PARASARA SRIDHAR DUGGIRALA

Assistant Professor
Department of Computer Science
University of North Carolina at Chapel Hill
201 S. Columbia St. Room 362.
Chapel Hill, NC 27599-3175

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Last updated: December, 2023

RESEARCH INTERESTS

Design and Analysis of Cyber-Physical Systems; Autonomy; Hybrid Systems; Control Synthesis; Abstract Interpretation; Algorithmic Verification; Embedded & Real-Time Systems; Robotics; Probabilistic Automata; Decision Procedures on Reals.

EDUCATION

PhD, Computer Science: December 2015
Advisors: Prof. Mahesh Viswanathan & Prof. Sayan Mitra
University of Illinois at Urbana Champaign

Bachelor of Technology, Computer Science and Engineering: May 2009
Advisor: Prof. Hemangee Kapoor
Indian Institute Of Technology Guwahati

EMPLOYMENT

[**E.1**] Assistant Professor, Department of Computer Science , University of North Carolina at Chapel Hill, January 2019 - Present.

[**E.2**] Assistant Professor, Department of Computer Science and Engineering & UTC Institute of Advanced Systems Engineering, University of Connecticut, August 2015 - December 2018.

[**E.3**] Research Assistant, University of Illinois at Urbana Champaign, Computer Science Department, August 2013 - August 2015.

[**E.4**] Research Internship, SRI International, Computer Science Laboratory.
May 2012 - August 2012.

[**E.5**] Research Internship, NEC Labs, System Analysis and Verification Group.
May 2011 - August 2011.

[**E.6**] Research Internship, Verimag, Timed and Hybrid Systems Group, May 2008 - July 2008.

AWARDS

[**A.1**] Best Paper Award Nomination, IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA) 2022.

[**A.2**] UNC Team secured 2nd position in GRAIC, a racing competition for autonomous vehicles, conducted as a part of Cyber-Physical Systems Week (CPSWeek) 2022.

[**A.3**] **Amazon Research Award** - AWS Automated Reasoning, Spring 2021.

[**A.4**] UNC Team secured 1st position in GRAIC, a racing competition for autonomous vehicles, conducted as a part of Cyber-Physical Systems Week (CPSWeek) 2021.

[**A.5**] Received **UNC IDEA Grant** for building infrastructure to test and develop autonomous racing algorithms, October 2019.

[**A.6**] UNC Team secured 1st position in F1Tenth, a racing competition for autonomous vehicles, conducted as a part of Cyber-Physical Systems Week (CPSWeek) 2019.

[**A.7**] RacingHuskies secured **poll position 2nd** in F1Tenth, a racing competition for autonomous vehicles, conducted at Cyber-Physical Systems Week (CPSWeek) 2018.

[**A.8**] **Best Paper Award sponsored by Robert Bosch** at Applied Verification for Continuous and Hybrid Systems (ARCH) Workshop, 2017.

[**A.9**] **Provost's Academic Plan Mini Grant Award** at University of Connecticut for "Flipped classroom approach for teaching theoretical Computer Science", 2017.

[**A.10**] **Most promising benchmark result sponsored by Robert Bosch** at Applied Verification for Continuous and Hybrid Systems (ARCH) Workshop @ CPSWeek, 2015.

[**A.11**] **Selected as a Young researcher** in Computer Science to attend **Second Heidelberg Laureate Forum**, 2014.

[**A.12**] **Feng Chen memorial award in Software Engineering** by Department of Computer Science, University of Illinois at Urbana Champaign, 2014.

[**A.13**] **Best Paper Award** at ACM SIGBED International Conference on Embedded Software (EMSOFT), 2013.

[**A.14**] **Awarded special position** in Regional Mathematics Olympiad conducted by All India Association of Mathematics Teachers for novelty in problem solving, 2004.

STUDENTS' AWARDS

[**S.1**] Undergraduate student Pranav Kallem is a **finalist in Morehead-Cain Fellowship**.

[**S.2**] Graduate student Bineet Ghosh receives **Best Presentation Award** in ACM SIGBED Student Research Competition, 2022.

[**S.3**] Grduate student Bineet Ghosh has been awarded **Chateaubraind Fellowship** from Embassy of France in the United States for the year 2021.

