

# JOSEPH E. GAUDIO

<https://josephgaudio.github.io>

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## RESEARCH RELATED EXPERIENCE

### **Aurora Flight Sciences, a Boeing Company**

*Research Scientist - Intelligent Systems and Control*

Cambridge, MA

*June 2020 — Present*

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

### **Massachusetts Institute of Technology — Active Adaptive Control Laboratory**

*Research Assistant*

Cambridge, MA

*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**

*Research Intern - Control & Autonomy*

Seattle, WA

*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**

*Guidance, Navigation and Control Intern*

St. Louis, MO

*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**

*Guidance, Navigation and Control Intern*

St. Louis, MO

*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**

*Guidance, Navigation and Control Intern*

St. Louis, MO

*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**

*Control Systems/Mechatronics Assistant*

Champaign, IL

*August 2014 — May 2016*

### **University of Illinois at Urbana-Champaign — Ewoldt Research Group**

*Research Assistant*

Champaign, IL

*January 2013 — January 2014*

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## EDUCATION

### **Massachusetts Institute of Technology**

*PhD Mechanical Engineering, Minor Mathematics*

Cambridge, MA

*May 2020*

Thesis: Fast Learning and Adaptation in Control and Machine Learning

Advisor: Dr. Anuradha M. Annaswamy

## PUBLICATIONS

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**Gaudio JE**, Annaswamy AM, Lavretsky E, Bolender MA, “Parameter Estimation in Adaptive Control of Time-Varying Systems Under a Range of Excitation Conditions,” *IEEE Transactions on Automatic Control*, 2022 (Accepted).

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**, 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

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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

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**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

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“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

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“Accelerated Learning with Robustness to Adversarial Regressors,” *Learning for Dynamics and Control (L4DC)*, 2021.

“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

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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

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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

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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

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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

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### GE Aviation

*Development Engine Assembly Intern*

Evendale, OH

*June 2014 — August 2014*

### Provisur Technologies

*R&D Mechanical Engineering Intern*

Mokena, IL

*May 2013 — August 2013*

## TECHNICAL SKILLS

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### Computer Languages

MATLAB/Simulink

### Software & Tools

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