

Houssam Abbas

Assistant Professor
Electrical Engineering and Computer Science
Oregon State University

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Academic Appointments

- 2019-Present **Assistant Professor**, *Oregon State University*.
School of Electrical Engineering and Computer Science
- 2015-2018 **Postdoctoral Researcher**, *University of Pennsylvania*.
Electrical and Systems Engineering Department

Education

- 2015 **Ph.D. in Electrical Engineering**, *Arizona State University*, Tempe, AZ.
- 2006 **M.Sc. in Electrical Engineering**, *Arizona State University*, Tempe, AZ.
- 2004 **Bachelor of Engineering in Computer and Communications**, *American University of Beirut*, Beirut, Lebanon.
- 2004 **Minor in Mathematics**, *American University of Beirut*, Beirut, Lebanon.

Research and Professional Experience

2006

2014

Design Automation Engineer, *Intel*, Chandler, AZ.

Worked in the System-on-a-Chip (SoC) Design Automation Group, with focus on Pre-Silicon Verification methods and tools.

1. Verification of low power designs for tablets and smartphones. Defined and deployed the Low-Power Verification Flow as the lead contact for IP and SoC design teams (more than nine teams over three geographies).

Researched formal verification techniques for the design and verification of state retention in digital circuits. Adapted functional verification techniques to the verification of power management features. Technical lead for the definition, development and deployment of functional coverage and temporal logic properties for low-power designs across the projects.

2. Software development Co-developed and maintained two major software projects used by thousands of engineers on a daily basis: a hardware test environment and an infrastructure for collecting and curating large amounts of test coverage data.

2008

2015

Research Assistant, *Arizona State University*, Tempe, AZ.

Advisor: Prof. Georgios Fainekos

School of Computing, Informatics and Decision Systems

Research on falsification of temporal logic properties of cyber-physical systems. Contributed to the testing tool S-TaLiRo (<http://tinyurl.com/Staliro>)

2006

2008

Research Assistant, *Arizona State University*, Tempe, AZ.

Advisor: Prof. Lina Karam

Electrical Engineering Department

Developed a de-noising algorithm for images corrupted by visual mosquito noise.

Research Intern, *University of Picardie Jules Verne*, Amiens, France.

Center for Robotics, Electronics and Automation

Research in pattern matching in omnidirectional images, and analysis of state estimation errors in such images

Teaching

Course Development

F1/10 Autonomous Racing.

Undergraduates and graduates, 4 credits

Designed and taught this class, which teaches skills in Perception (e.g., LiDAR data processing), Planning (e.g., motion planning), Control (e.g., PID control and optimization-based control) and programming (e.g., the Robot Operating System), and applies them to the development of an autonomous racing car. The students build the car from parts, and conclude the semester with an autonomous race against time.

Cyber-Physical Systems.

Undergraduates and graduates, 3 credits

Co-designed and taught this class about the theory and tools for model-based design of Cyber-Physical Systems. The class teaches modeling for formal verification in a case study on Life-Saving Medical Devices, and modeling for testing in a case study on Advanced Driver Assistance Systems. The students learn timed automata modeling, model-checking, temporal logics, specification-guided testing and reachability analysis. They acquire a working knowledge of Simulink and Stateflow, UPPAAL, S-TaLiRo and CORA. A course brochure can be found on my website.

Grant and Contract Support

- 2019 **NSF CCRI: Collaborative Research**, *F1/10 RACECAR: Community Platforms for Safe, Secure and Coordinated Autonomy*, 3 years, (\$1.5M; OSU share: \$580k).
- 2019 **Intel**, *Defending Against Attacks on Autonomous Vehicles via On-Board Formal Verification and Testing*, 1 year, (\$54k).

Patents

Control of multi-drone fleets with temporal logic objectives.

Rahul Mangharam, Yash Pant, Houssam Abbas and Rhudii Quaye

Patent Application 16/515,854

Temporal logic robustness-guided testing for Cyber-Physical Systems.