[**S.4**] Undergraduate student Charlotte Dorn is selected as **SIGBED Scholar** by ACM SIGBED for the year 2020-2021.

[**S.5**] Graduate student Manish Goyal receives **John Lof Leadership Academy Fellowship** from University of Connecticut School of Engineering in 2018.

[**S.6**] Graduate student Manish Goyal receives **UTC-IASE Graduate Fellowship** by UTC Institute for Advanced Systems Engineering in 2018.

[**S.7**] Graduate student Manish Goyal receives **SREB Travel Grant** from Institute on Teaching and Mentoring in 2017.

CURRENT FUNDING

NSF POSE 2303564, $ 1,500,000.00, *POSE: Phase II: An Open-Source Ecosystem for Scenic*, PI: Sanjit Seshia, Co-PI: Daniel Fremont, Necmiye Ozay, **Parasara Sridhar Duggirala**, 09/15/2023 - 08/31/2025.

AFOSR $ 450,000.00, *Neurosymbolic Techniques for Testing Autonomous Systems*, PI: **Parasara Sridhar Duggirala**, 04/01/2023 - 03/31/2026.

AFRL Wright Brothers Institute, $ 30,000.00, Sub-Contract, *Introduction to Program Verification*, PI: **Parasara Sridhar Duggirala**, 07/01/2022 - 08/01/2023.

NSF CNS 2038960, $1,199,995.00, *CPS: Medium: GOALI: Design Automation for Automotive Cyber-Physical Systems*, PI: Samarjit Chakraborty, Co-PI: James Anderson, Frank Smith, **Parasara Sridhar Duggirala**, Soheil Samii, 01/01/2020 - 12/31/2023.

PAST FUNDING

Amazon Research Award, $ 50,000.00, *Model Checking for Counterexamples*, PI: **Parasara Sridhar Duggirala**, 09/07/2021 - 09/06/2022.

NSF CNS 1739936, $497,372.00, *CPS: Small: Numerical and Symbolic Techniques for Verification and Synthesis of Cyber-Physical Systems*, PI: **Parasara Sridhar Duggirala**, 9/15/2017 - 8/31/2020, Effort: 8.33%.

AFOSR $540,000.00, *Enhanced Testing of Autonomous Systems using Formal Methods*, PI: **Parasara Sridhar Duggirala**, Co-PI: Stanley Bak (Safe Sky Analytics LLC), 08/1/2019 - 07/31/2022.

UNC Idea Grant $20,000.00, *A Testbed for Certification of Autonomous Vehicles*, PI: **Parasara Sridhar Duggirala**, 09/01/2019 - 06/01/2021.

United Technologies, $64,798, *Testing Based Validation and Verification Methods for Complex Cyber-Phyiscal Systems*, PI: **Parasara Sridhar Duggirala**, 01/05/2018 - 12/31/2018, Effort: 8.33%.

United Technologies, $96,922, *Testing Based Validation and Verification Methods for Complex Cyber-Phyiscal Systems*, PI: **Parasara Sridhar Duggirala**, 01/01/2017 - 12/31/2017, Effort: 8.33%.

Provost's Academic Plan Mini Grant at University of Connecticut, $4.5K, *Flipped classroom approach for teaching theoretical Computer Science*, PI: **Parasara Sridhar Duggirala**, 05/15/2017 - 05/29/2017, Effort: 3.84%.

Bibliography

REFERRED
JOURNAL
PUBLICATIONS

[J07] *M. Goyal*, M. Dewaskar, **P. S. Duggirala**, "NExG: Provable and Guided State Space Exploration of Neural Network Control Systems using Sensitivity Approximation", *IEEE Transactions on Computer Aided Design (TCAD), Special Issue for International Conference on Embedded Software (EMSOFT)*, October 2022.

[J06] C. Hobbs, *B. Ghosh*, S. Xu, **P. S. Duggirala**, S. Chakraborty, "Safety Analysis of Embedded Controllers under Implementation Platform Timing Uncertainties", *IEEE Transactions on Computer Aided Design (TCAD), Special Issue for International Conference on Embedded Software (EMSOFT)*, October 2022.

