

# Sayan Mitra

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- CURRENT APPOINTMENTS
- ◇ **Professor** (2018-present)  
Department of Electrical and Computer Engineering  
University of Illinois at Urbana-Champaign.
  - ◇ **Affiliate Professor** (2018-present)  
Department of Computer Science  
University of Illinois at Urbana-Champaign.
  - ◇ **Associate Director** (2018-present)  
Center for Autonomy  
University of Illinois at Urbana-Champaign.
  - ◇ **Research Professor** (2018-present)  
Coordinated Science Laboratory and Information Trust Institute  
University of Illinois at Urbana-Champaign.
- PAST ACADEMIC APPOINTMENTS
- ◇ **Associate Professor** (2014-2018)  
Department of Electrical and Computer Engineering  
University of Illinois at Urbana-Champaign.
  - ◇ **Affiliate Associate Professor** (2014-2018)  
Department of Computer Science  
University of Illinois at Urbana-Champaign.
  - ◇ **Assistant Professor** (2008-2014)  
Department of Electrical and Computer Engineering  
University of Illinois at Urbana-Champaign.
  - ◇ **Visiting Faculty** (July 2013)  
Department of Computer Science, Oxford University, UK.
  - ◇ **Visiting Faculty Fellow** (May- July 2011)  
Air-Force Research Laboratory  
Kirtland Air-Force Base, Albuquerque, New Mexico.
  - ◇ **Postdoctoral Fellow.** (2007-2008)  
Center for Mathematics of Information  
California Institute of Technology.
- EDUCATION
- ◇ **Massachusetts Institute of Technology**, Cambridge, USA.  
PhD in Computer Science, September 2007.  
Thesis: *A verification framework for ordinary and probabilistic hybrid systems*  
Advisor: Professor Nancy Lynch
  - ◇ **Indian Institute of Science**, Bangalore, India.  
MSc in Computer Science and Automation, 2001.
  - ◇ **Jadavpur University**, Kolkata, India.  
BE in Electrical Engineering, 1999.

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 AWARDS AND  
 FELLOWSHIPS

- ◇ Graduate advisee Hussein Sibai wins gold prize at ACM SIGBED Student Research Competition for his work on symmetry abstractions, May 21, 2021.
- ◇ Graduate advisee Chuchu Fan's dissertation is nominated for the ACM Dissertation Award from Illinois, 2020. The thesis won the CSL Dissertation award.
- ◇ Siebel Energy Institute Seed Grant for "Formal Tools for Safety Critical Power Grid Infrastructures and Cyber-physical Systems." with Chuchu Fan, 2019.
- ◇ Dean's Award for Excellence in Research, University of Illinois, 2018.
- ◇ RiSE fellowship from Austrian Society for Rigorous Systems Engineering, 2015.
- ◇ Robert Bosch Sponsored Best Result Award for the paper: "Progress on Powertrain Verification Challenge with C2E2" in ARCH Workshop of CPSWeek 2015.
- ◇ IEEE-Eta Kappa Nu's C. Holmes MacDonald Outstanding Electrical and Computer Engineering Teacher Award (2013).
- ◇ Samsung Global Research Outreach (GRO) award for the project "A Debugger for Mobile-Cloud Applications" (2012).
- ◇ Best Paper Award at 32nd Intl. Conf. FORTE/FMOODS 2012. for the paper "A Small Model Theorem for Rectangular Hybrid Networks" with Taylor Johnson (2012).
- ◇ Air-Force Office of Scientific Research (AFOSR) Young Investigator Research Award for the project "Verification Engines for Hybrid Networks" (2012).
- ◇ Air-Force Summer Faculty Fellowship Award (2011).
- ◇ National Science Foundation's Faculty Early Career (CAREER) Development Award for the project "Algorithms and Verification for Reliable Distributed Cyber-Physical Systems" (2011).
- ◇ Center for Mathematics of Information Fellowship awarded by California Institute of Technology (2007).
- ◇ Barindra Memorial Medal, Subodh K. Basu Medal, Sandeep Tandon Memorial Prize awarded by Jadavpur University (1999).

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 TEACHING AND  
 CURRICULUM  
 DEVELOPMENT

- ◇ Spring 2019, Spring and Fall 2020 ECE/CS598 Principles of Safe Autonomy. *New course developed and co-taught with Katherine Driggs-Campbell.*
- ◇ Spring 2016, Fall 2012, Fall2014 ECE/CS584 Embedded System Verification. *New course developed in 2009; now a permanent course in the ECE curriculum.*
- ◇ Spring 2013-2021 ECE 220 Introduction to Computing
- ◇ Spring 2012 ECE428/CS425 Distributed Systems
- ◇ Fall 2011 ECE190 Introduction to Computing Systems
- ◇ Fall 2010 ECE190 Introduction to Computing Systems
- ◇ Spring 2010 ECE598 Modeling and Verification of Embedded Computing Systems
- ◇ Fall 2009 ECE190 Introduction to Computing Systems
- ◇ Spring 2009 ECE428/CS425 Distributed Systems
- ◇ Fall 2008 ECE598 Modelling and Verification of Real-time and Hybrid Systems
- ◇ Spring 2008 Lecture series on *Deductive Verification*, part of CS141: *Distributed Systems Laboratory (CalTech)*.

SOFTWARE

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1. **GRAIC: Autonomous Racing Software Framework.**  
Minghao Jiang, Zexiang Liu, Kristina Miller, Dawei Sun, Arnab Datta, Yixuan Jia, Necmiye Ozay, and Sayan Mitra. First version released in Feb 2021. Available from: <https://popgri.github.io/Race/>
2. **FACTEST: Fast Controller Synthesis.**  
Primary contributors: Chuchu Fan, Kristina Miller, and Sayan Mitra. First version released in 2020. Available from: <https://kmmille.github.io/FACTEST/>
3. **DryVR: Combining models and data for robust verification of autonomous and cyberphysical systems.**  
Primary contributors: Bolun Qi, Chuchu Fan, Sayan Mitra, and Mahesh Viswanathan. First version released in 2017. Available from: <https://github.com/qibolun/DryVR>
4. **C2E2: A complete verification tool for stateflow/nonlinear hybrid automata.**  
Primary contributors: Parasara Sridhar Duggirala, Chuchu Fan, Matthew Potok, Bolun Qi, Sayan Mitra, Mahesh Viswanathan, . First version released in 2014. Available from: <http://publish.illinois.edu/c2e2-tool/>
5. **StarL: A Programming Platform for Distributed Robotics.**  
Primary contributors: Yixiao Lin, Ritwika Ghosh, Adam Zimmerman, and Sayan Mitra. First version released in 2014. Available from: <https://github.com/lin187/StarL1.5/>
6. **Passel: A verification tool for parameterized networks of hybrid automata.**  
Taylor Johnson and Sayan Mitra. First version released in 2014. Available from: <https://publish.illinois.edu/passel-tool/>
7. **HARE: Hybrid Abstraction Refinement Engine.**  
Parasara Sridhar Duggirala, Sayan Mitra, Mahesh Viswanathan. Released in 2013. Available from: <http://publish.illinois.edu/hare-tool/>

PUBLICATIONS

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The (\*) indicates that the author was a graduate student supervised by Sayan Mitra at the time of the publication of the article.

- BOOKS AND BOOK CHAPTERS
1. **Verifying cyberphysical systems: A path to safe autonomy.**  
Sayan Mitra. *MIT Press*, February 2021.
  2. **Data-driven safety verification of complex cyber-physical systems.**  
Chuchu Fan\* and Sayan Mitra. In *Design Automation for Cyber-Physical Systems*, editors, Mohammad Abdullah Al Faruque and Arquimedes Canedo, pages 107-143, Springer, 2019.
- JOURNAL ARTICLES
1. **Controller synthesis for linear system with reach-avoid specifications.** Chuchu Fan, Zengyi Qin, Umang Mathur, Qiang Ning, Sayan Mitra, and Mahesh Viswanathan. Accepted for publication in *IEEE Transactions in Automatic Control (TAC)*, 2021.
  2. **Koord: a language for programming and verifying distributed robotics applications.** Ritwika Ghosh, Chiao Hsieh, Sasa Misailovic, and Sayan Mitra. In *ACM Proceedings on Programming Languages (OOPSLA)*, volume 4, 2020.
  3. **Entropy and minimal bit rates for state estimation and model detection.**  
Daniel Liberzon and Sayan Mitra. In *IEEE Transactions on Automatic Control (TAC)*, 63(10): 3330-3344, 2018.
  4. **Data-driven formal reasoning and their applications in safety analysis of vehicle autonomy features.**  
Chuchu Fan\*, Bolun Qi\*, and Sayan Mitra. *IEEE Design & Test*, 31—38, January, 2018.