Georgios Fainekos, Bardh Hoxha and Houssam Abbas

Provisional Patent 61/900,866

Publications

Total citations 642, h-index 15 (Google Scholar, October 2019)

Journals

Under Review

- Y. V. Pant, H. M. Z. Li, R. A. Quaye, A. Rodionova, H. Abbas, M. Ryerson and R. Mangharam, FADS: Framework for Autonomous Drone Safety. *IEEE Transactions on Intelligent Transportation Systems*, Under review.

Published

- Colin Shea-Blymyer and H. Abbas, Algorithmic Ethics for Autonomous Cyber-Physical Systems. *ACM Transactions on Cyber-Physical Systems*.
- A. Rodionova, Y. V. Pant, C. Kurtz, K. Jang, H. Abbas, and R. Mangharam, Learning-'N-Flying: A Learning-based, Decentralized Mission Aware UAS Collision Avoidance Scheme. *ACM Transactions on Cyber-Physical Systems*. (Accepted)
- Y. V. Pant, H. Abbas, K. Mohta, R. A. Quaye, T. X. Nghiem, J. Devietti and R. Mangharam, Anytime Computation and Control for Autonomous Systems. *IEEE Transactions on Control Systems Technology*, March 2020.
- H. Abbas, K. Mamouras, A. Rodionova, E. Bartocci, S. Smolka and R. Grosu, Quantitative Regular Expressions for Arrhythmia Detection. *ACM Transactions on Computational Biology and Bioinformatics*, Sept-Oct 2019.
- H. Abbas, R. Alur, K. Mamouras, R. Mangharam, and A. Rodionova, Real-time Decision Policies with Predictable Performance. *The Proceedings of the IEEE*, December 2018.
- O. Beg, H. Abbas, T. Johnson and A. Davoudi, Model validation of PWM DC-DC converters, *IEEE Transactions on Industrial Electronics*. March 2017 .
- H. Abbas, G. Fainekos, S. Sankaranarayanan, F. Ivancic, and A. Gupta, Probabilistic temporal logic falsification of Cyber-Physical Systems. *ACM Transactions on Embedded Computing Systems*, Vol. 12, Issue 2, May 2013.

Peer-Reviewed Conferences

- N. Basnet and H. Abbas, Logical Signal Processing: a Fourier Analysis of Temporal Logic, *In ACM International Conference on Runtime Verification (RV)*, Oct. 2020
- C. Kurtz and H. Abbas, FairFly: A Fair Motion Planner for Fleets of Autonomous UAVs in Urban Airspace, *In IEEE International Conference on Intelligent Transportation Systems (ITSC)*, Sept. 2020
- C. Shea-Blymyer and H. Abbas, A Deontic Logic Analysis of Autonomous Systems' Safety, *In the Proc. of Hybrid Systems: Computation and Control (HSCC)*, April 2020
- H. Abbas, Private Runtime Verification, *In Intl. Conf. on Embedded Software (EMSOFT)*, New York, NY, October 2019
- H. Abbas, Y. V. Pant and R. Mangharam, Temporal Logic Robustness for General Signal Classes, *In Hybrid Systems: Computation and Control*, Montreal, Canada, April 2019
- Y. V. Pant, R. Quaye, H. Abbas, A. Varre and R. Mangharam, Fly-by-Logic: A Tool for multi-drone fleet planning using Temporal Logic Objectives, *In NASA Formal Methods Symposium*, Houston, TX, May 2019

