

Brian Lai

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EDUCATION

University of Michigan, Ann Arbor

Ph.D. Student in Aerospace Engineering; GPA: 3.99/4.0

Ann Arbor, MI

September 2020 - Present

- NSF GRFP Fellow

Rutgers University, New Brunswick

B.S. in Mechanical Engineering (Aerospace Concentration), Double Major in Mathematics; GPA: 4.0/4.0

New Brunswick, NJ

September 2016 - May 2020

Affiliations: Engineering Honors Academy, Tau Beta Pi

RESEARCH EXPERIENCE

Regularization-Induced Bias and Consistency in Recursive Least Squares

University of Michigan

Ph.D. Student — Advised by Professor [Dennis Bernstein](#)

July 2020 - Present

- **Summary:** Study the effect of regularization-induced bias on recursive least squares (RLS) parameter estimation
 - * Numerically and analytically quantified the transient and asymptotic accuracy of RLS parameter estimation

Nonlinear Trajectory Based Region of Attraction Estimation for Aircraft Dynamics Analysis

Rutgers University

James J. Slade Scholar — Advised by Professor [Laurent Burlion](#)

May 2019 - June 2020

- **Fellowship:** Recipient of the NJ NASA Space Grant Consortium Academic Year Fellowship
- **Program:** Conduct independent thesis research and earn 6 graduate research credits through the James J. Slade Program
 - * Developed algorithms adaptations to improve the robustness and speed of convergence of ROA estimation
 - * Generalized algorithm to nonlinear ODE systems with general equilibrium sets
 - * Algorithm applied to estimate the nonlinear 4-state longitudinal stability of the NASA GTM aircraft

Developing a Droplet Based Resin Feed System for Micro-Stereolithography Printing

Rutgers University

Research Assistant — Advised by Professor [Howon Lee](#)

August 2017 - May 2018

- **Summary:** Successful printing at 50 micron print depth up to ~100 layers using 1,6-Hexanediol diacrylate (HDDA) resin
 - * Invited to present to 100+ undergraduates, faculty, and engineers at Boeing's 2018 Engineer's Week in Philadelphia
- **Manufacturing:** Designed and machined PDMS belt actuator to deliver droplets of liquid polymer resin to projection system
- **Controls:** Developed control system in LabVIEW to successfully automate PDMS belt actuator and projection system

PROFESSIONAL EXPERIENCE

Air Force Research Laboratory, Munitions Directorate

Eglin Air Force Base, FL (Virtual)

Research Intern, Interim Secret Security Clearance

June 2021 - August 2021

- **Summary:** Developed online real-time data-driven estimation and control methods for flight control systems.
 - * Refined Retrospective Cost Adaptive PID Control to improve controller robustness and to reduce required controller tuning.
 - * Applied the adaptive PID controller to a quadrotor model under adverse and changing flight conditions.

The VMC Group: Vibration Isolation

Bloomington, NJ

Industrial Engineering Intern

June 2019 - August 2019

- **Industrial Engineering:** Responsible for making Bill of Materials (BoMs) and Methods of Manufacturing (MoMs) in Epicor ERP for all jobs in 3 different product series.
 - * Cut process time for creating BoMs and MoMs by 75% by automating raw material calculations using Excel VBA
- **Applications Engineering:** Ran concrete anchor analyses using Hilti PROFIS Anchor on 12 different [Spring Mount Isolators](#) to determine tension and shear utilization on Anchor Bolts
- **Software Development:** Developed a robust algorithm in JavaScript to determine material cut-lists for both standard and 80% of custom [Roof Mounted Seismic Isolators](#)

Cozzoli Machine Company: Advanced Packaging Machinery

Somerset, NJ

Mechanical Design Engineering Intern

September 2018 - May 2019

- **Summary:** Developed the [REFCC Monoblock Filler](#), capable of filling 60+ vials/min at $\pm 0.5\%$ fill accuracy, up to ISO 9001
- **Design and Drafting:** Used SolidWorks to design, model, and draft over 400 machine components
 - * Responsible for the design of all "Vial Change Assemblies": Mechanical assemblies which move vials and caps throughout the filling/capping process. 8 unique sets made, comprising 150+ original parts and 20+ original assemblies
 - * Interpreted engineering drawings to update 200+ outdated parts and assemblies
- **Analysis:** Performed mass moment of inertia analysis on 4 different power transmission systems to successfully recommend servo motor replacements for mechanical indexing

NJ Governor's School of Engineering and Technology (NJGSET)

Research Coordinator

Piscataway, NJ

May 2017 - July 2019

- **Summary:** Supervisor to 9 counselors, 13 project mentors, and 15 research groups of 4-5 exceptional high school scholars
- **Responsibilities:** Established project guidelines, reviewed all presentations and research papers, organized [final symposium](#) including 10 volunteers and 300+ attendees, and managed program research budget of \$5,000
 - * 14 groups applied and were selected to present at the 2018 [MIT IEEE Undergraduate Research Conference](#)
 - * Mentored 4 groups in [Bipedal Robotics](#), [Lean Manufacturing](#), [Wind Turbine Design](#), and [Autonomous Drone Landing](#)