[J05] *M. Goyal*, **P. S. Duggirala**, "Extracting counterexamples induced by safety violation in linear hybrid systems" *Automatica*, July 2020.

[J04] *B. Ghosh*, **P. S. Duggirala**, "Robust Reachable Set: Accounting for Uncertainties in Linear Dynamical Systems" *ACM Transactions on Embedded Computing Systems (TECS), Special Issue for International Conference on Embedded Software (EMSOFT)*, October 2019.

[J03] **P. S. Duggirala**, S. Bak, "Aggregation Strategies in Reachable Set Computation of Hybrid Systems" *ACM Transactions on Embedded Computing Systems (TECS), Special Issue for International Conference on Embedded Software (EMSOFT)*, October 2019.

[J02] P. Prabhakar, **P. S. Duggirala**, S. Mitra, M. Viswanathan, "Hybrid Automata Based CEGAR for Rectangular Hybrid Systems" *Formal Methods in Systems Design (FMSD)*, 2015.

[J01] S. Das, **P. S. Duggirala**, H. Kapoor, "A Formal Framework for Interfacing Mixed-Timing Systems" *Integration, the VLSI journal*, June 2013.

REFERRED
CONFERENCE
PUBLICATIONS

[C38] S. Xu, *B. Ghosh*, C. Hobbs, E. Fraccaroli, **P. S. Duggirala**, S. Chakraborty, "Statistical Approach to Efficient and Deterministic Schedule Synthesis for Cyber-Physical Systems", *International Symposium on Automated Technology for Verification and Analysis (ATVA)*, October 2023.

[C37] *B. Ghosh*, C. Hobbs, S. Xu, **P. S. Duggirala**, J. Anderson, P. S. Thiagarajan, S. Chakraborty, "Statistical Hypothesis Testing of Controller Implementations Under Timing Uncertainties", *IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA)*, August 2022.
Nominated for Best Paper Award.

[C36] *A. Karimi*, **P. S. Duggirala**, "Automatic Generation of Test-cases of Increasing Complexity for Autonomous Vehicles at Intersections", *ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)*, May 2022.

[C35] S. Sheikhi, *E. Kim*, **P. S. Duggirala**, S. Bak, "Coverage-Guided Fuzz Testing for Cyber-Physical Systems", *ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)*, May 2022.

[C34] L. Geretti, J. A. D. Sandretto, M. Althoff, L. Benet, A. Chapoutot, P. Collins, **P. S. Duggirala**, M. Forets, *E. Kim*, U. Linares, D. P. Sanders, C. Schilling, M. Wetzlinger, "ARCH-COMP21 Category Report: Continuous and Hybrid Systems with Nonlinear Dynamics" *Applied Verification for Continuous and Hybrid Systems, Part of IFAC Conference on Analysis and Design of Hybrid Systems (ARCH@ADHS)*, December 2021.

[C33] *B. Ghosh*, S. Chinchalli, **P. S. Duggirala**, "Interpretable Trade-offs Between Robot Task Accuracy and Compute Efficiency", *IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS)*, September 2021.

[C32] *E. Kim*, S. Bak, **P. S. Duggirala**, "Automatic Dynamic Parallelotope Bundles for Reachability Analysis of Nonlinear Systems", *International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS)*, August 2021.

[C31] S. Bak, S. Bogomolov, **P. S. Duggirala**, A. Gerlach, K. Potomkin, "Reachability of Black-Box Nonlinear Systems using Koopman Operator Linearization". *IFAC Conference on Analysis*

and Design of Hybrid Systems (ADHS), July 2021.

[C30] C. Hobbs, D. Roy, **P. S. Duggirala**, F. D. Smith, J. H. Anderson, S. Chakraborty, "Perception Computing-Aware Controller Synthesis for Autonomous Systems" *Design, Automation and Test in Europe (DATE)*, February 2021.

[C29] *M. Goyal*, **P. S. Duggirala**, "NeuralExplorer: State Space Exploration of Closed Loop Control Systems Using Neural Networks" *International Symposium on Automated Technology for Verification and Analysis (ATVA)*, October 2020.

