

ZOLEIKHA ABDOLLAHI BIRON

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PROFESSIONAL EXPERIENCE

University of Florida, Gainesville, FL

January 2019 - Present

Assistant Professor

Department of Electrical and Computer Engineering

Clemson University, Clemson, SC

May 2017 - December 2019

Postdoctoral Research Fellow

Department of Automotive Engineering

Clemson University, Clemson, SC

September 2013 - May 2017

Graduate Research Assistant

Clemson University International Center of Automotive Research (CU-ICAR)

EDUCATION

Clemson University, Clemson, USA

August 2013 - May 2017

Ph.D. Automotive Engineering

K.N.Toosi University of Technology, Tehran, Iran

MS. Electrical Engineering, 2011

University of Tehran, Tehran, Iran

BS, Electrical Engineering, 2008

RESEARCH INTERESTS

Theory: Control, Estimation and Fault Diagnosis of Dynamic Systems modeled with PDE

Applications: Cyber Physical Systems (CPS), Connected Vehicles, Transportation Systems, Security and control of distributed CPS, Energy Systems, Electric Vehicles, Robotics.

Current Focus:

- Control and Security of Cyber Physical Systems, Control and Resiliency of Connected Vehicles, Electric Vehicles, Power Grids.

- Estimation, Control and Fault Diagnosis of Dynamics Systems and Energy Storage Systems.

- Fault Diagnosis of PDE Systems

HONORS AND AWARDS

- Southeastern Women Automotive Forum (SWAF) Scholarship, 2017
- Outstanding Automotive Engineering Ph.D. Student Award, Department of Automotive Engineering, Clemson University, 2016
- Best paper award at 18th International Conference on Intelligent Transportation Systems (ICITS), 2016
- Travel Award for Dynamic Systems and Control Conference (DSCC), 2016
- SAE Cyber-Auto Challenge Award, 2016

- Southeastern Women Automotive Forum (SWAF) Scholarship, 2015
- Doctorate Symposium, Prognostics and Health Management (PHM) Award, 2015
- Travel Award for Dynamic Systems and Control Conference (DSCC), 2015
- Southeastern Women Automotive Forum (SWAF) Scholarship, 2014
- Graduate Automotive Technology Education Fellowship from U.S. Department of Energy, 2013
- Recipient, National Scholarship, Government of Iran, 2008
- Recipient, National Scholarship, Government of Iran, 2002

PUBLICATIONS

Book Chapter

1. **Z. Biron**, and P. Pisu, An Overview of Denial of Service (DoS) Attack in Control Systems with a Case Study of Connected Vehicles, CRC Press.

Peer Reviewed Journal Articles

1. **Z. Biron**, S. Dey, and P. Pisu, "Real-time Detection and Estimation of Denial of Service Attack in Connected Vehicle Systems", in IEEE Transaction on Intelligent Transportation Systems, no. 99, pp. 1-10, 2018.
2. Y. Chen, W. Wang, **Z. Biron**, Y. Jia, and V. Krovi, "A Robotic Lift Assist: A Smart Companion for Heavy Payload Transport and Manipulation in Automotive Assembly", IEEE Robotics and Automation Magazine, vol. 25, no. 2, pp. 107-119.
3. P. Pisu, J. Martin, and **Z. Biron**, "A Control-Oriented Perspective for Security in Connected and Automated Vehicles", Mechanical Engineering Magazine Select Articles 139.12 (2017): S17- S20, 2017.
4. S. Dey, **Z. Biron**, S. Tatipamula, N. Das, S. Mohon, P. Pisu, and B. Ayalew, "Model-based Real-time Thermal Fault Diagnosis of Lithium-ion Batteries", Control Engineering Practice, vol. 56, pp. 37-48, 2016.
5. **Z. Biron**, and P. Pisu, "Sensor and Actuator Fault Detection of Connected Vehicles under Packet Dropping Network", International Journal of Computer, Electrical, Automation, Control and Information Engineering vol.10, no. 6, pp.967-974, (selected as a recommended publication), 2016.
6. L. Qiu, L. Qian, P. Chen, **Z. Biron**, and P. Pisu, "Predictive Fuel Efficient Control Strategies for a Group of Connected Vehicles Considering Vertical Vibration", Science China Technological Sciences, no. 60 vol.11, pp.1732-1746 (selected as a recommended publication), 2017.
7. L. Qiu, L. Qian, **Z. Biron**, and P. Pisu, "Closed-loop hierarchical control strategies for connected and autonomous hybrid electric vehicles with random errors", Journal of IET Intelligent Transport System, vol. 12, no. 10, pp. 1378-1385, 2018.
8. L. Qiu, L. Qian, **Z. Biron**, Z. Kong, and P. Pisu, "Engine map based predictive fuel efficient control strategies for a group of connected vehicles", Journal of Automotive Innovation, vol. 1, no. 4, pp. 311319, 2018.
9. **Z. Biron**, and P. Pisu, "Real-time False Data Injection Attack Detection in Connected Vehicle Systems with PDE modelling", submitted to IEEE Transaction on Intelligent Transportation Systems.

