JOSEPH E. GAUDIO

https://josephgaudio.github.io

RESEARCH RELATED EXPERIENCE

Aurora Flight Sciences, a Boeing Company Cambridge, MA
Research Scientist - Intelligent Systems and Control *June 2020 — Present*

Research and development in intelligent systems, autonomy, and control.

Massachusetts Institute of Technology — Active Adaptive Control Laboratory Cambridge, MA
Research Assistant *September 2016 — May 2020*

Research at the intersection of online learning, adaptive systems, control theory, and machine learning:

- Stability theory in learning, leveraging the intersections between machine learning and adaptive control.
- Parameter convergence in online learning problems using adaptive algorithms.
- Online learning and control in the presence of time-varying features, nonlinear algorithms.
- Control of adaptive systems in the presence of constraints.
- Guidance, Navigation, and Control (GNC) of aerial vehicles.

Collaboration with The Boeing Company and the Air Force Research Laboratory (AFRL).

The Boeing Company Seattle, WA
Research Intern - Control & Autonomy *June 2018 — August 2018*

Developed a fault detection and isolation architecture for nonlinear systems in the Control & Autonomy group in Boeing Research & Technology (BR&T).

The Boeing Company St. Louis, MO
Guidance, Navigation and Control Intern *June 2017 — August 2017*

Developed adaptive controllers to augment existing control architectures of F15 manned fighter aircraft in the presence of significant plant uncertainty.

The Boeing Company St. Louis, MO
Guidance, Navigation and Control Intern *May 2016 — August 2016*

Developed multiple controllers for a plant with significant time and parameter varying uncertainties within the Advanced Flight Controls team in the Boeing Phantom Works. Controllers featured robust and adaptive components.

The Boeing Company St. Louis, MO
Guidance, Navigation and Control Intern *May 2015 — August 2015*

Implemented new autopilot architectures on unmanned aerial systems (UAS) within the Advanced Flight Controls team in the Boeing Phantom Works. Utilized 6-DOF simulation models as well as time and frequency domain tools to analyze system performance.

University of Illinois at Urbana-Champaign — Control Systems Laboratories Champaign, IL
Control Systems/Mechatronics Assistant *August 2014 — May 2016*

University of Illinois at Urbana-Champaign — Ewoldt Research Group Champaign, IL
Research Assistant *January 2013 — January 2014*

EDUCATION

Massachusetts Institute of Technology Cambridge, MA
PhD Mechanical Engineering, Minor Mathematics *May 2020*
Thesis: Fast Learning and Adaptation in Control and Machine Learning
Advisor: Dr. Anuradha M. Annaswamy

University of Illinois at Urbana-Champaign — Champaign, IL
BS Mechanical Engineering, Minor Electrical Engineering — *May 2016*

University College London — London, United Kingdom
Study abroad in the Department of Electronic and Electrical Engineering — *January 2015 — May 2015*

PUBLICATIONS

Cui Y, **Gaudio JE**, Annaswamy AM, "A New Algorithm for Discrete-Time Parameter Estimation," *arXiv:2103.16653*, 2021.

McDonald S, Cui Y, **Gaudio JE**, Annaswamy AM, "A High-order Tuner for Accelerated Learning and Control," *arXiv:2103.12868*, 2021.

Gaudio JE, Annaswamy AM, Moreu JM, Bolender MA, Gibson TE, "Accelerated Learning with Robustness to Adversarial Regressors," *Learning for Dynamics and Control (L4DC)*, 2021.

Sarker A, **Gaudio JE**, Annaswamy AM, "Parameter Estimation Bounds Based on the Theory of Spectral Lines," *arXiv:2006.12687*, 2020.

Gaudio JE, Annaswamy AM, Bolender MA, Lavretsky E, Gibson TE, "A Class of High Order Tuners for Adaptive Systems," *IEEE Control Systems Letters (L-CSS)*, 2020; Selected for presentation at the *59th IEEE Conference on Decision and Control (CDC)*, 2020.

Gaudio JE, Annaswamy AM, Lavretsky E, Bolender MA, "Fast Parameter Convergence in Adaptive Flight Control," *AIAA Guidance, Navigation, and Control Conference*, 2020.

Gaudio JE, Annaswamy AM, Lavretsky E, Bolender MA, "Parameter Estimation in Adaptive Control of Time-Varying Systems Under a Range of Excitation Conditions," *arXiv:1911.03810*, 2019.

Gaudio JE, Gibson TE, Annaswamy AM, Bolender MA, Lavretsky E, "Connections Between Adaptive Control and Optimization in Machine Learning," *58th IEEE Conference on Decision and Control (CDC)*, 2019; *International Conference on Machine Learning (ICML), Workshop on Adaptive & Multitask Learning*, 2019.

Gaudio JE, Gibson TE, Annaswamy AM, Bolender MA, "Provably Correct Learning Algorithms in the Presence of Time-Varying Features Using a Variational Perspective," *International Conference on Machine Learning (ICML), Workshop on Real-world Sequential Decision Making: Reinforcement Learning and Beyond*, 2019; *arXiv:1903.04666*, 2019.

