

SUMMARY

I'm a PhD student in Computer Engineering and a research associate at Arizona State University. My research interests include design and verification of cyber-physical systems, neural networks and control algorithms. I have more than seven years of industry work experience in software engineering. Most of my experience is in safety-critical software development. I have software development experience in C, C++, Python, and MATLAB. I have worked with real-time operating systems (Integrity-RTOS), robotic operating system (ROS), requirements management (DOORS), issue tracking (JIRA), configuration management (SVN, Git) and model-based software development (SCADE / Simulink) tools.

EDUCATION

PhD in Computer Engineering, Arizona State University (ASU), AZ, USA – GPA:3.91 (Expected: Dec. 2018)

MSc in Electronics Engineering, Middle East Technical University (METU), Ankara, Turkey (2007)

Thesis: Implementation and Simulation of MC68HC11 Microcontroller Unit Using SystemC for Co-Design Studies

BSc in Electronics Engineering, Hacettepe University, Ankara, Turkey (2004)

Capstone Project: Ultrasonic Signal Follower Robot. I have represented Hacettepe University with this project in an international computer expo CeBIT Eurasia 2004, and took place in national media.

PROFESSIONAL EXPERIENCE

Toyota Motor North America - Research & Development Fall'17, Spring'18 Co-Op (Sept. 2017 – Apr. 2018)

- Developed a simulation-based framework and novel automatic test generation approaches for verification and validation of autonomous driving systems that have machine learning components. Published an academic paper and a poster on this work.
- Worked on a verification technique for proving safety properties of neural-network based controllers. Published an academic paper on this work.
- Developed simple LiDAR, radar, camera-based sensor fusion methods in autonomous vehicle control for academic research projects.
- The group I was a team member of has gained a new testing capability for the autonomous driving systems with my internship project.
- Published 2 academic papers and 1 poster on the internship projects. Presented 1 more poster in the internal research expo of Toyota Research Institute of North America.

Wright Brothers Institute – Summer of Innovation Program (May 2017 – Aug. 2017)

- Summer of innovation program focuses on the application of formal verification methods on autonomous systems
- As a member of a group consisting of formal verification researchers, I have applied the verification framework S-TaLiRo which was developed in ASU CPS Lab on an unmanned air vehicles autonomy system (UxAS) which was developed by US Air Force Research Labs (AFRL).

ASU – Graduate Research Associate (Dec. 2013, current)

- Developing a verification framework in Python and MATLAB for automatically generating test cases for autonomous driving vehicle controllers for finding optimal test-cases and reducing testing time and risk.
- Contributing into the development of S-TaLiRo which is a robustness-guided falsification toolbox for testing CPS.
- Created a multi-core parallelization tool for Simulink models in MATLAB which delivers substantial decrease in the overall worst-case execution time. Scheduling and synchronization mechanisms implemented for μ C/OS-II.
- Published several papers and presented the outcomes of the research in international conferences.
- Built a small-scale autonomous driving race car which was placed in the 3rd place in the “f1tenth” competition.
- Did teaching assistantship for “Programming for Computer Eng.” (C/C++) course in Spring, 2014.

Turkish Aerospace Industries (TAI) – Avionics Software Engineer

(Sept. 2009 – Dec. 2013)

- Played an important role in the largest avionics modernization project done in Turkey. As the software development team, we have developed the onboard flight software for C-130 cargo aircraft.
- Developed software in model-based software development tool SCADE and in C.
- Got involved in almost every stage of the software development life cycle by peer-reviewing system requirements, writing and peer-reviewing software requirements, doing model-based and manual software development, doing code reviews and writing and reviewing software test cases.
- Worked in accordance with DO-178B certification requirements for Level-A safety critical software development. The developed software is certified by an independent certification authority.
- Contributed to the development of the software verification framework for the unmanned aerial vehicle (UAV) project ANKA. The framework helped to decrease the time needed to develop test cases.

BOTT Computer Systems – Embedded Software Engineer

(Dec. 2005 – December 2008)

- Developed embedded software in C and C++ for e-payment and access control systems for campuses with more than 100K users.
- Achieved a substantial increase in manageability of the systems by performing the transition from older technology (RS-232 connections and MS-DOS) into centrally controllable TCP/IP connected Linux systems which are distributed to many different campuses and cities. This improvement has increased the customer satisfaction and helped the company to sell these systems in many other cities regardless of the distance.
- Converted an analog vending machine to smart-card operated and connected digital vending machine as a new product for the company. Completed end-to-end development of the product by designing the electronic circuits, PCBs and developing the software in Assembly and in C.