5. **Simulation-Driven Reachability Using Matrix Measures.**  
Chuchu Fan\*, James Kapinski, Xiaoqing Jin, and Sayan Mitra. *ACM Trans. Embedded Computing Systems*. 17(1): 21:1–21:28, 2018.
6. **Differential privacy and entropy in distributed feedback systems: Minimizing mechanisms and performance trade-offs.**  
Zhenqi Huang\*, Yu Wang, Sayan Mitra, and Geir Dullerud. *In IEEE Transactions on Control of Network Systems*, 4(1): 118–130, 2017.
7. **Bounded invariant verification for time-delayed nonlinear networked dynamical systems.**  
Zhenqi Huang\*, Chuchu Fan\*, and Sayan Mitra. *In IFAC Journal on Nonlinear Analysis: Hybrid Systems (NAHS)*, Vol. 23, pages 211–229, February 2017, Elsevier.
8. **Simulation-based verification of cardiac pacemakers with guaranteed coverage.**  
Zhenqi Huang\*, Chuchu Fan\*, Alexandru Mereacre, Sayan Mitra and Marta Z. Kwiatkowska. *IEEE Design & Test*, volume 32(5), pages 27–34, 2015.
9. **Safe and stabilizing distributed multi-path cellular flows.**  
Taylor T. Johnson\* and Sayan Mitra. *Theoretical Computer Science (TCS)*, volume 579, pages 9–32, May 2015. Elsevier.
10. **Hybrid automata-based CEGAR for rectangular hybrid systems.**  
Pavithra Prabhakar, Parasara Sridhar Duggirala\*, Sayan Mitra, and Mahesh Viswanathan. *Formal Methods in Systems Design (FMSD)*, volume 42(2), pages 105–134, April 2015, Springer.
11. **Verifying cyber-physical interactions in safety-critical systems.**  
Sayan Mitra, Tichakorn Wongpiromsarn, and Richard Murray. *Special Issue of IEEE Security & Privacy on Safety-Critical Systems*, June 2013.
12. **Safe flocking in spite of actuator faults using directional failure detectors.**  
Taylor T. Johnson\* and Sayan Mitra. *In the Journal of Nonlinear Systems and Applications (JNSA)*, Volume 2, Number 1–2, 2011, Watam Press.
13. **Verification of periodically controlled hybrid systems: Application to an autonomous vehicle.**  
Tichakorn Wongpiromsarn, Sayan Mitra, Richard Murray, and Andy Lamperski. *In Special Issue of ACM Transactions on Embedded Computing Systems*, 11(S2): 53, 2012.
14. **Verification of distributed systems with local-global predicates.**  
K. Mani Chandy, Brian Go, Sayan Mitra, Concetta Pilotto, and Jerome White. *In the Journal of Formal Aspects of Computing*, 23(5), pages 1–31, Springer-London, September, 2010.
15. **Self-stabilizing robot formations over unreliable networks.**  
Seth Gilbert, Nancy Lynch, Sayan Mitra, and Tina Nolte. *In Special Issue on Self-Adaptive and Self-Organising Wireless Networking Systems of ACM Transactions on Autonomous and Adaptive Systems (TAAS)*, 4(3), July 2009.
16. **Verifying average dwell time of hybrid systems.**  
Sayan Mitra, Daniel Liberzon and Nancy Lynch. *ACM Transaction in Embedded Computing Systems (TECS)*, 8(1),1–37, December 2008.
17. **Specifying and proving properties of timed I/O automata in the TIOA toolkit.**  
Myla Archer, Hongping Lim, Nancy Lynch, Sayan Mitra, and Shinya Umeno. *In Special issue of the Journal on Design Automation for Embedded Systems*, volume 2, numbers 1–2, June 2008, Springer 2008.
18. **Proving approximate implementations for probabilistic I/O automata.**  
Sayan Mitra and Nancy Lynch. *Electronic Notes in Theoretical Computer Science*, 174(8):71–93, June 2007.
19. **PVS strategies for proving abstraction properties of automata.**  
Sayan Mitra and Myla Archer. *Electronic Notes in Theoretical Computer Science*, 125(2):45–65, 2005.

20. **Specification language design for hybrid systems.**  
Sayan Mitra and L. M. Patnaik. *Computational Mathematics, Modeling and Algorithms*, edited by J. C. Misra. Alpha Science Int'l, January 2003.

- PEER-REVIEWED  
CONFERENCE  
PUBLICATIONS
1. **Planning in dynamic and partially unknown environments.**  
Kristina Miller\*, Chuchu Fan, and Sayan Mitra In *Proceedings of 7th IFAC Conference on Analysis and Design of Hybrid Systems (ADHS'21)*, July 7-9, 2021.
  2. **Fast and guaranteed safe controller synthesis for aerial vehicle models.**  
Chuchu Fan, Kristina Miller\*, and Sayan Mitra. AIAA Scitech, 2021.
  3. **Online monitoring for safe pedestrian-vehicle interactions.**  
Peter Du, Zhe Huang, Tianqi Liu\*, Ke Xu, Qichao Gao, Hussein Sibai\*, Katherine Driggs-Campbell, and Sayan Mitra. In *Proceedings of 23rd IEEE Intl. Conf. on Intelligent Transportation Systems*, Virtual conference, 2020.
  4. **CyPhyHouse: A programming, simulation, and deployment toolchain for heterogeneous distributed coordination.**  
Ritwika Ghosh\*, Joao P. Jansch-Porto, Chiao Hsieh\*, Amelia Gosse, Minghao Jiang\*, Hebron Taylor, Peter Du, Sayan Mitra, Geir Dullerud. In *Proceedings of Intl. Conf. on Robotics and Automation (ICRA 2020)*, Paris, 2020.
  5. **Fast and guaranteed safe controller synthesis.**  
Chuchu Fan, Kristina Miller\*, and Sayan Mitra. In *Proceedings of 32nd Intl. Conf. on Computer Aided Verification (CAV 2020)*, Los Angeles, LNCS 12224, pages 629–652, Springer, 2020.
  6. **Multi-agent safety verification using symmetry transformations.**  
Hussein Sibai\*, Navid Mokhlesi\*, Chuchu Fan, and Sayan Mitra. In *Proceedings of 26th Intl. Conf. on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2020)*, pages 173–190, Dublin, Ireland, Springer 2020.
  7. **Using symmetry transformations in equivariant dynamical systems for their safety verification.**  
Hussein Sibai\*, Navid Mokhlesi\*, and Sayan Mitra. In *Proceedings of 17th Automated Technology for Verification and Analysis (ATVA 2019)*, Taipei, Taiwan. LNCS vol 11781, pages 98–114, Springer 2019. **Nominated for best paper award.**
  8. **Dione: A protocol verification system built with Dafny for I/O automata**  
Chiao Hsieh\* and Sayan Mitra. In *Proceedings of Integrated Formal Methods (iFM 2019)*, Bergen, Norway. LNCS vol 11918, pages 227–245, Springer, 2019.
  9. **Controller synthesis made real: Reach-avoid specifications and linear dynamics.**  
Chuchu Fan\*, Umang Mathur, Sayan Mitra, and Mahesh Viswanathan. In *Proceedings of Computer Aided Verification (CAV 2018)*, Oxford, Springer.
  10. **Approximate partial order reduction.**  
Chuchu Fan\*, Zhenqi Huang, and Sayan Mitra. In *Proceedings of Formal Methods (FM 2018)*, 588–607, Oxford.
  11. **Verifying nonlinear analog and mixed-signal circuits with inputs.**  
Chuchu Fan\*, Yu Meng\*, Jürgen Maier, Ezio Bartocci, Sayan Mitra, Ulrich Schmid. In *Proceedings of IFAC Conference on Analysis and Design of Hybrid Systems*, 241–246, 2018.
  12. **State Estimation of Dynamical Systems with Unknown Inputs: Entropy and Bit Rates.**  
Hussein Sibai\* and Sayan Mitra. In *Hybrid Systems: Computation and Control (HSCC 2018)*, pages 217–226, April 2018, Porto, Portugal.
  13. **Algorithmic Attack Synthesis Using Hybrid Dynamics of Power Grid Critical Infrastructures.**  
Zhenqi Huang, Sriharsha Etigowni, Luis Garcia, Sayan Mitra, Saman A. Zonouz. In *Proceedings of DSN*, 151–162, 2018.
  14. **SDCworks: a formal framework for software defined control of smart manufacturing systems.**  
Matthew Potok, Chien-Ying Chen, Sayan Mitra, and Sibin Mohan. In *Proceedings of Intl. Conference on Cyber-Physical Systems (ICCPs)*, 88–97, 2018.