- N. Paoletti, Z. Jiang, Md. Ariful Islam, H. Abbas, R. Mangharam, S. Lin, Z. Gruber and S. Smolka, Synthesizing Stealthy Reprogramming Attacks on Cardiac Devices, In *Int. Conf. on Cyber-Physical Systems (ICCPS)*, April 2019
- H. Abbas I. Saha, Y. Shoukry, R. Ehlers, G. Fainekos, R. Gupta, R. Majumdar and D. Ulus, Embedded Software for Robotics: Challenges and Future Directions, *Invited Special Session. Int. Conf. on Embedded Software (EMSOFT)*, October 2018
- H. Abbas and R. Mangharam, Generalized Robust MTL Semantics for Problems in Cardiac Electrophysiology, In *American Control Conference, Milwaukee, Wisconsin, June 2018*
- H. Abbas and R. Mangharam, Generalized Robust MTL Semantics for Problems in Cardiac Electrophysiology, In *American Control Conference, June 2018*
- H. Abbas, K. Mamouras, A. Rodionova, R. Alur, J. Liang, S. Dixit, and R. Mangharam, A novel programming language to reduce energy consumption by arrhythmia monitoring algorithms in implantable cardioverter-defibrillators, In *Heart Rhythm Sessions, Boston 2018*.
- Y. V. Pant, H. Abbas and R. Mangharam, Fly-by-Logic: Control of Multi-Drone Fleets with Temporal Logic Objectives, *Int. Conf. on Cyber-Physical Systems (ICCPS)*, April 2018
- H. Abbas, M. O'Kelly, A. Rodionova, and R. Mangharam, Safe At Any Speed: A Simulation-Based Test Harness for Autonomous Vehicles. In *Workshop on Model-Based Design of Cyber-Physical Systems (CyPhy)*, October 2017.
- H. Abbas, A. Rodionova, E. Bartocci, S. Smolka and R. Grosu, Quantitative Regular Expressions for Arrhythmia Detection Algorithms, In *Computational Methods in Systems Biology, Darmstadt, September 2017*
- M. O'Kelly, H. Abbas and R. Mangharam, Computer-Aided Design for Safe Autonomous Vehicles, In *the Procs. of Resilience Week, September 2017*
- Y. V. Pant*, H. Abbas* and R. Mangharam, Smooth Operator: Control using the Smooth Robustness of Temporal Logic, In *1st IEEE Conference on Control Technology and Applications, Hawaii, August 2017*. (*Equal contribution)
- H. Abbas, K.J. Jang, J. Liang, S. Dixit and R. Mangharam, A novel morphology discriminator to improve discrimination between Ventricular and Supraventricular tachycardias, In *Heart Rhythm Journal, Vol. 14, Issue 5 Supplement, May 2017*.

- H. Abbas, M. O'Kelly, and R. Mangharam, Relaxed Decidability and the Robust Semantics of Metric Temporal, In *Proceedings of the 20th ACM Int. Conf. on Hybrid Systems: Computation and Control, Pittsburgh, April 2017*
- Y. V. Pant, H. Abbas, and R. Mangharam, Robust model predictive control for non-linear systems with input and state constraints via feedback linearization, In *Proc. of the 55th IEEE Conference on Decision and Control, Las Vegas, December 2016* .