ACADEMIC PUBLICATIONS

Simulation-Based Adversarial Test Generation for Autonomous Vehicles with Machine Learning Components,

*Cumhur Erkan Tuncali, Georgios Fainekos, Hisahiro Ito, James Kapinski,
IEEE Intelligent Vehicles Symposium (IV), 2018*

Reasoning about Safety of Learning-Enabled Components in Autonomous Cyber-physical Systems,

*Cumhur Erkan Tuncali, James Kapinski, Hisahiro Ito, Jyotirmoy V. Deshmukh,
Design Automation Conference (DAC), 2018*

Poster: Sim-ATAV: Simulation-Based Adversarial Testing Framework for Autonomous Vehicles,

*Cumhur Erkan Tuncali, Georgios Fainekos, Hisahiro Ito, James Kapinski,
Hybrid Systems: Computation and Control (HSCC), 2018*

Experience Report: Testing and Verification of the UxAS System,

*Cumhur Erkan Tuncali, Bardh Hoxha, Guohui Ding, Georgios Fainekos, Sriram Sankaranarayanan,
NASA Formal Methods Symposium, Virginia, 2018*

Functional Gradient Descent Optimization for Automatic Test Case Generation for Vehicle Controllers,

*Cumhur Erkan Tuncali, Shakiba Yaghoubi, Theodore Pavlic, Georgios Fainekos,
13th Int. Conference on Automation Science and Engineering, (CASE 2017), Xi'an, China, Aug. 20-23, 2017*

Utilizing S-TaLiRo as an Automatic Test Generation Framework for Autonomous Vehicles,

*Cumhur Erkan Tuncali, Theodore Pavlic, Georgios Fainekos,
19th Int. Conference on Intelligent Transportation Systems, (ITSC 2016), Rio De Janerio, Brazil, Nov. 1-4, 2016*

Modeling Concurrency and Reconfiguration in Vehicular Systems: A Pi-Calculus Approach,

Joseph Campbell, Cumhur Erkan Tuncali, Peng Liu, Theodore Pavlic, Umit Ozguner, Georgios Fainekos, 12th Conference on Automation Science and Engineering, (CASE 2016), Fort Worth, Texas, USA, Aug. 21-24, 2016

Automatic Parallelization of Multirate Block Diagrams of Control Systems on Multicore Platforms,

Cumhur Erkan Tuncali, Georgios Fainekos, Yann-Hang Lee, ACM Transactions on Embedded Computing Systems (TECS), vol. 16, no.15, 2016

Automatic Parallelization of Simulink Models for Multi-Core Architectures,

Cumhur Erkan Tuncali, Georgios Fainekos, Yann-Hang Lee, 12th International Conference on Embedded Software and Systems, (ICESS 2015), New York, USA, Aug. 24-26, 2015

Implementation and Simulation of MC68HC11 Microcontroller Unit Using SystemC for Co-Design Studies

Cumhur Erkan Tuncali, (supervisor: Prof. Murat Askar) Master's Thesis, Middle East Technical University

SELECTED COURSES

PhD – Arizona State University:

- Real Time Embedded Systems
- Statistical Machine Learning
- Optimization
- Interaction Testing: Theory and Practice
- Introduction to Graph Theory
- Linear Systems Theory
- Nonlinear Control Systems
- Foundations of Algorithms
- Cyber Physical Systems
- Computer Systems I
- Computer Systems II
- Piano (beginner) for non-majors

MSc – Middle East Technical University:

- Transport Phenomena in Semiconductor Devices
- Principles of Analog VLSI Design
- Introduction to VLSI Design
- Principles of Digital CMOS VLSI Design
- Integrated Sensors and Sensor Systems
- Switching and Automata Theory
- Algorithms and Computational Complexity

BSc – Hacettepe University (senior-level courses):

- Digital Signal Processing
- Microprocessor Architecture and Programming I/II
- Telecommunications Theory I/II
- Power Electronics
- Fundamentals of Biomedical Engineering
- Fundamentals of Medical Imaging