Peer Reviewed Conference Papers

1. R. Abdollahi, **Z. Biron**, and H. Hadidi, "Effects of Tariff on Commercial Load Profile Optimization in the Presence of Batteries", accepted at IEEE Industry Application Society, 2019.
2. Y. Chen, W. Wang, **Z. Biron**, Y. Jia, and V. Krovi, "A Smart Companion Robot for Heavy Payload Transport and Manipulation in Automotive Assembly", accepted at the 2019 International Conference on Robotics and Automation (ICRA), 2019.
3. **Z. Biron**, and P. Pisu, "Cooperative Adaptive Cruise Control: PDE Modeling and String Stability Analysis", IEEE American Control Conference (ACC), doi: 10.23919/ACC.2018.8431321, 2018.
4. R. Merco, **Z. Biron**, and P. Pisu, "Replay Attack Detection in a Platoon of Connected Vehicles with Cooperative Adaptive Cruise Control", IEEE American Control Conference (ACC), doi: 10.23919/ACC.2018.8431538, 2018.
5. A. Rayamajhi, **Z. Biron**, R. Merco, J. Martin, J.M. Westall, and P. Pisu, "The Impact of Dedicated Short Range Communication on Cooperative Adaptive Cruise Control", IEEE International Conference on Communication (ICC), doi: 10.1109/ICC.2018.8422309, 2018.
6. **Z. Biron**, S.Dey, and P. Pisu, "On Resilient Connected Vehicles under Denial of Service", 2017 American Control Conference (ACC), Seattle, WA, 2017, pp. 4971-4976, doi: 10.23919/ACC.2017.7963725.
7. G. Savaia, **Z. Biron**, and P. Pisu, "A Receding Horizon Switching Control Resilient to Communication Failures for Connected Vehicles", ASME 2017 Dynamic System and Control Conference (DSCC), no. DSCC2017-5195, pp. V001T45A009 (6 pages); doi: 10.1115/DSCC2017-5195.
8. **Z. Biron**, S.Dey, and P. Pisu, "Sensor Fault Diagnosis of Connected Vehicles under Imperfect Communication Network", ASME 2016 Dynamic System and Control Conference (DSCC), no. DSCC2016-9822, pp. V001T16A003 (8 pages); doi: 10.1115/DSCC2016-9822.
9. **Z. Biron**, and P. Pisu, "Observer-Based Diagnostic Scheme for Lithium-Ion Batteries", In Proceedings of the ASME 2015 Dynamic Systems Control Conference (DSCC), no. DSCC2015-9913, pp. V002T19A003 (7 pages); doi: 10.1115/DSCC2015-9913. October 28-30, 2015, Columbus, Ohio, USA, 2015.
10. **Z. Biron**, and P. Pisu, "Sensor and Actuator Fault Detection of Connected Vehicles under Packet Drop out", 18th International Conference on Intelligent Transportation Systems, 2016.
11. S. Dey, **Z. Biron**, S. Tatipamula, N. Das, S. Mohon, P. Pisu, and B. Ayalew, "On-board Thermal Fault Diagnosis of Lithium-ion Batteries for Hybrid Electric Vehicle Application", IFAC Conference, vol. 45, issue. 15, pp. 389-394, 2015.
12. **Z. Biron**, B. HomChaudhuri and P. Pisu, "Observer Design Based Cyber Security for Cyber Physical Systems", 10th Annual Cyber and Information Security Research Conference ACM, Oak Ridge National Lab, 2015.
13. **Z. Biron**, and P. Pisu, "Distributed Fault Detection and Estimation for Cooperative Adaptive Cruise Control System in a Platoon", Prognostics and Health Management Conference (PHM), 2015.
14. **Z. Biron**, M. Hantehzadeh, and A.K. Sedigh, "Multilinear Modeling and Identification of the V94.2 Gas Turbine for Control System Design Purposes", Computer Modeling and Simulation (EMS), 2010 Fourth UKSim European Symposium, pp. 295-300, IEEE 2010, doi: 10.1109/EMS.2010.55.
15. **Z. Biron**, A.K.Sedigh, and R. Abdollahi, "Robust Gas Turbine Speed Control Using QFT", ASME Turbo Expo, no. GT2011-45605, pp. 141-147; doi: 10.1115/GT2011-45605, 2011.