[C28] *E. Kim*, **P. S. Duggirala**, "Kaa: A Python Implementation of Reachable Set Computation Using Bernstein Polynomials" *Applied Verification for Continuous and Hybrid Systems, Part of IFAC World Congress (ARCH Workshop)*, July 2020.

[C27] *M. Goyal*, D. Bergman, **P. S. Duggirala**, "Generating Longest Counterexample: On the Cross-roads of Mixed Integer Linear Programming and SMT" *American Control Conference (ACC)*, July 2020.

[C26] *M. Goyal*, **P. S. Duggirala**, "NeuralExplorer: State Space Exploration of Closed Loop Control Systems Using Neural Networks (Extended Abstract)" *Second Learning for Dynamics and Control Conference (L4DC)*, June 2020.

[C25] *A. Karimi*, **P. S. Duggirala**, "Formalizing traffic rules for uncontrolled intersections" *ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS)*, April 2020.

[C24] *Q. Jin*, **P. S. Duggirala**, "Re-thinking LiDAR-Stereo Fusion Frameworks" *AAAI Student Abstract*, January 2020.

[C23] *J. Homburg*, **P. S. Duggirala**, "Incremental Minimization of Symbolic Automata" *International Conference on Verified Software. Theories, Tools, and Experiments (VSTTE)*, July 2019.

[C22] **P. S. Duggirala**, D. Sheehy, "When Can We Treat Trajectories as Points?" *Canadian Conference on Computational Geometry (CCCG)*, August 2018.

[C21] *M. Goyal*, **P. S. Duggirala**, "On Generating A Variety of Unsafe Counterexamples for Linear Dynamical Systems" *IFAC Conference on Analysis and Design of Hybrid Systems (ADHS)*, July 2018.

[C20] S. Bak, **P. S. Duggirala**, "Simulation-Equivalent Reachability of Large Linear Systems with Inputs" *International Conference on Computer Aided Verification (CAV)*, July 2017.

[C19] S. Bak, **P. S. Duggirala**, "Rigorous Simulation-Based Analysis of Linear Hybrid Systems" *Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, April 2017.

[C18] S. Bak, **P. S. Duggirala**, "Direct Verification of Linear Systems with over 10000 Dimensions" *Applied Verification for Continuous and Hybrid Systems (ARCH Workshop at CPSWeek)* April 2017.
Best Paper Award sponsored by Robert Bosch.

[C17] S. Bak, **P. S. Duggirala**, "HyLAA: A Tool for Computing Simulation-Equivalent Reachability for Linear Systems" *ACM International Conference on Hybrid Systems: Computation and Control (HSCC)*, April 2017.

[C16] **P. S. Duggirala**, C. Fan, M. Potok, B. Qi, S. Mitra, M. Viswanathan, S. Bak, S. Bogomolov, T. T. Johnson, L. V. Nguyen, C. Schilling, A. Sogokon, H. Tran, W. Xiang, " Tutorial: Software tools for hybrid systems verification, transformation, and synthesis: C2E2, HyST, and TuLiP" *IEEE Conference on Control and Applications (CCA)*, September 2016.

[C15] C. Fan, B. Qi, S. Mitra, M. Viswanathan, **P. S. Duggirala**, "Automatic Reachability Analysis for Nonlinear Hybrid Models With C2E2" *International Conference on Computer Aided Verification (CAV)*, July 2016.

[C14] **P. S. Duggirala**, M. Viswanathan, "Parsimonious, Simulation Based Verification of Linear Systems" *International Conference on Computer Aided Verification (CAV)*, July 2016.

[C13] **P. S. Duggirala**, M. Viswanathan, "Analyzing Real Time Linear Control Systems Using

Software Verification" *IEEE Real-Time Systems Symposium (RTSS)*, December 2015.

[C12] **P. S. Duggirala**, C. Fan, S. Mitra, M. Viswanathan, "Meeting a Powertrain Verification Challenge" *International Conference on Computer Aided Verification (CAV)*, July 2015.

[C11] C. Fan, **P. S. Duggirala**, S. Mitra, M. Viswanathan, "Progress on Powertrain Verification Challenge with C2E2" *Applied Verification for Continuous and Hybrid Systems (ARCH Workshop at CPSWeek)* April 2015.
Most Promising Benchmark Result sponsored by Robert Bosch.

