Paul J Bonczek

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EDUCATION

University of Virginia Charlottesville, VA
Ph.D., *Electrical Engineering* *Expected Fall 2022*
Present Standing: Passed the Ph.D. candidacy
Ph.D. Advisor: Nicola Bezzo (bezzorobotics.com)
Dissertation Topic: *Randomness-based Behavior Monitoring for Resilient Autonomous Systems Operations*

University of Virginia Charlottesville, VA
M.E., *Electrical Engineering* *May 2021*

State University of New York (SUNY) Polytechnic Institute Utica, NY
B.S., *Electrical & Computer Engineering and Applied Mathematics* (Dual Major) *May 2016*
Cum Laude (GPA: 3.78/4.00)

Onondaga Community College, **SUNY** Syracuse, NY
A.A.S., *Electrical Technology* *May 2013*

RESEARCH EXPERIENCE

University of Virginia, School of Engineering and Applied Sciences Charlottesville, VA
Graduate Research Assistant *January 2018 – Present*

- Characterized various model-based randomness monitoring frameworks to detect stealthy sensor attacks on cyber-physical systems, namely the Cumulative Sign (CUSIGN) and Serial Randomness detectors.
- Examined detection capabilities of CUSIGN in multi-robot swarms under malicious sensor and communication attacks, which allows for system reconfiguration to maintain resilient operations.
- Developed a multi-agent system framework that is resilient to hijacking attempts due to stealthy communication attacks that also can covertly relay safety-critical information through hidden motion signatures.
- Investigate cooperative behaviors in multi-agent systems to aid in recovery/re-localization of vehicles subject to on-board sensor attacks that compromise localization capabilities and formation control performance.
- Formalized a detection and recovery framework to enable safe operations for mobile robots which experience cyberattacks and/or faults to on-board controllers.

RESEARCH INTERESTS

♦ Cyber-Physical System Security ♦ Runtime Monitoring and Detection ♦ Autonomous Systems
♦ Resilient Multi-agent Systems ♦ Robotic Swarms ♦ Adaptive Systems ♦ Secure Control and Autonomy

PUBLICATIONS

[1] **P.J. Bonczek**, R. Peddi, S. Gao, N. Bezzo, "*Detection of Non-random Sign-based Behavior for Resilient Coordination of Robotic Swarms*", in IEEE Transactions on Robotics (T-RO) Special Issue on Resilience in Networked Robotic Systems, vol. 38, no. 1, pp. 92-109, Feb. 2022. DOI: 10.1109/TRO.2021.3139592

[2] **P.J. Bonczek**, N. Bezzo, "*Detection and Inference of Randomness-based Behavior for Resilient Multi-vehicle Coordinated Operations*," IEEE/RSJ International Conference on Intelligent Robotics and Systems (IROS), pp. 5844-5850, 2021. DOI: 10.1109/IROS51168.2021.9635899

[3] **P.J. Bonczek**, N. Bezzo, "*Detection of Hidden Attacks on Cyber-Physical Systems from Serial Magnitude and Sign Randomness Inconsistencies*," IEEE American Control Conference (ACC), pp. 3281-3287, 2021. DOI: 10.23919/ACC50511.2021.9482962

[4] **P.J. Bonczek**, N. Bezzo, "*Memoryless Cumulative Sign Detector for Stealthy CPS Sensor Attacks,"* 21st International Federation of Automatic Control (IFAC) World Congress, vol. 53, no. 2, pp. 838-844, 2020. DOI: 10.1016/j.ifacol.2020.12.840

[5] **P.J. Bonczek**, S. Gao, N. Bezzo, "*Model-based Randomness Monitor for Stealthy Sensor Attacks*," IEEE American Control Conference (ACC), pp. 2036-2042, 2020. DOI: 10.23919/ACC45564.2020.9147412

Under Review

[U1] **P.J. Bonczek**, N. Bezzo, "*Resilient Detection and Recovery of Autonomous Systems Operating under On-board Controller Cyber Attacks*," submitted to the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

[U2] **P.J. Bonczek**, N. Bezzo, "*Resilient Multi-agent Formation Control via RSSI-based Localization*," submitted to the 2022 IEEE Conference on Decision and Control (CDC).