15. **DryVR: Data-driven verification and compositional reasoning for automotive systems.**  
Chuchu Fan, Bolun Qi, Sayan Mitra, and Mahesh Viswanathan. In Proceedings of *Computer Aided Verification (CAV)*, Heidelberg, 2017.
16. **Optimal data rate for state estimation of switched nonlinear systems.**  
Hussein Sibaie and Sayan Mitra. In the Proceedings of the 20th ACM *Hybrid Systems: Computation and Control*, Pages 71–80, Pittsburgh, PA, April 2017. **Nominated for best paper award.**
17. **Locally optimal reach set over-approximation for nonlinear systems.**  
Chuchu Fan\*, James Kapinski, Xiaoqing Jin, and Sayan Mitra. In the Proceedings of *ACM SIGBED Conference on Embedded Software (EMSOFT)* 2016, Pittsburgh, PA. **Nominated for best paper award.**
18. **Automatic reachability analysis for nonlinear hybrid models with C2E2.**  
Chuchu Fan\*, Bolun Qi\*, Sayan Mitra, Mahesh Viswanathan, and Parasara Sridhar Duggirala\*. In the Proceedings of *28th International Conference on Computer Aided Verification (CAV)*, LNCS 9779, Pages 531–538, Toronto, Springer 2016.
19. **Entropy and minimal data rates for state estimation and model detection.**  
Daniel Liberzon and Sayan Mitra. In *Hybrid System: Computation and Control (HSCC 2016)*, Pages 247–256, Vienna, Austria.
20. **Entropy notions for state estimation and model detection with finite-data-rate measurements.**  
Daniel Liberzon and Sayan Mitra. In the Proceedings of *55th IEEE Conference on Decision and Control (CDC)*, pages 7335–7340, December 2016, Las Vegas, NV.
21. **Differential privacy in control and network systems.**  
J. Cortés, G. E. Dullerud, S. Han, J. Le Ny, S. Mitra, and G. J. Pappas. In the Proceedings of *55th IEEE Conference on Decision and Control (CDC)*, pages 4252–4272, December 2016, Las Vegas, NV.
22. **Controller synthesis for linear time-varying systems with adversaries.**  
Zhenqi Huang\*, Yu Wang, Sayan Mitra, and Geir Dullerud. In the Proceedings of the *55th IEEE Conference on Decision and Control (CDC 2016)*, Osaka, Japan, 2015.
23. **Bounded verification with on-the-fly discrepancy computation.**  
Chuchu Fan\* and Sayan Mitra. In the proceedings of *13th International Symposium on Automated Technology for Verification and Analysis (ATVA 2015)*, Shanghai, China.
24. **Model checking tap withdrawal in C. elegans.**  
Md. Ariful Islam, Richard DeFrancisco, Chuchu Fan\*, Radu Grosu, Sayan Mitra and Scott Smolka. In the proceedings of the *Fourth International Workshop on Hybrid Systems and Biology*, Madrid, Spain 2015.
25. **Meeting a powertrain verification challenge.**  
Parasara Sridhar Duggirala\* and Chuchu Fan\* and Sayan Mitra and Mahesh Viswanathan. In the proceedings of *Computer Aided Verification – 27th International Conference (CAV 2015)*, LNCS 9206, pages 536–543. San Francisco, July 18–24, 2015.
26. **StarL: Towards a unified framework for programming, simulating and verifying distributed robotic systems.** Yixiao Lin\* and Sayan Mitra. In the Proceedings of the 16th ACM *SIGPLAN/SIGBED Conference on Languages, Compilers and Tools for Embedded Systems, (LCTES 2015)*, Pages 1–10. Portland, OR, USA, June.
27. **C2E2: A verification tool for annotated stateflow models.**  
Parasara Sridhar Duggirala\*, Sayan Mitra, Mahesh Viswanathan, and Matthew Potok. In the Proceedings of the *21st International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS)*, April 2015.
28. **A Strategy for automatic verification of stabilization of distributed algorithms.**  
Ritwika Ghosh\* and Sayan Mitra. In the *Proceedings of 35th IFIP WG 6.1 International Conference on Formal Techniques for Distributed Objects, Components, and Systems (FORTE*

- 2015), Grenoble, France, June 2–4. LNCS 9039, pages 35–49, Springer 2015. **Nominated for best paper award.**
29. **Differentially private distributed optimization.** Zhenqi Huang\*, Sayan Mitra, and Nitin Vaidya. In the proceedings of the *International Conference on Distributed Computing and Networks (ICDCN)*, January 2015. (Acceptance: 21%)
  30. **Entropy-minimizing mechanism for differential privacy of discrete-time linear feedback systems.** Yu Wang, Zhenqi Huang\*, Sayan Mitra, and Geir Dullerud. In the proceedings of the *Conference on Decision and Control (CDC)*, December 2014.
  31. **Invariant verification of nonlinear hybrid automata networks of cardiac cells.** Zhenqi Huang\*, Chuchu Fan\*, Alexandru Mereacre, Sayan Mitra, and Marta Kwiatkowska. In the proceedings of the *Computer-Aided Verification (CAV 2014)*, July 2014, Held as Part of the Vienna Summer of Logic, VSL 2014. Springer.
  32. **Synthesis and verification of motor-transmission shift controller for electric vehicles.** Hongxu Chen and Sayan Mitra. In the proceedings of the *International Conference on Cyber-physical Systems (ICCPSS 2014)*, April 2014.
  33. **Anonymized reachability of hybrid automata networks.** Taylor T. Johnson\* and Sayan Mitra. In the proceedings of *12th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS 2014)*. LNCS 8711, pages 130–145, Springer.
  34. **Temporal precedence checking for switched models and its application to a parallel landing protocol.** Parasara Sridhar Duggirala\*, Le Wang\*, Sayan Mitra, Mahesh Viswanathan, César Muñoz. In the proceedings of *19th International Symposium on Formal Methods (FM 2014)*, LNCS 8442, pages 215–229, Springer.
  35. **Proofs from simulations and modular annotations.** Zhenqi Huang\* and Sayan Mitra. In the proceedings of the *Seventeenth International Conference on Hybrid Systems: Computation and Control (HSCC 2014)*. Martin Fränzle, John Lygeros editors, Pages 183–192, ACM press, April 2014. **Nominated for DENSO Best Student Paper Award.**
  36. **On the cost of differential privacy in distributed control systems.** Zhenqi Huang\*, Yu Wang, Sayan Mitra, and Geir Dullerud. In the proceedings of the *Third International Conference on High Confidence Networked Systems (HiCoNS 2014)*. Pages 105–114, ACM press.
  37. **Verification of annotated models from executions.** Parasara Sridhar Duggirala\*, Sayan Mitra, and Mahesh Viswanathan. In the Proceedings of the *International Conference on Embedded Software (EMSOFT 2013)*, Montreal, Canada, April 2013.
  38. **Hybrid automaton-based CEGAR for rectangular hybrid systems.** Pavithra Prabhakar, Parasara S. Duggirala\*, Sayan Mitra, and Mahesh Viswanathan. In the Proceedings of International Conference on Verification, Model Checking, and Abstract Interpretation (VMCAI), Rome, Italy 2013. (Acceptance: 30%)
  39. **Invariant synthesis for verification of parameterized cyber-physical systems with application to aerospace systems** Taylor T. Johnson\* and Sayan Mitra. In Proceedings of AIAA Infotech, 2013. Boston, MA.
  40. **Static and dynamic analysis of timed distributed traces.** Parasara Sridhar Duggirala\*, Taylor Johnson\*, Adam Zimmerman\*, and Sayan Mitra. In the Proceedings of *The 33rd IEEE Real-Time Systems Symposium (RTSS)*, 2012, IEEE press. (Acceptance: 23%)
  41. **Verifying satellite rendezvous and conjunction avoidance: A formal approach to autonomy in space.** Taylor Johnson\*, Jeremy Green\*, Sayan Mitra, Rachel Dudley, and R. Scott Erwin. In the

- proceedings of *International Conference on Formal Methods (FM) 2012*, Paris, France. (Acceptance: 22%)
42. **A small model theorem for rectangular hybrid automata networks.**  
Taylor Johnson\* and Sayan Mitra. In the Proceedings of *32nd IFIP International Conference on Formal Techniques for Distributed Systems: Formal Techniques for Networked and Distributed Systems (FORTE)*, Stockholm, Sweden, June 2012. LNCS Vol 7273, pages 18–34, Springer. (**Best Paper Award** selected out of 151 submissions in 3 conferences which were part of *7th International Federated Conference on Distributed Computing Techniques (DisCoTec 2012)*).
  43. **Parameterized verification of distributed cyber-physical systems: An aircraft landing protocol case study.**  
Taylor Johnson\* and Sayan Mitra. In the Proceedings of *International Conference on Cyber-Physical Systems (ICCPs 2012)*, pages 161 – 170, Beijing, PRC. April 2012. IEEE press. (Acceptance: 34%)
  44. **Lyapunov abstractions for verifying inevitability of hybrid systems.**  
Parasara S. Duggirala\* and Sayan Mitra. In the Proceedings of *15th International Conference on Hybrid Systems: Computation and Control (HSCC 2012)*, pages 115–124, Beijing, PRC. April 2012. ACM press.
  45. **Computing bounded reach sets from sampled simulation traces.**  
Zhenqi Huang\* and Sayan Mitra. (Tool paper) In the Proceedings of *15th International Conference on Hybrid Systems: Computation and Control (HSCC 2012)*, Beijing, PRC. April 2012.
  46. **Stability of linear systems with quantized and sampled interconnections.**  
Taylor Johnson\*, Sayan Mitra, and Cédric Langbort. In the Proceedings of *50th IEEE Conference on Decision and Control (CDC 2011)*, Orlando, FL, USA.
  47. **Abstraction refinement for stability.**  
Parasara S. Duggirala\* and Sayan Mitra. In the Proceedings of *ACM/IEEE 2nd International Conference on Cyber-physical systems (ICCPs 2011)*, Chicago, IL, April 2011. (Acceptance: 26%)
  48. **Sandboxing controllers for cyber-physical systems.**  
Stanley Bak, Karthik Manamcheri\*, Sayan Mitra, and Marco Caccamo. In the Proceedings of *ACM/IEEE 2nd International Conference on Cyber-physical systems (ICCPs 2011)*, Chicago, IL, April 2011. (Acceptance: 26%)
  49. **A step towards verification and synthesis from Simulink/Stateflow models.**  
Karthik Manamcheri\*, Sayan Mitra, Stanley Bak, and Marco Caccamo. In the Proceedings (as tool paper) of *14th International Conference on Hybrid Systems: Computation and Control (HSCC 2011)*, Chicago, IL, April 2011.
  50. **Computing bounded epsilon-reach set with finite precision computations for a class of linear hybrid automata.**  
Kyoung-Dae Kim, Sayan Mitra, and P. R. Kumar. In the Proceedings of *14th International Conference on Hybrid Systems: Computation and Control (HSCC 2011)*, Chicago, IL, April 2011.
  51. **Safe flocking in spite of actuator faults.**  
Taylor Johnson\* and Sayan Mitra. In the Proceedings of *12th International Symposium on Stabilization, Safety, and Security of Distributed Systems*. LNCS 6366, pages 588–602. New York. September 2010.
  52. **On the theory of Stochastic Processors.**  
Parasara Sridhar Duggirala\*, Sayan Mitra, Rakesh Kumar and Dean Glazeski. In Proceedings of *7th International Conference on Quantitative Evaluation of Systems (QEST) 2010*. LNCS, Williamsburg, VA, September 2010.
  53. **Safe and stabilizing distributed cellular flows.**  
Taylor Johnson\*, Sayan Mitra, and M. Karthikeyan. In Proceedings of *IEEE International Conference on Distributed Computing Systems (ICDCS 2010)*. Pages 577 – 586, Genova, Italy. IEEE press. (Acceptance: 15%)