[C10] **P. S. Duggirala**, S. Mitra, M. Viswanathan, M. Potok, "C2E2: A Verification Tool For Stateflow Models" *Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, April 2015.

[C09] **P. S. Duggirala**, L. Wang, S. Mitra, M. Viswanathan, C. Muñoz "Temporal Precedence Checking for Switched Models and its Application to a Parallel Landing Protocol" *International Symposium on Formal Methods (FM)*, May 2014.

[C08] **P. S. Duggirala**, S. Mitra, M. Viswanathan, "Verification of Annotated Models From Executions" *ACM SIGBED International Conference on Embedded Software (EMSOFT)*, October 2013.

[C07] **P. S. Duggirala**, A. Tiwari, "Safety Verification for Linear Systems" *International Conference on Embedded Software (EMSOFT)*, October 2013.
Best Paper Award.

[C06] P. Prabhakar, **P. S. Duggirala**, S. Mitra, M. Viswanathan, "Hybrid Automata Based CEGAR for Rectangular Hybrid Systems" *Verification Model Checking and Abstract Interpretation (VMCAI)*, January 2013.

[C05] **P. S. Duggirala**, T. T. Johnson, A. Zimmerman, S. Mitra, "Static and Dynamic Analysis of Timed Distributed Traces" *IEEE Real-Time Systems Symposium (RTSS)*, December 2012.

[C04] K. Ghorbal, **P. S. Duggirala**, F. Ivancic, V. Kahlon, A. Gupta, "Efficient Probabilistic Model Checking of Systems with Ranged Probabilities" *Reachability Problems (RP)*, September 2012.

[C03] **P. S. Duggirala**, S. Mitra, "Lyapunov Abstractions for Inevitability of Hybrid Systems" *ACM International Conference on Hybrid Systems Computation and Control (HSCC)*, April 2012.

[C02] **P. S. Duggirala**, S. Mitra, "Abstraction Refinement for Stability" *International Conference on Cyber-Physical Systems (ICCPS)*, April 2011.

[C01] **P. S. Duggirala**, S. Mitra, R. Kumar and D. Glazeski, "On The Theory Of Stochastic Processors" *Qualitative Estimation of SysTems (QEST) Conference*, September 2010.

OTHER PUBLICATIONS

[W.1] *M. Stuart*, J. Garcia, S. Olut, T. Hasan, A. Mahmood, *K. Williams*, **P. S. Duggirala**, "A Machine Learning Approach to Water Velocity Estimation for Better Navigation of Marine Gliders" *OCEANS Conference and Exposition*, September 2021.

[W.2] *M. Stuart*, **P. S. Duggirala**, "Comparison of Two Approaches for Robustness Verication of Deep Neural Networks" *Workshop on Design and Analysis of Robust Systems (DARS), collocated with International Conference on Computer Aided Verification (CAV)* July 2019.

[W.3] *M. Goyal*, **P. S. Duggirala**, "Learning Robustness of Nonlinear Systems Using Neural Networks" *Workshop on Design and Analysis of Robust Systems (DARS), collocated with International Conference on Computer Aided Verification (CAV)* July 2019.

[W.4] S. Bak, **P. S. Duggirala**, "HyLAA 2.0: A Verification Tool for Linear Hybrid Automaton Models of Cyber-Physical Systems" *Tool Demonstrations at IEEE Real-Time Systems Symposium (Demo@RTSS)* December 2018.

PATENTS *Probabilistic Model Checking of Systems with Ranged Probabilities* - **P. S. Duggirala**, K. Ghorbal, F. Ivancic, V. Kahlon, A. Gupta. US Patent Number: 8799194.

SOFTWARES ○ **Kaa:** A tool for computing reachable set of nonlinear systems using parallelotope bundles, Bernstein polynomials, and global optimization. Developed by Edward Kim.

Website: `https://github.com/Tarheel-Formal-Methods/kaa`.