PUBLICATIONS

- [1] **B. Lai**, S. A. U. Islam, and D. Bernstein, "Regularization-induced bias and consistency in recursive least squares," in [Proceedings of the American Control Conference](#), 2021.
- [2] **B. Lai**, T. Cunis, and L. Burlion, "Nonlinear trajectory based region of attraction estimation for aircraft dynamics analysis," in [AIAA Scitech 2021 Forum](#), 2021, [[link](#)].
- [3] J. Arrigo, V. Chen, Z. K. Guha, A. Kruthiventy, R. Valencia, and **B. Lai**, "A visionless autonomous quadcopter landing," in [2019 IEEE MIT Undergraduate Research Technology Conference \(URTC\)](#), 2019, [[link](#)].
- [4] R. Sharma, M. Kasher, L. Zhang, N. Mani, and **B. Lai**, "Application of lean manufacturing principles in optimizing factory production," in [2018 IEEE MIT Undergraduate Research Technology Conference \(URTC\)](#), 2018, [[link](#)].
- [5] S. Alankar, J. Chen, T. Kadela, E. Petrov, D. Voronin, and **B. Lai**, "Analysis and construction of a bipedal walking robot," in [2017 IEEE MIT Undergraduate Research Technology Conference \(URTC\)](#), 2017, [[link](#)].

HONORS & AWARDS

- **NSF Graduate Research Fellow** — NSF Graduate Research Fellowship Program (GRFP) April 2021 - Present
- **Matthew Leydt Society (top 2% of graduating class)** — Rutgers University, New Brunswick May 2020
- **Math Honors (1 of 16 selected among graduating class)** — Rutgers Mathematics Department May 2020
- **NASA Space Grant Fellowship Recipient** — NJ NASA Space Grant Consortium September 2019 - May 2020
- **James J. Slade Research Scholar** — Rutgers School of Engineering June 2019 - May 2020
- **PMMI Member Family Scholarship Recipient** — The Association for Packaging and Processing Technologies May 2019
- **Kuhl Memorial Engineering Scholarship Recipient** — Rutgers School of Engineering August 2018
- **Rutgers Scarlet Scholarship Recipient** — Rutgers University, New Brunswick September 2016 - May 2020

TEACHING

- **Rutgers Learning Centers: [Learning Assistant](#)** September 2017 - May 2020
 - **MATH 311** - Introduction to Real Analysis (*Summer 2019*)
 - **MATH 300** - Introduction to Mathematical Reasoning (*Spring 2019, Fall 2019*)
 - **MATH 152** - Calculus II for the Mathematical and Physical Sciences (*Spring 2018*)
 - **MATH 151** - Calculus I for the Mathematical and Physical Sciences (*Fall 2017, Spring 2018, Fall 2018*)
- **Rutgers Learning Centers: [Group Tutor](#)** December 2016 - December 2019
 - **MATH 421** - Advanced Calculus for Engineering (*Spring 2018 - Present*)
 - **MATH 311** - Introduction to Real Analysis (*Fall 2019 - Present*)
 - **MATH 300** - Introduction to Mathematical Reasoning (*Spring 2019 - Present*)
 - **MATH 251** - Multivariable Calculus (*Fall 2017 - Present*)
 - **MATH 244** - Differential Equations for Engineering and Physics (*Fall 2017 - Present*)
 - **ENG 222** - Engineering Mechanics: Dynamics (*Spring 2018*)
 - **ENG 221** - Engineering Mechanics: Statics (*Fall 2017 - Spring 2018*)
 - **MATH 152** - Calculus II for the Mathematical and Physical Sciences (*Spring 2017 - Present*)
 - **MATH 151** - Calculus I for the Mathematical and Physical Sciences (*Spring 2017 - Present*)

UNIVERSITY INVOLVEMENT

- **2020 Rutgers Undergraduate Mathematics Problem Solving Competition:** 1st place out of 11 teams competing *April 2020*
- **Rutgers Tau Beta Pi (TBP):** Academic Affairs Chair *January 2019 - May 2020*
 - Led 10 TBP members to share their experience doing undergraduate research with 50+ first year engineering students
- **2019 Garden State (NJ) Undergraduate Mathematics Competition:** 3rd place out of 28 teams competing *April 2019*
- **Honors Academy Study Sessions:** Founder & Director *August 2017 - May 2018*
 - Managed 15 tutors to bring 25 weekly study sessions to freshman residence halls
 - 150+ community service hours awarded yearly

SKILLS

- **Programming Languages:** MATLAB, LaTeX, C++, Excel VBA, JavaScript, Java, Python **Languages:** English, Chinese, Spanish
- **Design and Analysis:** SolidWorks, GD&T, DFMA Principles, Hilti PROFIS, ANSYS
- **Manufacturing:** Epicor ERP System, Lean Manufacturing, 5S, Mill Lathe and CNC experience