

Houssam Abbas

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Electrical Engineering and Computer Science
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Academic Appointments

- 2019 **Assistant Professor**, *School of Electrical Engineering and Computer Science, Oregon State University.*
- 2015-2018 **Postdoctoral Researcher**, *University of Pennsylvania.*
Working with Rahul Mangharam in the 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).

a) Technical contributions: 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 ('assertions') for low-power designs across the projects.

b) Methodology contributions: As methodology lead, interfaced with outside software vendors to co-ordinate their support for Intel processes and advance Intel priorities. Co-chaired a Tool User Group, which developed software specifications of new features to simulator vendor.

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. Code robustness and efficiency were key requirements in both projects.

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.

2003

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

Publications

Total citations 416, h-index 11 (Google Scholar, November 2018)

Journals

[1] **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*, 2018.

[2] **H. Abbas**, R. Alur, K. Mamouras, R. Mangharam, and A. Rodionova, Real-time Decision Policies with Predictable Performance. *The Proceedings of the IEEE*, 2018.

[3] **H. Abbas**, A. Rodionova, K. Mamouras, E. Bartocci, S. Smolka and R. Grosu, Quantitative Regular Expressions for Arrhythmia Detection Algorithms. *ACM Transactions on Computational Biology and Bioinformatics*, To Appear 2019.

[4] O. Beg, **H. Abbas**, T. Johnson and A. Davoudi, Model validation of PWM DC-DC converters, *IEEE Transactions on Industrial Electronics*. March 2017 .

[5] **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.

Conferences and Workshops

MEDICAL DEVICES

[6] **H. Abbas** and R. Mangharam, Generalized Robust MTL Semantics for Problems in Cardiac Electrophysiology, In *American Control Conference*, June 2018

[7] **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.

- [8] **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*
- [9] **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*.
- [10] **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*
- [11] **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*.
- [12] **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* .

AUTONOMOUS SYSTEMS

- [13] **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), 2018*
- [14] 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), 2018*
- [15] M. O'Kelly, **H. Abbas** and R. Mangharam, Computer-Aided Design for Safe Autonomous Vehicles, In *the Procs. of Resilience Week, 2017*
- [16] 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)
- [17] 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* .
- [18] 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*.
- [19] **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*.
- [20] 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*

[21] 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* .

CYBER-PHYSICAL SYSTEMS FOUNDATIONS

[22] **H. Abbas** and R. Mangharam, Generalized Robust MTL Semantics for Problems in Cardiac Electrophysiology, *In American Control Conference, Milwaukee, Wisconsin, June 2018*

[23] **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*

[24] **H. Abbas**, H. Mittelmann and G. Fainekos, Formal Property Verification in a Conformance Testing Framework, *In the Proc. of MEMOCODE 2014, Lausanne, October 2014*.

[25] 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*.

[26] **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]

[27] **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* .

[28] **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*.

[29] **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*.

[30] **H. Abbas** and G. Fainekos, Linear Hybrid System Falsification through Local Search, *In the Proc. Of Automated Technology for Verification and Analysis, Taipei, 2011* .

IMAGE PROCESSING

[31] **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* .

Magazine Articles

[32] **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

[33] 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

Patents

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

Georgios Fainekos, Bardh Hoxha and Houssam Abbas

Provisional Patent 61/900,866

Control of multi-drone fleets with temporal logic objectives.

Rahul Mangharam, Yash Pant, Houssam Abbas and Rhudii Quaye

Provisional Patent 62/699,933

Selected Talks and Tutorials

- 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

Teaching Experience

- 2018 **F1/10 Autonomous Racing**, *University of Pennsylvania*, Fall 2018.
16 students (undergraduate and graduate), 3 credits, 80 contact hours
Designed and taught this class, which teaches skills in Perception (e.g., computer vision), Planning (e.g., motion planning), Control (e.g., PID control) and Robotics (e.g., the Robot Operating System), and applies them to the development of an autonomous racing car that is 1/10th the size of a real car, but 10 times the fun! The students build the car from scratch, and conclude the semester with head-to-head racing between autonomous vehicles.
- 2017 **Digital Twins: Model-Based Embedded Systems**, *University of Pennsylvania*, Fall 2017 and Spring 2018.
19 students (undergraduate and graduate), 3 credits, 48 contact hours
Co-designed and taught this graduate-level 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, modeling for control in a case study on Energy-Efficient Buildings, and modeling for testing in a case study on Advanced Driver Assistance Systems. The students learn state-space modeling, timed automata, model-checking, co-simulation, temporal logics, specification-guided testing, and parameter identification. They acquire a working knowledge of Simulink and Stateflow, UPPAAL, and MLE+. A brochure for the course can be found on my website.
- 2017 **Project Mentoring**, *Southern Illinois University*, Fall 2017 and Spring 2018.
Mentored a group of four undergraduates in CS and EE at Southern Illinois University, working on their final year project. The students built small-scale, snap-and-go mobile robots.

Service

- **Organization**
 - Co-Chair, Design and Analysis of Robust Systems Workshop, 2019
 - Special session on Advanced Driver Assistance Systems in EMSOFT, 2018
 - Co-chair of the 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
 - Program Committee, International Conference on Embedded Software (EMSOFT), 2018
 - 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 Reviewer**

- International Conference on Embedded Software (EMSOFT)
- 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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