54. **Bounded  $\epsilon$ -Reachability of linear hybrid automata with a deterministic and transversal discrete transition condition.**  
Kyoung-Dae Kim, Sayan Mitra, and P. R. Kumar. In Proceedings of the 49th *IEEE Conference on Decision and Control (CDC 2010)*, Atlanta, GA.
55. **Hybrid cyberphysical system verification with simplex using discrete abstractions.**  
Stanley Bak, Ashley Greer, and Sayan Mitra. In the Proceedings of *IEEE 16th Real-Time and Embedded Technology and Applications Symposium (RTAS 2010)*. **Nominated for best paper award.** (Acceptance: 22%)
56. **Stability of distributed algorithms in the face of incessant faults.**  
R. Lee DeVille and Sayan Mitra. In the Proceedings of *11th International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS'09)*, LNCS 5873, pages 224–237. Lyon, France. November 2009.
57. **On convergence of concurrent systems under regular interactions.**  
Pavithra Prabhakar, Sayan Mitra, and Mahesh Viswanathan. In the Proceedings of *20th International Conference on Concurrency Theory (CONCUR 2009)*. LNCS 5710, pages 527–541. Bologna, Italy, September, 2009. (Acceptance: 28%)
58. **Periodically controlled hybrid systems: Verifying A controller for an autonomous vehicle.**  
Tichakorn Wongpiromsarn, Sayan Mitra, Richard Murray and Andrew Lamperski. In the Proceedings of *12th International Conference on Hybrid Systems: Computation and Control (HSCC 2009)*, San Francisco, CA. LNCS 5469, pages 396–410, March 2009.
59. **Self-stabilizing mobile robot formations with virtual nodes.**  
Seth Gilbert, Nancy Lynch, Sayan Mitra, Tina Nolte. In the Proceedings of *10th International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS'08)*, Detroit, MI. LNCS 5340, pages 188–202. November 2008.
60. **Convergence verification: From shared memory to partially synchronous systems.**  
K. Mani Chandy, Sayan Mitra, and Concetta Pilotto. In Proceedings of *6th International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS'08)*, Saint Malo, France. LNCS 5215, pages 218–232, September 2008.
61. **A Formalized theory for Stability and Convergence of Automata in PVS.**  
Sayan Mitra and K. Mani Chandy. In Proceedings of *21st International Conference on Theorem Proving in High Order Logics (TPHOLs'08)*, Montreal, Canada. LNCS 5170, pages 230 – 245. August 2008.
62. **Trace-based semantics for probabilistic timed I/O automata.**  
Sayan Mitra and Nancy Lynch. Extended abstract in *Hybrid Systems: Computation and Control (HSCC'07)*, volume 4416 of LNCS, Springer 2007, April 2007.
63. **Learning Cycle-linear hybrid automata of excitable cell models.**  
Radu Grosu, Sayan Mitra, Pei Ye, Scott Smolka, Emilia Entcheva, and I.V. Ramakrishnan. In Proceedings of *Hybrid Systems: Computation and Control (HSCC'07)*, April 2007.
64. **Specifying and proving properties of Timed I/O Automata in the TIOA Toolkit.**  
Myla Archer, Hongping Lim, Nancy Lynch, Sayan Mitra, and Shinya Umeno. In Proceedings of *Fourth ACM-IEEE International Conference on Formal Methods and Models for Codesign (MEMOCODE'06)*. Napa, CA 2006. (Selected for special issue of *Journal on Design Automation of for Embedded Systems*.)
65. **Verifying Average Dwell time by solving optimization problems.**  
Sayan Mitra, Daniel Liberzon, and Nancy Lynch. In Ashish Tiwari and João P. Hespanha, editors, *Hybrid Systems: Computation and Control (HSCC'06)*, volume 3927 of LNCS, Santa Barbara, CA, March 2006.
66. **Translating Timed I/O Automata specifications for Theorem Proving in PVS.**  
Hongping Lim, Dilsun Kaynar, Nancy Lynch, and Sayan Mitra. In *Proceedings of Formal Modeling and Analysis of Timed Systems (FORMATS'05)*, volume 3829 of LNCS, Uppsala, Sweden, September 2005.

67. **Proving Atomicity: an assertional approach.**  
Gregory Chockler, Nancy Lynch, Sayan Mitra, and Joshua Tauber. In Pierre Fraigniaud, editor, *Proceedings of 19th International Symposium on Distributed Computing (DISC'05)*, volume 3724 of LNCS, pages 152 – 168, Cracow, Poland, September 2005. (Acceptance: 20%)
68. **Path Vector Face Routing: Geographic Routing with Local Face Information.**  
Ben Leong, Sayan Mitra and Barbara Liskov. In *Proceedings of 13th IEEE International Conference on Network Protocols (ICNP'05)*, Boston, Massachusetts, November 2005. (Acceptance: 17%)
69. **Motion Coordination using Virtual Nodes.**  
Nancy Lynch, Sayan Mitra, and Tina Nolte. In *Proceedings of 44th IEEE Conference on Decision and Control (CDC'05)*, Seville, Spain, December 2005. Full version available as *Technical Report MIT-LCS-TR-986*.
70. **Stability of Hybrid Automata with Average Dwell Time: an Invariant Approach.**  
Sayan Mitra and Daniel Liberzon. In *Proceedings of the 43rd IEEE Conference on Decision and Control*, Paradise Island, Bahamas, December 2004.
71. **Safety Verification of model Helicopter Controller using Hybrid Input/Output Automata.**  
Sayan Mitra, Yong Wang, Nancy Lynch, and Eric Feron. In *Hybrid System: Computation and Control (HSCC'03)*, volume 2623 of LNCS, Prague, Czech Republic, 2003. Full version available as *Technical report MIT-LCS-TR-880*.

PEER-REVIEWED  
WORKSHOP  
PUBLICATIONS &  
TUTORIALS

1. **Egocentric abstractions for verification of distributed cyber-physical systems.**  
Sung Woo Jeon and Sayan Mitra. To appear in *IEEE Workshop on the Internet of Safe Things (SafeThings'21)* co-located with Oakland.
2. **HIOA-CPS: Combining hybrid input/output automaton and game theory for security modeling of cyber-physical systems.**  
Mustafa Abdallah, Sayan Mitra, Shreyas Sundaram and Saurabh Bagchi. To appear in *IEEE Workshop on the Internet of Safe Things (SafeThings'21)* co-located with Oakland.
3. **Continuous integration and testing for autonomous racing software: An experience report from GRAIC.**  
Minghao Jiang, Kristina Miller, Dawei Sun, Zexiang Liu, Yixuan Jia, Arnab Datta, Necmiye Ozay, and Sayan Mitra. Presented at *ICRA 2021 Workshop on Opportunities and Challenges in Autonomous Racing*, May 2021.
4. **Optimistic optimization for statistical model checking with regret bounds.**  
Negin Musavi, Dawei Sun, Sayan Mitra, Geir Dullerud, and Sanjay Shakkottai. Symbolic-Numerical Methods (SNR), colocated with QONFEST 2020.
5. **Language Semantics Driven Design and Formal Analysis for Distributed Cyber-Physical Systems.**  
Ritwika Ghosh, Sasa Misailovic, and Sayan Mitra. ApPLIED Workshop held with PODC, 41-44, 2018.
6. **TightRope: Towards Optimal Load-balancing of Paths in Anonymous Networks.**  
Hussein Darir, Hussein Sibai, Nikita Borisov, Geir E. Dullerud, and Sayan Mitra. In *Proceedings of the Workshop on Privacy in the Electronic Society (WPES) held with the ACM CCS conference*, 2018: 76-85
7. **Verifying safety of an autonomous spacecraft rendezvous mission** Nicole Chan and Sayan Mitra. In *Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2017)* at CPSWeek 2017.
8. **Tutorial: Software tools for hybrid systems verification, transformation, and synthesis: C2E2, HyST, and TuLiP.**  
P. S. Duggirala, C. Fan, M. Potok, B. Qi, S. Mitra, M. Viswanathan, S. Bogomolov, T. Johnson, L. V. Nguyen. In *Proceedings of IEEE Conference on Control Applications (CCA)*, pages 1024-1029, 2016.