- H. Abbas, Z. Jiang, K.J. Jang, M. Beccani, J. Liang, and R. Mangharam, High-Level Modeling for Computer-Aided Clinical Trials of Medical Devices, *In Proceedings of the 18th High-Level Design and Validation Workshop, Santa Cruz, October 2016*
- H. Abbas, Z. Jiang, K.J. Jang, M. Beccani, J. Liang, S. Dixit and R. Mangharam, Computer-aided clinical trials for implantable cardiac devices, *In 53d Annual Technical Meeting of the Society of Engineering Science, Maryland, October 2016.*
- H. Abbas, K.J. Jang, Z. Jiang, and R. Mangharam, Towards Model checking implantable cardioverter defibrillators, *In the Proc. of Hybrid Systems: Computation and Control (HSCC) 2016, Vienna, April 2016 .*
- M. O'Kelly, H. Abbas and R. Mangharam, APEX: A Tool for Autonomous Vehicle Plan Verification and Execution, *In the Proc. of SAE World Congress, April 2016*
- Y. V. Pant, K. Mohta, H. Abbas, T. X Nghiem, J. Devietti, and R. Mangharam, Co-design of Anytime Computation and Robust Control, *In the Proc. of RTSS 2015, San Antonio, TX, October 2015 .*
- H. Abbas, H. Mittelmann and G. Fainekos, Formal Property Verification in a Conformance Testing Framework, *In the Proc. of MEMOCODE 2014, Lausanne, October 2014.*
- B. Hoxha, H. Bach, H. Abbas, A. Dokhanchi, Y. Kobayashi, and G. Fainekos, Towards Formal Specification Visualization for Testing and Monitoring of Cyber-Physical Systems, *In the Proc. of DIFTS 2014, Lausanne, October 2014.*
- H. Abbas, B. Hoxha, G. Fainekos and K. Ueda, Robustness-Guided Temporal Logic Testing and Verification for Stochastic Cyber-Physical Systems, *In the Proc. of IEEE-CYBER 2014, Hong Kong, June 2014. [Finalist for best student paper award]*
- H. Abbas, A. Winn, G. Fainekos and A. Julius, Functional Gradient Descent Method for Metric Temporal Logic Specifications, *In the Proc. of 2014 American Control Conference, Portland, June 2014 .*
- H. Abbas and G. Fainekos, Computing Descent Direction of MTL Robustness for Nonlinear Systems, *In the Proc. of 2013 American Control Conference, Washington D.C., June 2013.*
- H. Abbas and G. Fainekos, Convergence Proofs for Simulated Annealing Falsification of Safety Properties, (Invited) *In the Proc. of 50th Annual Allerton Conference on Communication, Control and Computing, Monticello, IL, October 2012.*
- H. Abbas and G. Fainekos, Linear Hybrid System Falsification through Local Search, *In the Proc. Of Automated Technology for Verification and Analysis, Taipei, 2011 .*
- H. Abbas and L.J. Karam, Suppression of Mosquito Noise by Recursive Epsilon-Filters, *In Proceedings of IEEE Int. Conf. on Acoustics, Speech and Signal Processing, Honolulu, HI, April 2007 .*

Workshops Without Proceedings

- A. Rodionova, M. O'Kelly, H. Abbas, V. Pacelli, and R. Mangharam, An autonomous vehicle control stack. In *Workshop on Applied Verification for Continuous and Hybrid Systems, April 2017*.

Magazine Articles

- H. Abbas, M. O'Kelly, A. Rodionova and R. Mangharam, A Driver's License for Driverless Vehicles, In *ASME Dynamic Systems and Control Magazine, December 2017*
- Z. Jiang, H. Abbas, K.J. Jang, and R. Mangharam, The challenges of high-confidence medical device software, In *IEEE Computer Magazine, Vol. 49(1), January 2016*

Selected Talks and Tutorials

- October 2020 **Oregon Chapter of the IEEE Signal Processing Society, Invited talk**, 'Logical Signal Processing'
- February 2020 **Information Theory and Applications Workshop, Invited talk**, 'A Deontic Logical Analysis of Autonomous Systems' Safety'
- October 2019 **Intel Corp, Invited talk**, 'The Intersection of Security and Safety for Autonomous Vehicles'
- July 2018 **Runtime Verification for Rigorous System Design Workshop, Invited talk**, 'A Platform for Online Monitoring of Autonomous Cars'
- March 2018 **Intel Corp, Invited talk**, 'A Driver's License Test for Driverless Vehicles'
- November 2017 **NSF Cyber-Physical Systems PI Meeting, Invited talk**, 'Closing the Loop for Medical CPS'
- October 2017 **Qualcomm, Invited talk**, 'A Driver's License Test for Driverless Vehicles'
- May 2017 **Hospital of the University of Pennsylvania, Invited talk**, 'A novel morphology discriminator to improve discrimination between Ventricular and Supraventricular tachycardias'
- April 2017 **CyberCardia (NSF Frontiers) PI Meeting**, 'A novel morphology discriminator to improve discrimination between Ventricular and Supraventricular tachycardias'
- April 2016 **CyberCardia (NSF Frontiers) PI Meeting**, 'Towards Model-Checking Implantable Cardioverter Defibrillators', April 2016
- April 2016 **Cyber-Physical Systems Week**, 'F1/10 Autonomous Racing Tutorial', April 2016
- May 2016 **BioMedical Engineering Society Annual Meeting, Invited talk**, 'In-silico Pre-clinical Trials for Implantable Cardiac Devices'
- November 2015 **International Conference on Complex Systems Engineering, Invited talk**, 'Co-design of Anytime Estimation and Control for Cyber-Physical Systems', November 2015

