on Decision and Control (CDC), 2011.
- C5. Matthias Althoff, **Akshay Rajhans**, Bruce H. Krogh, Soner Yaldiz, Xin Li, and Larry Pileggi, “*Formal Verification of Phase-Locked Loops Using Reachability Analysis and Continuization*”, IEEE/ACM International Conference on Computer-Aided Design (ICCAD), 2011. **William J. McCalla Best Paper Award.**
- C4. Matthias Althoff, **Akshay Rajhans**, Bruce H. Krogh, Soner Yaldiz, Xin Li, Larry Pileggi, “*Using Continuization in Reachability Analysis for the Verification of a Phase-Locked Loop*”, Frontiers in Analog Circuit (FAC) Synthesis and Verification, co-located with Computer-Aided Verification (CAV) 2011.
- C3. Ajinkya Bhave, David Garlan, Bruce H. Krogh, Sarah Loos, André Platzer, **Akshay Rajhans**, Bradley Schmerl, “*Multi-View Consistency in Architectures for Cyber-Physical Systems*”, Safe and Secure Systems & Software Symposium (S5) 2011.
- C2. Ajinkya Bhave, David Garlan, Bruce H. Krogh, **Akshay Rajhans**, and Bradley Schmerl, “*Augmenting Software Architectures with Physical Components*”, Embedded Real Time Software and Systems Conference (ERTS²), 2010.
- C1. Alexandre Donzé, Bruce H. Krogh, and **Akshay Rajhans**, “*Parameter Synthesis for Hybrid Systems with an Application to Simulink Models*”, 12th International Conference on Hybrid Systems: Computation and Control (HSCC) 2009.

Student Advising and Teaching

Ph.D. Thesis Committee

- o Yi Deng, ECSE Department at Rensselaer Polytechnic Institute. **Advisor:** Prof. A. Agung Julius. **Thesis Title:** “*The Application of Trajectory-Based Analysis for Hybrid Systems.*” Defended July 2015.

Student Competitions

- o (2017) **MathWorks Technical Lead**, *CAT Vehicle Challenge*, an autonomous vehicle student research competition: simulation rounds hosted online in the Cyber-Physical Systems Virtual Organization (CPS-VO) Portal, along with the final round held on an actual autonomous vehicle (CAT Vehicle) at the University of Arizona, **Instructor:** Prof. Jonathan Sprinkle.
- o (2017, 2016) **Judge**, *CPS V&V Grand Prix*, Formal Methods Research Course Competition for 15-424/15-624/15-824: Foundations of Cyber-Physical Systems, Carnegie Mellon University, **Instructor:** Prof. André Platzer.

Teaching Assistant

- o **18-474: Embedded Control Systems**, ECE Department, Carnegie Mellon University, Spring 2011, Spring 2010.
- o **MATH 114: Calculus II**, Mathematics Department, University of Pennsylvania, Spring 2008, Fall 2007.
- o **ESE 210: Introduction to Dynamic Systems**, ESE Department, University of Pennsylvania, Spring 2007.
- o **ESE 301: Introduction to Probability**, ESE Department, University of Pennsylvania, Fall 2006.

STEM Outreach

- o (2021) **Panelist** on the topic of *STEM@Work: New England Innovation Day*, NE FIRST, March 2021.
- o (2009) **Laboratory Instructor**, *Summer Engineering Experience for Girls (SEE)*, a day-long summer camp for high-school students at Carnegie Mellon University, **Primary Instructor:** Prof. Bruno Sinopoli.

- (2002) **Instructor**, *Social Educational Activity*, organized by the IEEE Bombay Section Region 10 to create awareness amongst high-school students, **Topic:** *Mobile Communications*.