9. **Controller synthesis for linear time-varying systems with adversaries.**  
Zhenqi Huang, Yu Wang, Sayan Mitra and Geir Dullerud. In *Hot Topics in Science of Security (HOTSOS)*, Science of Security Meeting, CMU, April 2016.
10. **Progress on powertrain verification challenge with C2E2.**  
Chuchu Fan, Parasara Sridhar Duggirala, Sayan Mitra, and Mahesh Viswanathan. In *Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2015)* held as part of CPSWeek 2015. **Robert Bosch Sponsored Best Results Award.**
11. **Proving abstractions of dynamical systems through numerical simulations.**  
Sayan Mitra. In *Hot Topics in Science of Security (HOTSOS)*, Science of Security Meeting, Raleigh, April 2014.
12. **Differentially private iterative synchronous consensus.**  
Zhenqi Huang, Sayan Mitra and Geir Dullerud. In *Proceedings of the Workshop on Privacy in the Electronic Society (WPES) held with the ACM CCS conference*, Raleigh, NC, 2012. (Acceptance: 29%)
13. **Approximate simulations for task-structured probabilistic I/O automata.**  
Sayan Mitra and Nancy Lynch. In *LICS workshop on Probabilistic Automata and Logics (PAuL'06)*, Seattle, WA, August 2006.
14. **Reusable PVS proof strategies for proving abstraction properties of I/O automata.**  
Sayan Mitra and Myla Archer. In *STRATEGIES 2004, IJCAR Affiliated Workshop on strategies in automated deduction*, Cork, Ireland, July 2004.
15. **Energy efficient connected clusters for mobile ad hoc networks.**  
Sayan Mitra and Jesse Rabek In *Proceedings of 3rd Annual Mediterranean Ad Hoc Networking Workshop (MED-HOC-NET'04)*, Bodrum, Turkey, 2004.
16. **Specifying and proving timing properties with TIOA tools.**  
Dilsun Kaynar, Nancy Lynch, and Sayan Mitra. In *Work in progress session of the 25th IEEE International Real-Time Systems Symposium (RTSS-WIP)*, Lisbon, Portugal, December 2004.
17. **Developing strategies for specialized theorem proving about untimed, timed, and hybrid I/O automata.**  
Sayan Mitra and Myla Archer In *STRATA 2003, Workshop on Design and Application of Strategies/Tactics in Higher Order Logics*, Rome, Italy, September, 2003.

INVITED &  
POSITION PAPERS  
& MAGAZINE  
ARTICLES &  
REPORTS

1. **ARCH-COMP18 Category Report: Continuous and Hybrid Systems with Nonlinear Continuous Dynamics.**  
Fabian Immler, Matthias Althoff, Xin Chen, Chuchu Fan, Goran Frehse, Niklas Kochdumper, Yangge Li, Sayan Mitra, Mahendra Singh Tomar, Majid Zamani. *Report for ARCH Workshop held as part of ADHS*, 53-70, 2018.
2. **ARCH-COMP18 Category Report: Continuous and Hybrid Systems with Linear Continuous Dynamics.**  
Matthias Althoff, Stanley Bak, Xin Chen, Chuchu Fan, Marcelo Forets, Goran Frehse, Niklas Kochdumper, Yangge Li, Sayan Mitra, Rajarshi Ray, Christian Schilling, Stefan Schupp. *Report for ARCH Workshop held as part of ADHS*, 23-52, 2018.
3. **Analyzing the cost of securing control systems.**  
Zhenqi Huang, Yu Wang, Sayan Mitra, and Geir Dullerud. In *Next Wave: NSA's Journal on Emerging Technologies.*, 2015.
4. **Developing Programming Abstractions for Cyberphysical Systems.**  
Sayan Mitra. *NSF Workshop on Transportation CPS*. January, 2014.
5. **Invariant Synthesis for Verification of Parameterized Cyber-Physical Systems with Applications to Aerospace Systems.**  
Taylor T. Johnson and Sayan Mitra. *Cyber-physical Aerospace Systems at AIAA Infotech@Aerospace*, 2013.

6. **Design Automation Challenges in Automotive Cyber-Physical Systems.**

Sayan Mitra Presented at *NSF-NIST-USCAR Workshop for Developing Dependable and Secure Automotive Cyber-Physical Systems from Components*, Troy, MI, 2011.

PATENTS

1. **TF14195-02(US): Bounded Verification Through Discrepancy Computations.**

Sayan Mitra, Chuchu Fan, and Zhenqi Huang. Issued 2018.

PRESENTATIONS

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INVITED TALKS  
AND SEMINARS

1. **Interfaces for models and data in verification and synthesis.** Workshop on Learning and Control, co-located with CPS-IoTWeek 21, chaired by Rafal Wisniewski and Manuela Bujorianu, May 18, 2021.
2. **Data requirements for estimation and verification.** Simons Institute, Theoretical Foundations of Computer Science Seminar, May 11, 2021.
3. **Towards verified robot code.**
  - *Semiautonomous Systems Seminar*, UC Berkeley, February 12th, 2021.
  - *Chair's Distinguished Lecture in Aerospace Engineering*, University of Michigan, October 29, 2020. [link](#)
  - *C3.ai Digital Transformation Institute's Workshop on Safe Autonomy: Learning, Verification, and Trusted Operation of Autonomous Systems*, December 7-8, 2020. [link](#)
4. **Recent results on verification of cyber-physical systems.** NSF-NITRD, Computing-Enabled Networked Physical Systems Interagency Working Group, December 2, 2020.
5. **Abstractions for programming distributed robotic applications.** *Workshop on Safe Operation of Connected and Autonomous Vehicle Fleets, Mathematical Challenges and Opportunities for Autonomous Vehicles*, IPAM, UCLA, October 26-30.
6. **Cyber-physical system verification: Opportunities for building bridges.** *Global summit of overseas and resident Indian scientists, V5H3S1*, October 2020. [link](#)
7. **Optimal data rate estimation and model detection for safe autonomy.** *USC-MHI Cyber-Physical Systems Seminar promoted by the Center for Cyber-Physical Systems and the Internet-of-Things (CCI)*, October 16th, 2019.
8. **Verification for safe autonomy: Challenges and recent developments.** *Distinguished Colloquium Series at University of Maryland, sponsored by Booz Allen Hamilton, 10th Anniversary.* May 3rd, 2019.
9. **Driverless cars and how you can help build one.** *Saturday Engineering for Everyone (SEE)*, March 2nd, 2019.
10. **Entropy and data rates for estimation, detection, and verification.**
  - Workshop on New Problems on Learning and Data Science in Control Theory, American Control Conference (ACC), July 2018.
11. **Tools for auditing algorithms.**
  - Frontiers Series, Masters Program in Technology Management, University of Illinois College of Business, December 2, 2016.
12. **Safety verification for nonlinear and hybrid models with C2E2.**
  - ACM High Integrity Language Technology International Workshop on Model-Based Development and Contract-Based Programming (ESWeek), October 7, 2016.
13. **Optimal network resource allocation for monitoring dynamical systems.**
  - TCS Research, Innovation Labs, June 20th Kolkata 2016.

