

PARASARA SRIDHAR DUGGIRALA

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Last updated: May, 2017

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

EDUCATION *PhD, Computer Science*: August 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

- AWARDS**
- [A.1] **Best Paper Award sponsored by Robert Bosch** at Applied Verification for Continuous and Hybrid Systems (ARCH) Workshop, 2017.
 - [A.2] **Provost's Academic Plan Mini Grant Award** at University of Connecticut for "Flipped classroom approach for teaching theoretical Computer Science", 2017.
 - [A.3] **Most promising benchmark result sponsored by Robert Bosch** at Applied Verification for Continuous and Hybrid Systems (ARCH) Workshop @ CPSWeek, 2015.
 - [A.4] **Selected as a Young researcher** in Computer Science to attend **Second Heidelberg Laureate Forum**, 2014.
 - [A.5] **Feng Chen memorial award in Software Engineering** by Department of Computer Science, University of Illinois at Urbana Champaign, 2014.
 - [A.6] **Best Paper Award** at ACM SIGBED International Conference on Embedded Software (EMSOFT), 2013.
 - [A.7] **Awarded special position** in Regional Mathematics Olympiad conducted by All India Association of Mathematics Teachers for novelty in problem solving, 2004.

- EMPLOYMENT**
- [E.1] Assistant Professor, Department of Computer Science and Engineering & UTC Institute of Advanced Systems Engineering, University of Connecticut, Fall 2015 - Present.
 - [E.2] Research Internship, SRI International, Computer Science Laboratory, Summer 2012.
 - [E.3] Research Internship, NEC Labs, System Analysis and Verification Group, Summer 2011.
 - [E.4] Teaching Assistant, University of Illinois at Urbana Champaign, Computer Science Department, Fall 2012.
 - [E.5] Research Assistant, University of Illinois at Urbana Champaign, Computer Science Department, Fall 2009 - Fall 2015.
 - [E.6] Research Internship, Verimag, Timed and Hybrid Systems Group, Summer 2008.

FUNDING Academic Planning, University of Connecticut., *Bayesian Design of Tests for Fault Detection and Identification in Complex Systems*, \$250K, 2016. PIs: George Bollas (lead PI), Ming-Hui Chen, **Parasara Sridhar Duggirala**, and Krishna Pattipati.

CHASE (Center for Hardware Assurance and Security Engineering sponsored by Honeywell, Comcast, and MDA), *Securing Embedded Systems With Verified Memory Access Implementations*, \$65K, 2017. PIs: **Parasara Sridhar Duggirala** (lead PI), Marten van Dijk, John Chandy.

United Technologies Research Center, *Testing Based Validation and Verification Methods for Complex Cyber-Physical Systems*, \$97K, 2017. PI: **Parasara Sridhar Duggirala**.

Provost's Academic Plan Mini Grant, *Flipped classroom approach for teaching theoretical Computer Science*, \$4.5K, 2017, PI: **Parasara Sridhar Duggirala**.

JOURNAL PUBLICATIONS [J.1] P. Prabhakar, **P. S. Duggirala**, S. Mitra, M. Viswanathan, "Hybrid Automata Based CEGAR for Rectangular Hybrid Systems" *Formal Methods in Systems Design (FMSD)* 2015.

[J.2] S. Das, **P. S. Duggirala**, H. Kapoor, "A Formal Framework for Interfacing Mixed-Timing Systems" *Integration, the VLSI journal*, June 2013.

CONFERENCE PUBLICATIONS [C.1] S. Bak, **P. S. Duggirala**, "Simulation-Equivalent Reachability of Large Linear Systems with Inputs" *International Conference on Computer Aided Verification (CAV)* July 2017.

(Peer-reviewed) [C.2] 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.

[C.3] 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.

[C.4] **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 Multi-Conference on Systems and Control (CCA)* September 2016.

[C.5] 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.

[C.6] **P. S. Duggirala**, M. Viswanathan, "Parsimonious, Simulation Based Verification of Linear Systems" *International Conference on Computer Aided Verification (CAV)* July 2016.

[C.7] **P. S. Duggirala**, M. Viswanathan, "Analyzing Real Time Linear Control Systems Using Software Verification" *IEEE Real-Time Systems Symposium (RTSS)* December 2015.