○ **NeuralExplorer:** A tool for state-space exploration and counter-example generation for closed loop control systems using Neural Networks. Developed by Manish Goyal.
Website: `https://github.com/manishgcs/NeuralExplorer`

○ **HyLAA:** A tool for verification of linear dynamical and hybrid systems by exploiting the superposition principle of linear dynamics using generalized stars. Also implements new techniques such as constraint propagation and aggregation techniques. Developed in collaboration with Dr. Stanley Bak of Air Force Research Laboratory.
Website: `http://stanleybak.com/hylaa/`

○ **C2E2:** A tool for safety verification of annotated Stateflow models from sample simulations. The tool is used in Universities and Research Labs such as University of Texas at Arlington, Michigan State University, Air Force Research Laboratory, and NASA.
Website: `http://publish.illinois.edu/c2e2-tool/`

○ **HARE:** A tool for performing Counterexample Guided Abstraction Refinement on Rectangular Hybrid Automata, built on top of model checker HyTech.
Website: `http://publish.illinois.edu/hare-tool/`

Teaching Record and Students Advised

Teaching
Record

COMP 455: Formal Models of Languages and Computation.
Fall 2023 - Department of Computer Science.
98 Students at University of North Carolina at Chapel Hill.

COMP 455: Formal Models of Languages and Computation.
Fall 2022 - Department of Computer Science.
48 Students at University of North Carolina at Chapel Hill.

COMP 089-84 FYS: Computing All Around Us.
Fall 2022 - Department of Computer Science.
24 Students at University of North Carolina at Chapel Hill.

COMP 455: Formal Models of Languages and Computation.
Spring 2022 - Department of Computer Science.
41 Students at University of North Carolina at Chapel Hill.

COMP 590-144: Program Verification and Synthesis.
Fall 2021 - Department of Computer Science.
12 Students at University of North Carolina at Chapel Hill.

COMP 790-144: Safe Autonomy.
Spring 2021 - Department of Computer Science.

COMP 590-144: Program Verification and Synthesis.
Fall 2020 - Department of Computer Science.
11 Students at University of North Carolina at Chapel Hill.

COMP 790-144: Safe Autonomy.
Fall 2019 - Department of Computer Science.
14 Students at University of North Carolina at Chapel Hill.

COMP 790-144: Introduction to Formal Methods.
Spring 2019 - Department of Computer Science.
15 Students at University of North Carolina at Chapel Hill.

CSE 4100: Programming Language Translation.
Fall 2018 - Department of Computer Science & Engineering.
28 Students at University of Connecticut.

SE 5302: Introduction to Formal Methods.
Fall 2018 - UTC Institute for Advanced Systems Engineering.
12 Students at University of Connecticut.

CSE 3502: Theory of Computation.
Spring 2018 - Department of Computer Science & Engineering.
40 Students at University of Connecticut.

SE 5303: Design Flows for Embedded Systems.
Fall 2017 - UTC Institute for Advanced Systems Engineering.
9 Students at University of Connecticut.

CSE 3502: Theory of Computation.
Spring 2017 - Department of Computer Science & Engineering.
58 Students at University of Connecticut.

SE 5301: Modeling Abstractions for Systems Engineering.
Spring 2017 - UTC Institute for Advanced Systems Engineering.
5 Students at University of Connecticut.

SE 5302: Introduction to Formal Methods.
Fall 2016 - UTC Institute for Advanced Systems Engineering.
7 Students at University of Connecticut.

CSE 5095: Intro. to Formal Meth. and Verif. of Cyber-Physical Systems.
Spring 2016 - Department of Computer Science & Engineering.
29 Students at University of Connecticut.

CSE 3502: Theory of Computation.
Fall 2015 - Department of Computer Science & Engineering.
66 Students at University of Connecticut.

STUDENT ADVISING

Doctoral Student Advising.

Spring 2017 - Summer 2022: Manish Goyal, Department of Computer Science
Research: *Behavioral Validation in Cyber-Physical Systems: Safety a Data Driven Techniques for Validation and Verification of Cyber-Physical Systems.*

Fall 2017 - Summer 2023: Bineet Ghosh, Department of Computer Science
Research: *Design and Verification of Autonomous Systems in Presence of Uncertainties.*

Spring 2017 - Present: Abolfazal Karimi, Department of Computer Science
Research: *End-to-End Verification of Autonomous Vehicular Systems.*

Fall 2019 - Present: Meghan Stuart, Department of Computer Science
Research: *Explainable and Interpretable Artificial Intelligence.*

Master Student Advising.