14. **Automating invariant and progress proofs for distributed systems.**
  - RiSE fellow seminar, TU Wien, Austria, December 8th 2016.
15. **From models and data to proofs for improving cyber-physical systems.**
  - *UTC Inst. for Advanced System Engineering, University of Connecticut, Sept. 19th, 2016.*
  - *Qualcomm San Diego Seminar Series, June 9, 2015.*
  - *Tenth Carnegie Mellon Conference on Electrical Industry: Testbeds for Smart Grids and Smart Cities, March 30, 2015.*
  - *CSE Colloquium Series, Michigan State University, March 27, 2015.*
  - *TSS Seminar, University of Illinois, Urbana-Champaign, Feb 24th, 2015.*
  - *Advanced Computing Seminar, Indian Statistical Institute, Kolkata, Jan 14th, 2015.*
  - *Invited Seminar, Robert Bosch Center for Embedded Systems, Indian Institute of Science, Bangalore Jan 8th, 2015.*
16. **Simulation-based verification of cyber-physical systems.**
  - *Control Systems Seminar, University of Michigan, December 4th, 2014.*
  - *Control Theory Seminar, University of California, Berkeley. October 27th, 2014.*
  - *Dagstuhl Seminar on Verification of Cyberphysical Systems, March 16–21st, 2014.*
  - *Department of Aerospace Engineering, Georgia Institute of Technology, April 9th, 2014.*
17. **Simulation-based verification of temporal precedence.** NASA Langley Formal Methods Group, January 9th, 2014.
18. **From simulations to verification: hybrid and distributed systems.**
  - *Computational Modeling and Analysis of Complex Systems (CMACS) Seminar, Carnegie Mellon University, May 10th, 2013.*
  - *Center for Information Systems and Engineering (CISE) Seminar, Boston University, April 24th, 2013.*
19. **Hybrid system verification: progress and simulations.**
  - *Information Systems Laboratory (ISL) Seminar, Stanford University, January 24th, 2013.*
  - *Design of Robotics and Embedded systems, Analysis, and Modeling Seminar (DREAMS), University of California at Berkeley, January 22th, 2013.*
  - *AFOSR Complex Systems review meeting, Washington DC, December, 2012.*
20. **Hybrid system verification: Some recent results.** IMSE Seminar, 2013 Series, University of Illinois at Urbana-Champaign, January 16th, 2013.
21. **Verification of cyber-physical systems: static and dynamic techniques.**
  - *Special Research Seminar, Department of Automation, Tsinghua University, April 20th, 2012.*
  - *Department of Mechanical Engineering, Beijing University, April 16th, 2012.*
22. **Automatic verification of region stability of embedded systems.**
  - *CSE Seminar, Indian Institute of Technology, Kharagpur, January 12th, 2012.*
  - *Indian Statistical Institute, Kolkata, January 11th, 2012.*
  - *IEEE Calcutta Section in collaboration with Electrical Engineering Department of Jadavpur University, January 10th, 2012.*
23. **Verifying inevitability of hybrid systems.** *Decision and Control Laboratory Seminar Series, Georgia Institute of Technology, December 1st, 2011.*
24. **Automatic verification of region stability.**
  - *University of California, Los Angeles, October 5th, 2011.*

- *IST Seminar Series, California Institute of Technology, October 4th, 2011.*
  - *CCDC Seminar Series, University of California, Santa Barbara, October 7th, 2011.*
25. **Distributed cyber-physical systems: algorithms and verification.** *Research Seminar, Wright-Patterson Air-Force Base, Dayton, Ohio, July 20th, 2011.*
  26. **Abstractions for verification of hybrid systems.**
    - *Research Seminar, Kirtland Air-Force Base, Albuquerque, New Mexico, June 15th, 2011.*
    - *Control System Group Seminar, Department of Electrical and Computer Engineering, University of New Mexico, June 16th, 2011.*
  27. **Abstractions for safety and stability verification of cyber-physical systems.** *PRECISE Seminar, University of Pennsylvania, PA, March 2011.*
  28. **Abstraction-refinement for hybrid system verification: an air-traffic control case study.** *2nd Workshop on Formal Methods for Aerospace (FMA) in conjunction with IEEE Conference on decision and control (CDC), Atlanta, 2010.*
  29. **Verification of hybrid systems through abstractions and approximations.** *Workshop on Hybrid Dynamic Systems 2010, at the University of Waterloo, Canada.*
  30. **Virtual infrastructure for programming mobile robots.** *Special Research Seminar at the Microsoft Research India, in Bangalore, India, December 2009.*
  31. **Replication-based fault-tolerance of wireless distributed control systems.** *CalTech Verification and Validation Workshop, Pasadena, CA, September 2009.*
  32. **Virtual infrastructure for programming mobile robots.** *Workshop on Formal methods for Robotics and Automation Workshop at the 2009 IEEE International Conference on Robotics and Automation (ICRA), in Kobe, Japan, May 2009.*
  33. **Proving convergence: From synchronous to partially synchronous systems.** *Computer Engineering Seminar Series at UIUC, Urbana, IL, October 2008.*
  34. **Verifying hybrid systems: stability and implementations.** *Self-Organizing Systems group seminar, University of Washington, Seattle, WA, January 2007.*
  35. **Verifying hybrid systems.** *CMI Seminar Series at Caltech, Pasadena, CA, February 2008.*
  36. **On building PVS interfaces for abstraction proofs.** *CHACS Seminar, Naval Research Lab, Washington D.C., August 2003.*
- CONFERENCE PRESENTATIONS
1. **Approximate Partial Order Reduction.** *In Proceedings of Formal Methods (FM 2018), Oxford, 2018.*
  2. **Entropy and minimal data-rates for state estimation and model detection.** *International conference on Hybrid Systems: Computation and Control, CPSWeek 2016, Vienna, Austria, April 2016.*
  3. **Data-driven safety verification of nonlinear and hybrid models with C2E2.** *ACM High-Integration Language Technologies International Workshop, ESWeek 2016, Pittsburgh, PA, October 7th 2016.*
  4. **StarL: Towards a unified framework for programming, simulating and verifying distributed robotic systems.** *LCTES 2015, held as part of FCRC, Portland, OR, June 2015.*
  5. **Privacy preserving distributed optimization.** *16th International Conference on Distributed Computing and Networking, Goa, India. Jan 2015.*
  6. **Simulation-based Verification of Cyberphysical Systems.** *Toyota Summit on Industrial Cyberphysical Systems, December 18th, 2014.*

7. **Proving Abstractions from Numerical Simulations for Security Properties of Cyberphysical Systems.**  
*HOTSOS 2012*, Raleigh, April 2014.
8. **Static and Dynamic Analysis of Timed Distributed Traces.**  
*RTSS 2012*, San Juan, Puerto Rico, December 2012.
9. **Parameterized Verification of Cyber-Physical Systems: A Aircraft Landing Protocol Case Study.**  
*ICCPs 2012*, CPSWeek, Beijing, PRC, April 2012.
10. **Lyapunov Abstractions for Inevitability of Hybrid Systems.**  
*HSCC 2012*, CPSWeek, Beijing, PRC, April 2012.
11. **Stability Verification of Digitally-Interconnected Linear Systems.**  
*CDC-ECC 2011*, Orlando, FL, December 2011.
12. **Stability of Distributed Algorithms in the face of Incessant Faults.**  
*International Symposium on Stabilization, Safety, and Security of Distributed Systems (SSS'09)*, Lyon, France. November 2009.
13. **Proving Approximate Implementations.**  
*CMI Retreat'07*, Los Angeles, CA, October 2007.
14. **Learning Cycle-Linear Hybrid Automata for Excitable Cells.**  
*HSCC'07*, Pisa, Italy, April 2007.
15. **Approximate Simulations for Task-PIOAs.**  
*Workshop on Probabilistic Automata and Logics (PAuL'06) (Affiliated with LICS'06)*, Seattle, WA, August 2006.
16. **Verifying Average Dwell Time through Optimization.**  
*Hybrid Systems: Computation and Control (HSCC'06)*, Santa Barbara, CA, March 2006.
17. **Translating TIOA specs for Theorem Proving in PVS.**  
*Formal Modelling and Analysis of Timed Systems (FORMATS'05)*, Uppsala, Sweden, September 2005.
18. **Stability Verification of TIOA.**  
*Timed I/O Automata Workshop*, MIT, Cambridge, MA, December, 2005.
19. **Reusable PVS proof strategies for proving abstraction properties of I/O automata.**  
*STRATEGIES Workshop (Affiliated with IJCAR'04)*, Cork, Ireland, July 2004.
20. **Safety Verification of Model Helicopter Controller.**  
*Hybrid Systems: Computation and Control (HSCC'03)*, Prague, Czech Republic, April 2003.

## PANELS

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- TECHNICAL PANEL DISCUSSIONS
1. **CPS in the age of AI.** NSF sponsored workshop on Next Big Research Challenges in Cyber-Physical Systems, April 2021.
  2. **State of the art and challenges in implementing autonomy.** AFCEA Ideation and Innovation Virtual Event. March 10, 2021.
  3. **Hard problems in Science of Security.** Held as part of Hot Topics in Science of Security (HOTSos). April 13th, 2021.

## ADVISING

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- DOCTORAL THESES
- ◇ **Ritwika Ghosh** (CS, University of Illinois, 2014–2020)—*Separation of distributed coordination and control for programming reliable robots*  
First position (2020): Senior Software Engineer, bodo.ai.

- ◇ **Chuchu Fan** (ECE, University of Illinois, 2014–2019)—*Formal methods for safe autonomy: Data-driven verification, synthesis, and applications*.  
First position (2019): Assistant Professor of Aerospace Engineering, MIT.
- ◇ **Zhenqi Huang** (ECE, University of Illinois, 2013–2016)—*Compositional analysis of networked cyber-physical systems: Safety and Privacy*.  
Current position (2019): Software Engineer, Zoox Inc. First position (2016): Dispatch.ai.
- ◇ **Parasara Sridhar Duggirala** (CS, University of Illinois, 2015)—*Verification of hybrid systems through abstraction refinement*.  
Current position (2019): Assistant Professor of Computer Science, University of North Carolina at Chapel Hill. First position (2015): Assistant Professor of Computer Science and Engineering, University of Connecticut.
- ◇ **Taylor Johnson** (ECE, University of Illinois, 2013)—*Uniform verification of safety for parameterized networks of hybrid automata*.  
Current position (2019): Assistant Professor of Computer Science, Vanderbilt University. First position (2013): Assistant Professor of Computer Science, University of Texas at Arlington.