[C.8] **P. S. Duggirala**, C. Fan, S. Mitra, M. Viswanathan, "Meeting a Powertrain Verification Challenge" *International Conference on Computer Aided Verification (CAV)* July 2015.

[C.9] **P. S. Duggirala**, S. Mitra, M. Viswanathan, M. Potok, "C2E2: A Verification Tool For State-flow Models" *Tools and Algorithms for the Construction and Analysis of Systems (TACAS)* April 2015.

[C.10] **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.

[C.11] **P. S. Duggirala**, S. Mitra, M. Viswanathan, "Verification of Annotated Models From Executions" *ACM SIGBED International Conference on Embedded Software (EMSOFT)* October 2013.

[C.12] **P. S. Duggirala**, A. Tiwari, "Safety Verification for Linear Systems" *International Conference on Embedded Software (EMSOFT)* October 2013.
Best Paper Award.

- [C.13] 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.
- [C.14] **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.
- [C.15] 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.
- [C.16] **P. S. Duggirala**, S. Mitra, “Lyapunov Abstractions for Inevitability of Hybrid Systems” *ACM International Conference on Hybrid Systems Computation and Control (HSCC)*, April 2012.
- [C.17] **P. S. Duggirala**, S. Mitra, “Abstraction Refinement for Stability” *International Conference on Cyber-Physical Systems (ICCPS)*, April 2011.
- [C.18] **P. S. Duggirala**, S. Mitra, R. Kumar and D. Glazeski, “On The Theory Of Stochastic Processors” *Qualitative Estimation of SysTems (QEST)* Conference, September 2010.

- WORKSHOP PUBLICATIONS
- [W.1] 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.
 - [W.2] 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.

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

- TALKS
- [T.1] **Formal Methods and Security: An Introduction**
Center for Hardware Assurance, Security, and Engineering Workshop, May 2017.
 - [T.2] **Efficient Dynamic Analysis Based Verification of Large Linear Systems**
Cyber-Physical Systems Verification & Validation: Industrial Challenges & Foundations, Carnegie Mellon University, May 2017.
 - [T.3] **Rigorous Simulation-Based Analysis of Linear Hybrid Systems**
Tools and Algorithms for Construction and Analysis of Systems (TACAS), April 2017.
 - [T.4] **Role of Formal Verification in Certification of Autonomous Vehicles**
Northeast Autonomous Vehicle Summit, March 2017.
 - [T.5] **Data-Driven Techniques for Design Analysis of Cyber-Physical Systems**
BECAT Seminar Series on Big Data, March 2017.
 - [T.6] **Dynamic Analysis of Linear Systems**
Symbolic and Numerical Techniques for Cyber-Physical Systems Verification, Dagstuhl seminar, December 2016.
 - [T.7] **Scalable Dynamic Analysis Techniques for Cyber-Physical Systems Verification**
Computer Science Department Colloquium, Worcester Polytechnic Institute, November 2016.
 - [T.8] **Parsimonious, Simulation Based Verification of Linear Systems**
International Conference on Computer Aided Verification (CAV), July 2016.
 - [T.9] **Formal Proofs For Embedded Systems Safety and Security**
CHASE Conference on Secure/Trustworthy Systems and Supply Chain Assurance, June 2016.
 - [T.10] **Logic And Program Verification**
University of Connecticut Logic Seminar, April 2016.
 - [T.11] **A Roadmap for End-To-End Verification of Embedded Control Systems**
Rice University, December 2015.
 - [T.12] **Analyzing Real Time Linear Control Systems Using Software Verification**
IEEE Real-Time Systems Symposium (RTSS), December 2015.