Service

- **Organization**

- Chair, Posters and Demos at Runtime Verification, 2020
- Co-Chair, Design and Analysis of Robust Systems Workshop, 2019
- Co-organizer, Special session on Advanced Driver Assistance Systems in EMSOFT, 2018
- Co-organizer, Special session on Embedded Software for Robotics in EMSOFT, 2018
- Co-chair of, Monitoring and Testing of CPS Workshop, 2017 and 2018
- Organizing committee for the Internet of Safe Things Workshop, 2018

- **Committees**

- Steering Committee, Monitoring and Testing of Cyber-Physical Systems (MT-CPS) 2019, 2020, 2021
- Program Committee, Runtime Verification Conference (RV), 2020
- Program Committee, Medical Cyber-Physical Systems (MCPS) 2021
- Program Committee, Spring Simulation Conference (SpringSim), 2019, 2020
- Program Committee, Cyber-Physical Systems Workshop (CyPhy), 2019
- Program Committee, International Conference on Embedded Software (EMSOFT), 2018, 2019, 2020
- Program Committee, International Workshop on Human-in-the-loop Internet of Things Systems, 2018
- Program Committee, Workshop on the Design and Analysis of Robust Systems, 2018

- **Standards committees**

- Member of the IEEE P1801 Standards Committee, and its Information Model sub-committee. 2014.

- **Journal Reviewer**

- IEEE Transactions on Automatic Control
- IEEE Transactions on Image Processing
- Formal Methods in System Design
- ACM Transactions on Cyber-Physical Systems
- ACM Transactions on Embedded Computing Systems
- International Journal on Software Tools for Technology Transfer

- **Conference and Workshop Reviewer**

- Hybrid Systems: Computation and Control (HSCC)
- International Conference on Cyber-Physical Systems (ICCPs)
- American Automatic Control Conference (ACC)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE Conference on Decision and Control (CDC)
- International Conference on Quantitative Evaluation of Systems (QEST)
- International Symposium on Automated Technology for Verification and Analysis (ATVA)
- Applied Verification for Continuous and Hybrid Systems (ARCH) Workshop
- International Conference on Formal Modeling and Analysis of Timed Systems (FORMATS)

Awards

- Finalist for Best Student Paper Award, IEEE CYBER 2014
- Preparing Future Faculty Emeriti Fellowship at ASU (2014)
- Department Impact Award at Intel (2012)
Awarded for my leading the development of the pre-silicon low-power verification methodology for all SoC teams, and my development and support of tools that implement the methodology, including static analysis and dynamic simulation.
- Department Recognition Award at Intel (2008)
Awarded for my work on the RTL simulation and validation environment used by all SoC teams at the company.
- Department Recognition Award at Intel (2010)
Awarded for my development of a parallelized solution for computing functional coverage goals on SoC designs.
- Department Impact Award at Intel (2010)
Awarded for porting a large design (millions of lines of code) between simulators to accelerate simulation and meet the post-silicon delivery deadlines.
- Recipient of the Helene and Emile Chartouni Scholarship at A.U.B. (2000-2004)

Languages

- Arabic: Native speaker
- English: Fluent
- French: Fluent
- Greek: Beginner

Immigration Status

U.S. and Lebanese citizen

References

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