## MASTERS THESES

- ◇ **Kristina Miller** (ECE, University of Illinois, tentatively 2021)—*TBD*.
- ◇ **SungWoo Jeon** (ECE, University of Illinois, tentatively 2021)—*TBD*.
- ◇ **Dawei Sun** (ECE, University of Illinois, tentatively 2021)—*TBD*.
- ◇ **Yangge Li** (ECE, University of Illinois, tentatively 2020)—*Model learning and verification from data (tentative)*.
- ◇ **Minghao Jiang** (ECE, University of Illinois, May 2021)—*Continuous integration and testing for autonomous racing in simulation*. First position: Amazon.
- ◇ **Navid Mokhlesi** (ECE, University of Illinois, tentatively 2021)—*TBD*.
- ◇ **Tianqi Liu** (ECE, University of Illinois, tentatively 2020)—*A two-level path planning and monitoring architecture for real-world autonomous driving systems*. First position: Jump Trading.
- ◇ **Matthew Potok** (ECE, University of Illinois, tentatively 2018)—*Safe machine learning and applications to smart manufacturing systems*. First position: Aurora Aerospace.
- ◇ **Hussein Sibai** (ECE, University of Illinois, tentatively 2017)—*Entropy and minimal data rate estimation for switched and hybrid systems*. First position: Continued for PhD.
- ◇ **Nicole Chan** (ECE, University of Illinois, tentatively 2017)—*Controller design approaches for hybrid systems*. First position: Pilot AI.
- ◇ **Shuting Li** (ECE, University of Illinois, 2018)—*Online interfaces for programming distributed robotics*. First position: Airbnb.
- ◇ **Bolun Qi** (ECE, University of Illinois, Summer 2018)—*An interactive verification framework with reachtubes*. First position: Facebook.
- ◇ **Yixiao Lin** (ECE, University of Illinois, 2016)—*A modular architecture for programming and simulation of distributed robotic systems*. First position: Medalia
- ◇ **Chuchu Fan** (ECE, University of Illinois, 2016)—*Automatic computation of discrepancy of non-linear models*. First position: Continued for PhD.
- ◇ **Ritwika Ghosh** (CS, University of Illinois, 2017). First position: Continued for PhD.
- ◇ **Zhenqi Huang** (ME, University of Illinois, 2013)—*On simulation-based verification on nonlinear and nondeterministic hybrid systems*. First position: Continued for PhD.
- ◇ **Adam Zimmerman** (ECE, University of Illinois, 2012)—*StarL for programming reliable robotic networks*. First position: Google.
- ◇ **Jeremy Green** (ECE, University of Illinois, 2012)—*Compositional bounded reachability using time partitioning and abstraction*. First position: Dynamic Motion Control.



- ◇ **M. S. Karthikeyan** (ECE, University of Illinois. 2011)— *Translation of Simulink-Stateflow Models to Hybrid Automata*. First position: National Instruments.
  - ◇ **Berenice Carrasco Cabrera** (ECE, University of Illinois. 2011)— *Opportunistic clock synchronization for ad hoc networks*. First position: IBM.
  - ◇ **Taylor Johnson** (ECE, University of Illinois, 2010)— *Fault-tolerant distributed cyber-physical systems: two case studies*. Received **Most Interesting CPS Research Problem Prize** at the 2009 Ph.D. Student Forum on Cyber-Physical Systems organized under the aegis of *IEEE Real Time Systems Symposium* for a position paper. First position: Continued for PhD.
- UNDERGRAD. THESES
- ◇ **Arnab Datta** (ECE, University of Illinois, Fall 2021)—*Testing autonomous driving systems*.
  - ◇ **Yifeng Ni** (ECE, University of Illinois, Fall 2021)—*Porting Koord application to fixed-wing UAVs*.
  - ◇ **Peter Leung** (ECE, University of Illinois, Spring 2020)—*Application of black-box optimization in verification*.
  - ◇ **RongZhou Li** (ECE, University of Illinois, Fall 2019)—*A nondeterministic vehicle simulation tool*.
  - ◇ **Shuting Li** (ECE, University of Illinois, Summer 2016)—*An online playground for distributed robotics*.
  - ◇ **Liji Sun** (ECE, University of Illinois, Summer 2016)—*A comparison of share memory algorithms for distributed robotics*.
  - ◇ **Bolun Qi** (ECE, University of Illinois, Summer 2016)—*Parallelizing simulation-based model checking*.
  - ◇ **Shengliang Dai** (ECE, University of Illinois, Summer 2015)— *Expectation invariants for randomized programs*
  - ◇ **Matthew Potok** (ECE, University of Illinois, Summer 2014)— *Frontend for C2E2 verification tool*.
  - ◇ **Yixiao Lin** (ECE, University of Illinois, Spring 2013)— *Programming for distributed coordination*.
  - ◇ **Le Wang** (ECE, University of Illinois, Spring 2013)— *Verification of SAPA-ALAS landing protocol*.
  - ◇ **Lucas Buccafusca** (CS, University of Colorado, Summer 2012)— *Flocking algorithms for StarL*.
  - ◇ **Matthew Johnson** (CS, University of Illinois. 2012)— *StarL: Application development for distributed robotics platform on Android*.
  - ◇ **Yaming Tang** (ECE, University of Illinois. 2011–2012)— *Image processing on Android*.
  - ◇ **Danyang Zhuo** (ECE, University of Illinois. 2011–2012)— *Ad hoc networking on Android Phones*.
  - ◇ **Zhongdong Zhu** (ECE, University of Illinois. 2011–present)— *Distributed Flows Simulation*.
- DOCTORAL DISSERTATION COMMITTEES
- ◇ **Vimuth Fernando** (CS, University of Illinois, 2021)—Programming systems for Safe and Accurate Parallel Programs in the Face of Uncertainty. Thesis advisor: Sasa Misailovic.
  - ◇ **Shripad Gade** (ECE, University of Illinois, 2020)—TBD. Thesis advisor: Shubhonmesh Bose.
  - ◇ **Alli Nilles** (CS, University of Illinois, 2020)—Design of Controllable Boundary Interactions for Minimal Mobile Robots. Thesis advisor: Steve Lavalle.
  - ◇ **Joao Porto** (MechSE, University of Illinois, 2020)—Learning and decentralized control in linear switched systems Thesis advisor: Geir Dullerud.
  - ◇ **Jianxiong Gao** (ECE, University of Illinois, 2019)—Use of symbolic execution as auto grading tool for introductory programming courses. Thesis advisor: Steve Lumetta.
  - ◇ **Yu Wang** (MechSE, University of Illinois, 2018)—Stochastic verification of temporal logic specifications on stochastic hybrid systems via model reduction. Thesis advisor: Geir Dullerud.
  - ◇ **Guosong Yang** (ECE, University of Illinois, 2017)—Switched and hybrid systems with inputs: Small-gain theorems and finite data-rate feedback stabilization. Thesis advisor: Daniel Liberzon.

- ◇ Nima Roohi (CS, University of Illinois, 2017)—Model checking cyber-physical systems. Thesis advisor: Mahesh Viswanathan.
- ◇ Seyed Nematollah Ahmadyan (ECE, University of Illinois, 2016)—Randomized algorithms for validation of nonlinear analog circuits. Thesis advisor: Shobha Vasudevan.
- ◇ Abdullah Al-Nayeem (CS, University of Illinois, May 2013)—Physically-Asynchronous Logically-Synchronous (PALS) System Design and Development. Thesis advisor: Lui Sha.
- ◇ Stanley Bak (CS, University of Illinois, May 2013)—(tentative) Simplex-based Design and Verification of Cyberphysical Systems. Thesis advisor: Marco Caccamo.
- ◇ Jingjin Yu (CS, University of Illinois, Feb 2013)—Combinatorial Structures and Filter Design in Information Spaces. Thesis advisor: Steven M. Lavalley.
- ◇ Ghazale Hosseinabadi (ECE, University of Illinois, May 2012)—Exploiting Wireless Broadcast Property to Improve Performance of Distributed Algorithms and MAC protocols in wireless networks. Thesis advisor: Nitin Vaidya.
- ◇ Douglas Eskins (CS, University of Illinois, 2012)—Modeling Human Decision Points in Complex Systems. Thesis advisor: William Sanders.
- ◇ Vijay Raman (CS, University of Illinois, December 2011)—Traffic Aware Channel Allocation and Routing in Multi-Channel Multi-Radio Wireless Networks. Thesis advisor: Nitin Vaidya.
- ◇ Aneel Tanwani (ECE, University of Illinois, November 2011)—Invertibility and Observability of Switched Systems with Inputs and Outputs. Thesis advisor: Daniel Liberzon.
- ◇ Kyoung-Dae Kim (ECE, University of Illinois, May 2011)—Middleware and Control of Cyber-Physical Systems: Temporal Guarantees and Hybrid Systems Analysis. Thesis advisor: P. R. Kumar.
- ◇ Pavithra Prabhakar (CS, University of Illinois, June 2011)— Approximation Based Safety and Stability Verification of Hybrid Systems. Thesis advisor: Mahesh Viswanathan.