Posters

1. **Z. Biron**, and P. Pisu, Fault Diagnosis of Connected Vehicles, Prognostics and Health Management (PHM), 2015.
2. J. Gill, R. Merco, V. Rastogi, G. Wtkins, D. Kote, H. Diwan, J. Guterrez, Y. Li, **Z. Biron**, P. Pisu, S. Babu, A. Robb, and J. Martin, Virtual Reality Based Simulator for Training and Evaluation of Autonomous Vehicles, NVIDIA's GTC conference, 2017.

TECHNICAL INVITED TALKS

- "Resilient Control of Cyber Physical System in the Presence of Cyber Attacks", Mechanical Engineering Department, Penn State University, April 2019
- "Security of Connected Vehicles", University of Virginia, Mechanical and Aerospace Engineering Department, April 2018
- "Resilient Control of Cyber Physical System with an Application in Connected Vehicles", Electrical and Computer Engineering Department, Virginia Commonwealth University, March 2018
- "Security of Connected Vehicles", San Diego State University, Electrical and Computer Engineering Department, February 2018
- "Control-Oriented Approaches to Secure Power Grid Systems", RTIPS Laboratory, Clemson University, 2017
- "Cyber Security of Cyber Physical Systems with an Application of Connected Vehicles", Doctoral Symposium of Prognostics and Health Management (PHM), 2015
- "On-board Thermal Fault Diagnosis of Lithium-ion Batteries for Hybrid Electric Vehicle Applications", E-COSM 2015
- "Robust Control via QFT Approach for Industrial Gas Turbines", Seminar, Department of Electrical and Computer Engineering, K. N. Toosi University of Technology, 2011

MAJOR CONTRIBUTIONS TO GRANT PROPOSALS

- "Security of Distributed Cyber-Physical Systems with Connected Vehicle Applications, Awarded in NSF Cyber Physical System, \$800,000, 2015.
Principal Investigator: Prof. Pierluigi Pisu (Clemson University) Co-PIs: Prof. Richard Brooks (Clemson University), Prof. Jim Martin (Clemson University)
- "Smart Companion Robot for Automotive Assembly" Awarded in ARM institute, \$1000,000, 2017.
Principal Investigator: Prof. Venkat Krovi (Clemson University) Co-PIs: Prof. Pierluigi Pisu, Prof. Laine Mears, Prof. Yunyi Jia, and Prof. Kapil Madathil (Clemson University)

ACADEMIC RESEARCH EXPERIENCES

1. Stability Control of Connected Vehicles Control
 - Developing PDE model of a string of connected vehicles equipped with Cooperative Adaptive Cruise Control (CACC)
 - Developing PDE based stability analysis of the string of connected vehicles and finding out critical requirement for string stability along with stable individual vehicle
2. Traffic Control
 - Developing a macroscopic model of traffic using the PDE models