Fall 2019 - Spring 2022: Edward Kim, Department of Computer Science
Research: *Automatic Dynamic Parallelotope Bundles for Reachability of Nonlinear Systems*

Fall 2019: Qilin Jin, BS-MS in Computer Science.
Project: *Sensor Fusion for Autonomous Vehicles.*

Doctoral Dissertation Committees.

Kaki Ryan, University of North Carolina at Chapel Hill - Spring 2025 (Expected).

Swarandeep Saha, University of North Carolina at Chapel Hill - Fall 2024 (Expected).

Shareef Ahmed, University of North Carolina at Chapel Hill - Fall 2024 (Expected).

Kedrian James, University of North Carolina at Chapel Hill - Fall 2024 (Expected).
Dissertation Title: *Towards a Framework for Improving Crash Triaging and Patch Verification.*

Peter Hase, University of North Carolina at Chapel Hill - Spring 2024 (Expected).

Sergiy Voronov, University of North Carolina at Chapel Hill - Summer 2023.
Dissertation Title: *Scheduling Real-Time Graph-based Workloads.*

Sims Osborne, University of North Carolina at Chapel Hill - Summer 2023.
Dissertation Title: *Using Simultaneous Multithreading to Support Real-Time Scheduling.*

Yubo Luo, University of North Carolina at Chapel Hill - Summer 2023.
Dissertation Title: *Scaling up Task Execution on Resource-Constrained Systems.*

Alyssa Byrnes, University of North Carolina at Chapel Hill - Spring 2023.
Dissertation Title: *Formal Frameworks to Analyze Human-Robot Interaction.*

Lisa Bauer, University of North Carolina at Chapel Hill - Spring 2022.
Dissertation Title: *Analyzing and Improving Commonsense Tasks with Knowledge Augmentation.*

Mengyu Fu, University of North Carolina at Chapel Hill - Spring 2022.
Dissertation Title: *Efficient Motion and Inspection Planning For Medical Robots with Theoretical Guarantees.*

Anwica Kashfeen, University of North Carolina at Chapel Hill - Spring 2022.
Dissertation Title: *Identifying and Characterizing Repeated Regions in Genome.*

Coby Wang, University of North Carolina at Chapel Hill - Fall 2021.
Dissertation Title: *Federated Detection Against Cross-Site Credential Vulnerabilities and Attacks.*

Tanya Amert, University of North Carolina at Chapel Hill - Summer 2021.
Dissertation Title: *Enabling Real-Time Certification of Autonomous Driving Applications.*

Bashima Islam, University of North Carolina at Chapel Hill - Spring 2021.
Dissertation Title: *Scheduling Tasks on Intermittently-Powered Real-Time Systems.*

Ming Yang, University of North Carolina at Chapel Hill - Summer 2020.
Dissertation Title: *Sharing GPUs for Real-Time Autonomous-Driving Systems.*

Alan Kuntz, University of North Carolina at Chapel Hill - Fall 2019.
Dissertation Title: *Integrating Optimization and Sampling for Robot Motion Planning with Applications in Healthcare.*

Nicholas Cavanna, University of Connecticut - Fall 2019.
Dissertation Title: *Methods in Homology Inference.*

Undergraduate Advising at University of North Carolina at Chapel Hill.

Spring 2023: Pranav Kallem, Anoush Mudaliar, Undergraduate in Computer Science.
Project: *Algorithms for F1Tenth Autonomous Racing.*

Fall 2021: Han Gao, Undergraduate in Computer Science.
Project: *NSF CPS 2021 Challenge* and *Reinforcement Learning Algorithms for Drone Racing.*
TarHeels Racing secured 2nd position at GRAIC, an autonomous vehicle racing competition at CPS Week 2022.

Fall 2020: Michael Alcorn, Undergraduate in Computer Science.
Project: *Algorithms for Autonomous Racing.*

Spring 2020: Kipp Williams, Undergraduate in Computer Science.
Project: *Prediction and Control of Autonomous Underwater Vehicles.*

Spring 2019: Charlotte Dorn, Undergraduate in Computer Science.
Project: *Building and Operating Swarms of Autonomous Vehicles.*
Winner of ACM SIGBED Fellowship to attend CPSWeek/ESWeek Conference (only three undergraduates secured this award).