- [T.13] **Meeting a Powertrain Verification Challenge**
International Conference on Computer Aided Verification (CAV), July 2015.
- [T.14] **Dynamic Analysis of Cyber-Physical Systems**
 - United Technologies Research Center, March 2016.
 - Indian Institute of Technology Hyderabad, January 2016.
 - Indian Institute of Technology Guwahati, December 2015.
 - Massachusetts Institute of Technology, October 2015.
 - PRECISE seminar, University of Pennsylvania, May 2015.
 - ExCAPE webminar, April 2015.
 - Department of Computer Science and Engineering, University of Connecticut, April 2015.
- [T.15] **C2E2: A Verification Tool For Stateflow Models**
Tools and Algorithms for Construction and Analysis of Systems (TACAS), April 2015.
- [T.16] **Simulations to Proofs in C2E2**
CPS Verification & Validation: Industrial Challenges & Foundations,
Carnegie Mellon University, December 2014.
- [T.17] **Temporal Precedence Checking for Switched Models and its Application to a Parallel Landing Protocol**
International Symposium on Formal Methods (FM), May 2014.
- [T.18] **Dynamic Analysis of Cyber-Physical Systems**
Midwest Verification Day, University of Illinois at Chicago, September 2013.
- [T.19] **Static and Dynamic Analysis of Timed Distributed Traces**
Formal Methods Seminar, University of Illinois at Urbana Champaign, November 2012.
- [T.20] **Introduction to Counterexample Guided Abstraction Refinement (CEGAR)**
SRI International, Menlo Park, July 2012.
- [T.21] **Lyapunov Abstractions for Inevitability of Hybrid Systems**
SRI International, Menlo Park, June 2012.
- [T.22] **Abstractions for Verification of Cyber-Physical Systems**
60th CSL Anniversary Symposium, October 2011.
- [T.23] **Abstraction Refinement for Stability**
International Conference on Cyber-Physical Systems (ICCPS), April 2011.
- [T.24] **Stochastic Processors: Design, Analysis and Challenges**
6th Annual CSL Student Conference, January 2011.
- [T.25] **Automatic Attack Input Generation for Firefox Extensions**
NEC Labs America, Princeton, NJ, January 2011.
- [T.26] **On The Theory Of Stochastic Processors**
Quantitative Evaluation of SysTems(QEST) Conference, September 2010.

- SOFTWARES
- **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 *CSE 3502: Theory of Computation.*
Spring 2017 - Department of Computer Science & Engineering.
University of Connecticut.
SE5301: Modeling Abstractions for Systems Engineering.
Spring 2017 - UTC Institute for Advanced Systems Engineering.
University of Connecticut.
SE5302: Introduction to Formal Methods.
Fall 2016 - UTC Institute for Advanced Systems Engineering.
University of Connecticut.
CSE 5905: Intro. to Formal Meth. and Verif. of Cyber-Physical Systems.
Spring 2016 - Department of Computer Science & Engineering.
University of Connecticut.
CSE3502: Theory of Computation.
Fall 2015 - Department of Computer Science & Engineering.
University of Connecticut.

STUDENT MENTORING **Doctoral Student Advising at University of Connecticut.**
Fall 2016 - Present: Abdullah Baihan, Department of Computer Science and Engineering
Research: *Efficient Security Implementations for Internet-of-Things Systems.*
Spring 2017 - Present: Manish Goyal, Department of Computer Science and Engineering
Research: *Data Driven Techniques for Validation and Verification of Cyber-Physical Systems.*
Spring 2017 - Present: Abolfazal Karimi, Department of Mathematics
Research: *End-to-End Verification of Autonomous Vehicular Systems.*

Undergraduate Advising at University of Illinois Urbana Champaign.

Summer 2015: Bolun Qi, Undergraduate in Computer Engineering.
Project: *Performance Improvements C2E2 Front End.*
Resulted in publication at CAV 2016.
Summer 2014: Matthew Potok, Undergraduate in Computer Engineering.
Project: *Enhancing Usability of C2E2.*
Resulted in publication at TACAS 2015.
Spring 2014: Le Wang, Undergraduate in Computer Engineering.
Project: *Verification of Parallel Aircraft Landing Protocol (ALAS) using C2E2.*
Resulted in a publication at FM 2014.
Spring 2014: Yi Lu: Undergraduate in Computer Engineering.
Project: *Modeling and Analysis of Nonlinear Biological Systems.*

SERVICE **Programme Committee Member.**

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).

Technical Advisor for Rational CyPhy Inc.

January 2016 — Present.

External reviewer.

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.

Graduate student selection committee.

Department of Computer Science, University of Illinois at Urbana-Champaign, Spring 2015.

Graduate Mentor for new Graduate Students.

Department of Computer Science, University of Illinois at Urbana-Champaign, 2012-2014.

Graduate Student Ambassador.

Department of Computer Science, University of Illinois at Urbana-Champaign, Spring 2013.

PERSONAL • Nationality : Indian; Work authorization in US.

DETAILS • Sex: Male

• Languages: Telugu (Native), English, Hindi.