Annaswamy AM, **Gaudio JE**, "Robust Adaptive Control," *Encyclopedia of Systems and Control*, Springer London, 2019.

Gaudio JE, Annaswamy AM, Bolender MA, Lavretsky E, "Adaptive Flight Control in the Presence of Limits on Magnitude and Rate," *arXiv:1907.11913*, 2019.

Gaudio JE, Annaswamy AM, Lavretsky E, "Adaptive Control of Hypersonic Vehicles in the Presence of Rate Limits," *AIAA Guidance, Navigation, and Control Conference*, 2018.

Blackwell BC, Deetjen ME, **Gaudio JE**, Ewoldt RH, "Quantitative Measures of Yield-Stress Fluid Drop Impacts on Coated Surfaces," *Atomization and Sprays*, 2017.

Blackwell BC, Deetjen ME, **Gaudio JE**, Ewoldt RH, "Sticking and Splashing in Yield-Stress Fluid Droplet Impacts on Coated Surfaces," *Physics of Fluids*, 2015.

Deetjen ME, Blackwell BC, **Gaudio JE**, Ewoldt RH, "Liquid-Solid Impacts of Yield-Stress Fluids," *APS Division of Fluid Dynamics 66th Annual Meeting*, Pittsburgh, 2013.

CONFERENCE WORKSHOPS ORGANIZED

Gibson TE, **Gaudio JE**, Annaswamy AM, "Intersections of Machine Learning and Parameter Estimation in Control," *57th IEEE Conference on Decision and Control (CDC)*, 2018.

CONFERENCE INVITED SESSIONS ORGANIZED

Gaudio JE, Dibaji SM, Gibson TE, Annaswamy AM, "Machine Learning in Control, Theory and Applications I&II," *58th IEEE Conference on Decision and Control (CDC)*, 2019.

CONFERENCE PRESENTATIONS

"Fast Parameter Convergence in Adaptive Flight Control," *Aerospace Control and Guidance Systems Committee (ACGSC) Meeting 125*, 2020.

"Connections Between Adaptive Control and Optimization in Machine Learning," *58th IEEE Conference on Decision and Control (CDC)*, 2019.

"Adaptive Control Theory in the Presence of Hard Limits on Magnitude and Rate with Aerospace Applications," *LIDS Student Conference*, 2018.

"Adaptive Control of Hypersonic Vehicles in the Presence of Rate Limits," *AIAA Guidance, Navigation, and Control Conference*, 2018 (Invited Presentation).

POSTER PRESENTATIONS

"Provably Correct Learning Algorithms in the Presence of Time-Varying Features Using a Variational Perspective," *International Conference on Machine Learning (ICML), Workshop on Real-world Sequential Decision Making: Reinforcement Learning and Beyond*, 2019.

"Connections Between Optimization in Machine Learning and Adaptive Control," *International Conference on Machine Learning (ICML), Workshop on Adaptive & Multitask Learning*, 2019.

"Stable and Fast Learning with Momentum and Adaptive Rates," *Learning for Dynamics and Control (L4DC)*, 2019.

"Connections Between Adaptive Control and Machine Learning," *Learning for Dynamics and Control (L4DC)*, 2019.

"Accelerated Learning in the Presence of Time Varying Features," *LIDS Student Conference*, 2019.

"Accelerated Learning in the Presence of Time Varying Features," *MIFODS Workshop on Non-Convex Optimization and Deep Learning*, 2019.

"On Robustness and Acceleration for Linear Dynamical Systems," *Princeton Day of Optimization*, 2018.

TECHNICAL COMMITTEES

IEEE Control Systems Society: Technical Committee on Intelligent Control (TCIC).

IEEE Control Systems Society: Technical Committee on System Identification and Adaptive Control (TCSIAC).

TEACHING AND MENTORING EXPERIENCE

Teaching Assistant for MIT 2.153: Adaptive Control and Connections to Machine Learning - Held weekly office hours, taught one lecture, and graded problem sets.

Mentor for a SuperUROP project on learning methods for fault detection in aerial vehicles.

AWARDS AND HONORS

Sontheimer Travel Award in Mechanical Engineering, MIT

National Science Foundation Graduate Research Fellowship Program — Honorable Mention 2016, 2018

James Scholar, UIUC

University Honors/Bronze Tablet (Top 3 Percent of Graduating Class), UIUC

Undergraduate Research Opportunities Program — Research Award Recipient, UIUC

Seichi Konzo Memorial Award for Outstanding Student in Mechanical Engineering, UIUC

PAPER REVIEWING

IEEE Transactions on Automatic Control; IEEE Transactions on Control Systems Technology; IEEE Control Systems Letters; Annual Reviews in Control; AIAA Journal of Guidance, Control, and Dynamics; American Control Conference (ACC); Learning for Dynamics and Control (L4DC).

ADDITIONAL EXPERIENCE

GE Aviation Evendale, OH
Development Engine Assembly Intern *June 2014 — August 2014*

Provisur Technologies Mokena, IL
R&D Mechanical Engineering Intern *May 2013 — August 2013*

TECHNICAL SKILLS

Computer Languages MATLAB/Simulink
Software & Tools LaTeX