Undergraduate Advising at University of Connecticut.

Spring 2018: Mengying Yu, Undergraduate in Computer Science and Mathematics.
Independent study: *Applying Machine Learning Techniques on Real-Life Data Sets*.

Fall 2017 - Spring 2018: Jonathan Homburg, Undergraduate in Computer Science and Mathematics.
Honors Thesis Project: *Incremental Minimization of Symbolic Automata*.
Honors thesis is published as a paper at VSTTE 2019.

Fall 2016 - Spring 2018: Renukanandan Tumu, Undergraduate in Computer Science.
Project: *Primary developer for F1Tenth Racing Car*.
Currently a graduate student at University of Pennsylvania.

Fall 2015: Ellizabeth Pellieter, Undergraduate in Computer Science.
Theory of Computation Honors Project: *Modeling Computing Machines in Maude*.

High School Student Mentoring at University of North Carolina at Chapel Hill.

Summer 2021: Pracheeti Shikarkhane, Senior High School Student at North Carolina School of Science and Mathematics.
Project: *Study of Perception Algorithms for Autonomous Vehicles*.

Summer 2021: Kendal Wen, Senior High School Student at North Carolina School of Science and Mathematics.
Project: *Classification Algorithms for Handwriting Recognition*.

Fall 2020 - Spring 2021: Gabriel Hart, Senior High School Student at North Carolina School of Science and Mathematics.
Project: *Sampling Based Motion Planning in Presence of Dynamic Obstacles*.

SERVICE **Programme Committee Member.**

ICCPS 2024: International Conference on Cyber-Physical Systems - also Publicity Chair for USA.

ASP-DAC 2023: Asia and South Pacific Design Automation Conference.

RTAS 2023: IEEE Real-Time and Embedded Technology and Applications Symposium.

ICRA 2023: IEEE International Conference on Robotics and Automation - Associate Editor.

CAV 2022: International Conference on Computer Aided Verification.

RTAS 2022: IEEE Real-Time and Embedded Technology and Applications Symposium.

ICRA 2022: IEEE International Conference on Robotics and Automation - Associate Editor.

EMSOFT 2021: International Conference on Embedded Software.

JSys: Journal of Systems Research, Real-Time Systems and Cyber-Physical Systems Area.

LCTES 2021: Languages, Tools, and Compilers for Embedded Systems.

EMSOFT 2020: International Conference on Embedded Software.

LCTES 2020: Languages, Tools, and Compilers for Embedded Systems.

TACAS 2019: Tools and Algorithms for Construction and Analysis of Systems.

SNR 2016: Intl. Workshop on Symbolic and Numerical Methods for Reachability Analysis.

SNR 2016: Intl. Workshop on Symbolic and Numerical Methods for Reachability Analysis.

ICCPS-WIP 2016: ACM-IEEE Intl. Conf. on Cyber-Physical Systems (Work in Progress).

Proposal Reviewer for NSF: 2016; 2020; 2022.

Program Chair: 13th International Workshop on Numerical Software Verification - NSV (collocated with International Conference on Computer Aided Verification) 20202.

Technical Advisor for Rational CyPhy Inc.
January 2016 — Present.

External reviewer.
Nonlinear Analysis Hybrid Systems, Formal Methods in System Design, IEEE Transactions on Cyber-Physical Systems (TCPS), ACM Transactions on Embedded Systems (TECS), Journal on Information and Computation, CAV'17, Constraints'16, RTSS'16, ICALP'16, ICCPS-WiP'16, SNR'16, LCTES'15, CONCUR'15, ATVA'15, NFM'15, IEEE Transactions on Networking'14, FSTTCS'14, NFM'14, QEST'14, VSTTE'14, MEMOCODE'13, SSS'13, CAV'13, SSS'12, ICDCN'12, TACAS'12, ATVA'12, CAV'12, NFM'11, HSCC'11.

OTHER
DETAILS

Languages: English (fluent), Hindi (fluent), Telugu (native).