#### SPONSORED RESEARCH PROJECTS

#### CURRENT PROJECTS

- ◇ *Increasing the level of autonomy for agricultural robots through effective interaction and programming paradigms* (\$1,000,000, 4 years, 2020–2024), supported by NSF NRI (PI: Katie Driggs-Campbell (PI), Sayan Mitra (co-PI), Sasa Misailovic, Roy Dong, Girish Chowdhary)
- ◇ *Safe and reliable autonomous systems* (\$450,000, 3 years, 2020–2023), supported by NSF CCF (PI: Sasa Misailovic (PI) and Sayan Mitra (co-PI))
- ◇ *Predictive online safety analysis from multi-hop state estimates for high-autonomy on highways* (\$489,465, 3 years, 2019–2021), supported by NSF, Formal Methods in the Field (PI: Sayan Mitra, co-PI: Necmiya Ozay, Romit Roy Choudhury)
- ◇ *Automated testing and formal verification of state-machine switched guidance and control systems* (\$125,000, 2 years, 2019–2021), supported by UTC (PI: Sayan Mitra)
- ◇ *CPS: Privacy-preserving network congestion control: Theory and applications* (\$500,000, 3 years, 2017–2020), supported by NSF, CPS (PI: Sayan Mitra, co-PI: Geir Dullerud, Nikita Borisov)
- ◇ *Certifiable trust in autonomy* (\$240,000, 3 years, 2018–2020), supported by Boeing Company (PI: Sayan Mitra)
- ◇ *Optimal network resource allocation for monitoring continuous and hybrid systems* (\$500,000, 3 years, 2017–2020), supported by AFOSR, (PI: Sayan Mitra, co-PI: Daniel Liberzon)
- ◇ *CPS Frontiers: Collaborative Research: Software Defined Control for Smart Manufacturing Systems* (\$4,000,000, 4 years, 2016–2021), supported by NSF (PI: Dawn Tilbury, co-PI: Kira Barton, Morley Mao, Sibin Mohan, Sayan Mitra, Elaine Shi)

- ◇ *CRI: CyPhyHouse: A laboratory for evolving distributed and mobile cyber-physical systems research* (\$610,000, 3 years, 2016-2019), supported by NSF (PI: Sayan Mitra, co-PI: Geir Dullerud and Nitin Vaidya).
- PAST PROJECTS
- ◇ *Static-Dynamic Analysis of Security Metrics of Cyber-Physical Systems* (\$750,000, 3 years, 2014-2017), supported by NSA (PI: Sayan Mitra, co-PI: Geir Dullerud, Swarat Chaudhuri)
  - ◇ *From Simulations to Proofs for Cyber-Physical Systems* (\$500,000, 3 years, 2014-2017), supported by NSF (PI: Sayan Mitra, co-PI: Mahesh Viswanathan)
  - ◇ *Security of Cyber-Physical Systems* (\$185,000 1 year, 2012-2013), supported by NSA (PI: Sayan Mitra, co-PI: Geir Dullerud)
  - ◇ *VEHN: Verification Engines for Hybrid Networks* ( \$500,000, 4 years, 2012-2015), supported by AFOSR (PI: Sayan Mitra)
  - ◇ *A debugger for mobile systems* ( \$180,000,3 years, 2012-2015), supported by Samsung (PI: Sayan Mitra)
  - ◇ *Algorithms and Verification for Reliable Distributed Cyber-Physical Systems* (\$488,000, 5 years, 2011-2016), supported by NSF (PI: Sayan Mitra)
  - ◇ *Model-Based Design: Theory, Toolkit, and Benchmarks* (\$62,000, 1 year, 2011-2012), sponsored by John Deere (PI: Sayan mitra).
  - ◇ *Middleware for Wireless Distributed Systems* (3 years, 2010-2013), sponsored by Boeing (\$400,000, PI: Nitin Vaidya, co-PI: Sayan mitra).
  - ◇ *Verification of Simulink/Stateflow models* ( \$500,000, 3 years, 2009-2012), supported by NSF (PI: Sayan Mitra, co-PI: Mahesh Viswanathan)
  - ◇ *Embedded Safety Critical Application Programming Environment: Advancing the theory, the tool and benchmarking* (\$80,000, 1 year, 2010-2011), sponsored by John Deere (PI: Sayan mitra).
  - ◇ *Hybrid system verification research* (\$50,000, 1 year, 2009-2010), sponsored by Rockwell Collins Inc. (PI: Sayan Mitra).
  - ◇ *Hardware Simplex-based controller synthesis* (\$80,000, 1 year, 2009-2010), sponsored by John Deere (PI: Marco Caccamo, co-PI: Sayan mitra).

## SERVICE

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- PROGRAM COMMITTEE, EDITORSHIP, AND OTHER SERVICES
- ◇ Steering Committee Member HSCC 2020-.
  - ◇ Program Committee Member ICCPS 2021,
  - ◇ Program Committee Member ICCPS 2020, CAV 2020, RTSS 2020.
  - ◇ Program Committee Member ICCPS 2019.
  - ◇ Program Committee Member HSCC, ICCPS, DISC, QEST, HOTSOS 2018.
  - ◇ ACM SIGBED International Conference on Embedded Software (EMSOFT 2017).
  - ◇ 14th International Conference on Quantitative Evaluation of Systems (QEST 2017).
  - ◇ Program chair and editor (with Goran Frehse) for Proceedings of 20th ACM Intl. Conf. on Hybrid Systems: Computation and Control (HSCC 2017).
  - ◇ Inaugural Workshop on Science of Security of Cyberphysical systems, at CPSWeek 2016, Vienna, Workshop Organizer and Co-Chair.
  - ◇ Real-Time Systems Symposium (RTSS 2016).
  - ◇ Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2016).
  - ◇ External Review Committee member of Computer-Aided Verification (CAV'16).
  - ◇ 19th ACM Intl. Conf. on Hybrid Systems: Computation and Control (HSCC 2016).
  - ◇ 12th International Conference on Quantitative Evaluation of Systems (QEST 2015)

- ◇ ACM SIGPLAN Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES'15).
- ◇ Symposium and Bootcamp on the Science of Security (HotSoS 2015).
- ◇ 18th ACM Intl. Conf. on Hybrid Systems: Computation and Control (HSCC 2015).
- ◇ Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2015).
- ◇ Farm to Fork Symposium: Nanosensor networks and Exabyte Analysis. Urbana-Champaign (Chair, panel on sensor networks) 2014.
- ◇ IEEE Symposium on Software Reliability Engineering (ISSRE 2014).
- ◇ Real Time Systems Symposium (RTSS 2014).
- ◇ Summer Computer Simulation Conference (2014).
- ◇ Applied Verification for Continuous and Hybrid Systems (ARCH 2014).
- ◇ 3rd Intl. Conf. on High Confidence Networked Systems (HiCons 2014).
- ◇ The Euromicro Conference on Digital System Design (DSD), Special Session on Design of Cyber-physical systems, 2013.
- ◇ 4th IEEE/ACM Intl. Conf. on Cyber-Physical Systems (ICCPS 2013).
- ◇ 16th ACM Intl. Conf. on Hybrid Systems: Computation and Control (HSCC 2013).
- ◇ Robotics Science and Systems Conf. (RSS 2012), Sydney, Australia.
- ◇ 14th Intl. Symp. on Stabilization, Safety, and Security of Distributed Systems (SSS 2012).
- ◇ 15th ACM Intl. Conf. on Hybrid Systems: Computation and Control (HSCC 2012).
- ◇ 12th Intl. Conf. on Distributed Computing and Networking (ICDCN 2011).
- ◇ 14th ACM Intl. Conf. on Hybrid Systems: Computation and Control (HSCC 2011).
- ◇ Cyber-Physical Systems Week (CPSWeek 2011).
- ◇ 1st Intl. Workshop on Rewriting Techniques for Real-Time Systems (RTRTS 2010).
- ◇ 11th Intl. Symp. on Stabilization, Safety, and Security of Distributed Systems (SSS 2009).
- ◇ 13th Intl. Conf. on Hybrid Systems: Computation and Control (HSCC 2010).

EXTERNAL  
JOURNAL  
REVIEWING

- ◇ Formal Methods in System Design
- ◇ IEEE Transactions on Software Engineering
- ◇ Automatica
- ◇ IEEE Transactions on Automatic Control
- ◇ Theoretical Computer Science
- ◇ IEEE Systems, Man and Cybernetics
- ◇ IEEE Transactions on Computers
- ◇ ACM Transactions on Embedded Computing Systems
- ◇ Journal of Automated Reasoning
- ◇ Journal of Discrete Algorithms
- ◇ Journal of Aerospace, Computing, Information, and Communication
- ◇ Journal of Performance Evaluation

UNIVERSITY  
SERVICE

- ◇ Chair of Search Committee for ECE Teaching faculty, 2017, 2019.
- ◇ Member of Search Committee for ECE Department Head, 2019.
- ◇ Chair of Computer Engineering Group, 2017-2019.
- ◇ Intelligent Robotics Laboratory, Advisory Committee Member, 2017-2018.

TECHNICAL SOCIETY MEMBERSHIPS      Member of Executive Committee of ACM SIGBED (2019–)  
IEEE Senior Member, ACM, HKN  
IEEE Technical Committee on Computational Aspects of Control System Design (TC-CACSD)  
IEEE Technical Committee on Hybrid Systems

LANGUAGES      English, Bangla, Hindi

CITIZENSHIP      Citizen of USA.