In Preparation

[P1] **P.J. Bonczek**, N. Bezzo, "*A Cooperative Recovery Framework for Safe Multi-robot Operations: Exploiting Randomness*," in preparation for submission to IEEE Robotics and Automation Letters (RA-L).

[P2] **P.J. Bonczek**, N. Bezzo, "*A Characterization of a Run Randomness Detector for Stealthy Sensor Attacks on Cyber-Physical Systems*," in preparation for submission to IEEE Control Systems Letters (L-CSS).

PRESENTATIONS

UVA Link Lab Student Flash Talks	*2020*
University of Virginia Engineering Research Symposium (UVERS) Finalist	*2020*
UVA Link Lab Student Research Poster and Talk	*2019*
UVA ECE Student Research Poster Session	*2018*

TEACHING EXPERIENCE

University of Virginia, School of Engineering and Applied Sciences — Charlottesville, VA

Graduate Teaching Assistant

ECE Capstone (Advisement, Discussion, and Grading) — *Fall 2016, Fall 2017*

- Advised (~50 students) undergraduate students with senior capstone projects.

Fundamentals II (Grading) — *Spring 2017*

Fundamentals III (Grading) — *Spring 2017*

Electromagnetic Energy Conversion (Grading and Lab Instructor) — *Spring 2020*

PROFESSIONAL EXPERIENCE

Griffiss Institute at the Air Force Research Laboratory — Rome, NY

Engineering Intern — *Summer 2016*

- Worked with a team of interns to set up and test a photonic-based neuromorphic computer.
- Learned to wire-bond.

Griffiss Institute at the Air Force Research Laboratory Rome, NY
Engineering Intern *Summer 2015*

- Designed and built an analog PID controller for an inverted pendulum as a test case for adaptive abilities using memristors.

Griffiss Institute at the Air Force Research Laboratory Rome, NY
Engineering Intern *Summer 2014*

- Memristor testing to observe switching resistive properties.

IR Cameras, LLC Utica, NY
Engineering Intern *July 2013 – May 2014*

- Quality control testing for the packaging assembly of Infrared (IR) cameras.

PROFESSIONAL ACTIVITIES

Scientific Paper Reviewer

IEEE American Control Conference (ACC)	*2019, 2020, 2022*
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)	*2021, 2022*
IEEE Transactions on Robotics (T-RO)	*2021*
International Conference on Cyber-Physical Systems (ICCPS)	*2021*
IEEE International Conference on Robotics and Automation (ICRA)	*2021*
International Federation of Automatic Control (IFAC) World Congress	*2020*
IEEE Conference on Decision and Control (CDC)	*2019, 2022*
IEEE Robotics and Automation Letters (RA-L)	*2019*
IEEE Mediterranean Conference on Control and Automation (MED)	*2022*
Learning for Dynamics and Control Conference (L4DC)	*2022*

Memberships

Institute of Electrical and Electronics Engineers (IEEE), Student member *2019 – Present*
IEEE Societies: Young Professionals (YP), Robotics and Automation (RAS), Control Systems (CSS), Aerospace and Electronic Systems (AESS), Information Theory (ITSOC), Intelligent Transportation Systems (ITSS), Systems, Man, and Cybernetics (SMC)

AWARDS & CERTIFICATES

Academic Achievement Award *2016*
SUNY Polytechnic Institute
-Highest GPA for Applied Mathematics courses upon graduation (4.0)

President's Honor List *Fall 2014, Spring 2015, Fall 2015, Spring 2016*
SUNY Polytechnic Institute

Coursera Deep Learning Specialization *2020*
ID: 58HLTKUBXRR2

RELEVANT COURSEWORK

- Autonomous Mobile Robotics
- Multivariable Robust Control Theory
- Probability and Stochastic Processes
- Reinforcement Learning
- Adaptive Control Theory
- Digital Control Theory

SKILLS & INTERESTS

Programming: Proficient in MATLAB, Python. Basics of R, C++, Arduino
Tools: LaTeX, Microsoft Office and PowerPoint, GitHub, Simulink, iMovie
Interests: Cooking, Scuba diving, hiking, WWII history