- Modeling urban-freeway traffics with the macroscopic PDE models
 - Urban freeway systems fulfill medium and large transportation tasks in big cities and can be controlled through ramp-control of urban roads, freeways and both two networks together
3. Robust Control of Connected Vehicles under Packet Dropping in Communication Network
 - Developing a linear model for a platoon of vehicles equipped with Cooperative Adaptive Cruise Control (CACC) system.
 - Modeling the packet dropping failure in DSRC communication network with Bayesian random variable considering the topology of DSRC protocol
 - Developing a control strategy to mitigate the packet dropping phenomena in DSRC using Kalman filter observer in a platoon of connected vehicles
 4. Connected Vehicles Fault Diagnosis under Imperfect Communication Network
 - Developing fault diagnosis schemes for connected vehicles to diagnose physical and cyber failures under unreliable network
 - Designing two separate observers using sliding mode and Kalman filter approaches to compensate packet dropping and diagnose the sensor faults in the system
 5. Resilient Control of Connected Vehicles under Denial of Service (DoS)
 - Modeling the DoS impact on DSRC communication system with stochastic delays
 - Estimating the states of each vehicle while available measurements delay due to DoS attack
 - Developing a resilient observer-based control strategy to DoS attack in DSRC communication network to modify the performance of the vehicles
 - Luenberger observer state predictor to predict the states of system with delayed measurements
 - Delay estimator using the statistical characteristics of the monitored residuals
 6. State Estimation of Distributed Cyber Physical Systems under Denial of Service (DoS)
 - Modeling the DoS impact on DSRC communication system with unknown delay and PDE transport representation
 - Developing an observer-based algorithm to estimating the states of each subsystem of CPS under delayed measurements due to DoS attack
 - The scheme includes two observers; (i) PDE observer to estimate the unknown delay; (ii) Delayed Luenberger observer to predict the states of system with delayed measurements
 7. PDE Modeling of the Platoon of Vehicles Equipped with CACC
 - Modeling a platoon of connected vehicles equipped with Cooperative Adaptive Cruise Control (CACC) strategy with Ordinary Differential Equations (ODE)
 - Developing new variable of traffic density coupled with local velocity
 - Developing spatial continuous model of the platoon using Partial Differential Equation (PDE) approximation
 8. False Data Injection Attack Detection in Connected Vehicles
 - Modeling the false data injection attack as fake identity in the platoon of vehicles
 - Injecting fake vehicles as ghost vehicles into the platoon of connected vehicles
 - Developing PDE observer design to estimate states of the PDE model of the connected vehicles

- Developing PDE based diagnostic scheme to identify the fake vehicle in the system
9. Denial of Service Attack Estimation in Connected Vehicles
 - Modeling the effect of DoS attack into the DSRC network with unknown constant delay
 - Developing adaptive observer to estimate the unknown delay into the platoon of connected vehicles
 - Evaluation the effectiveness of the approach in the presence of parameter uncertainties and measurement noise
 10. Fuel Economy Management of the Connected Vehicles with Vertical Vibration
 - Modeling connected vehicles with nonlinear model considering vertical vibration suspension model
 - Developing decentralized predictive fuel efficient control strategy for a group of connected vehicles to minimize (i)the over all fuel consumption, and (ii) the vertical vibration for each individual vehicle while, the safety and physical constraints are considered
 - Formulating the problem in the Model Predictive Control (MPC) framework with finite time horizon to calculate the optimal velocity profile
 11. Fuel Economy Management of the Connected Vehicles with Engine Map
 - A decentralized model predictive control (MPC) framework is formulated to predict the optimal velocity profile to optimize the fuel economy and mobility while guaranteeing the safety for every individual vehicle
 - In the MPC framework, an engine map-based fuel consumption model is considered by implementing a backward conventional vehicle model in the MPC cost function

TEACHING EXPERIENCES

University of Florida, ECE Department

- Co-Instructor of Linear Control System, EEL4657, Spring 2019

Clemson University, Automotive Engineering Department

Instructor

- Alternative Energy Sources, AuE 817, spring 2018

Teaching Assistant

- Alternative Energy Sources, AuE 817, CU, Spring 2016
- Hybrid Powertrain Control Lab, CU, Fall 2015
- Alternative Energy Sources, AuE 817, CU, spring 2015
- Sliding Mode Control, AuE 893, CU, Summer 2015
- Vehicle Control and System Design, AuE 827, CU, Fall 2014

K.N.Toosi University of Technology, ECE Department

Teaching Assistant

- Robotic Course, 2009
- Adaptive Control, 2010

University of Tehran, ECE Department

Teaching Assistant

- Linear Control, University of Tehran (UT), 2006

PROFESSIONAL ACTIVITIES

Reviewer

- Journal of Computers and Security
- IEEE Transactions on Control System Technology
- IEEE Transactions on Intelligent Transportation Systems
- IEEE Transactions on Automatic Control
- IEEE Transactions on Vehicular Technology
- Journal of Transportation Research Part C: Emerging Technologies
- ASME Journal of Dynamic Systems, Measurement and Control
- IET Journal of Circuits, Devices, and System
- IET Journal of Communications
- IET Intelligent Transport Systems
- American Control Conference (ACC)
- ASME Dynamic Systems and Control Conference (DSCC)
- IEEE Conference on Decision and Control (CDC)
- IEEE Conference on Control Technology and Applications (CCTA)

Committee Member and Organizer

- Co-Chair, Energy Systems at ASME Dynamic Systems and Control Conference (DSCC), 2019
- Co-Chair, Energy Systems at American Control Conference (DSCC), 2019
- Technical Committee, Prognostics and Health Management (PHM) Conference 2017