DREW STEEVES

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SUMMARY

PhD candidate in Mechanical & Aerospace Engineering with expertise in the control of dynamical systems, safety-critical control with applications to autonomous vehicles, and performance-driven control with applications to robotic systems. Industry experience at Ford Motor in ADAS development and performance-driven safety design and verification for autonomous vehicles, and in deep neural network architecture for image classification at Mitsubishi Electric Research Lab. Software experience in Matlab/Simulink and Python. Has achieved international recognition for award-winning theoretical contributions to the field. *Strong interest in leveraging theoretical expertise and programming skills to add high value in a corporate setting.*

EDUCATION

Ph.D., Controls Engineering, University of California, San Diego — Sept. 2017 – Dec. 2022 (exp.)

M.A.Sc., Applied Math & Engineering, Queen's University, Canada — Sept. 2015 – Aug. 2017

B.Sc., Mechanical Engineering, Queen's University, Canada — Sept. 2011 – May 2015

INDUSTRY EXPERIENCE

Advanced Controls Intern, ADAS & Safety — Summer 2022
Ford Motor Company — *Dearborn, MI*

- Developed and tested a safety-critical control algorithm that eliminates unnecessary interventions by the safety filter when passing large oncoming vehicles (e.g., Tesla's phantom braking)
- Advanced a safety-critical design that leverages backup safe policies to predict safety forward in time and avoid unsafe behaviors
- Refined an optimization framework that reduces computationally-heavy distributed co-optimization problems to quadratic programs with quadratic constraints; reduces computation time by >10x
- Leveraged Matlab expertise (quadprog, fmincon, ODYS) to efficiently solve optimization problems which enforce AV safety: developed simulations to verify control/safety design in several highway-driving, low-speed driving, and four-way intersection scenarios, where design exceeded performance of existing methods (no passing interference, numerically efficient and tractable)
- Contributed to the development of Ford's L3-autonomy ADAS by creating safety monitoring system during lane changes, designing lane change abort maneuvers; integrated design into Ford's object-oriented driving simulator to verify effectiveness
- Communicated with research scientists across several projects at Ford to integrate feedback into the safety design; work was highly regarded and praised across Research & Advanced Engineering department

Research Intern, Learning — Summer 2019
Mitsubishi Electric Research Lab — *Cambridge, MA*

- Proposed a new, faster training algorithm for Deep Neural Network architectures (residual, convolution) for image classification problems in machine learning based on differential flatness properties for control systems
- Collaborated across the Data Analytics group at MERL to support and promote the NN training design

RESEARCH EXPERIENCE

Ph.D. Researcher — Sept. 2017 – present
University of California San Diego — *La Jolla, CA*

- Invented performance-driven control & safety algorithms for autonomous vehicles, robotic and flexible beam systems by combining novel time-varying methods with control (PID, MPC, adaptive), safety-critical design (CBF), estimation, and time-delay compensation to generate robust, industry-relevant algorithms
- Acclaimed research portfolio recognized by multiple merit-based invitations for high-profile talks at international conferences & venues, including mission-critical control design discussions at the Air Force Office of Scientific Research's Basic Research Innovation Collaboration Center (BRICC)
- Developed safety-critical algorithms for AVs that minimize deviations from planned trajectory and respect actuator/road constraints; led to 2x reduction in steering input while retaining (least-squares) closest safe passing distance to obstacle, and safely navigated multiple late-detected obstacles
- Designed finite-time tracking algorithms for robotics & flexible beams in noisy but mission-critical environments; robustness and peaking issues eliminated
- Tailored, applied, and examined designs efficiently in Matlab (fmincon, quadprog) & Python to identify key problem attributes that led to design improvements
- Awarded $375,046 by the National Science Foundation for co-authoring grant proposal (with PI) based on dissertation research

- Leveraged 10+ years expertise in mathematics and engineering to solve complex controls problems and publish 15+ peer-reviewed journal and conference papers
- Initiated and guided several international research collaborations that delivered high-impact research papers

M.A.Sc. & B.Sc. Researcher June 2013 – Aug. 2017
Queen's University *Kingston, ON (Canada)*

- Awarded SIAM Control and Optimization Best Paper Prize (first student awardee in history) for thesis work on coupled partial differential equations applying to epidemic and wildfire spreading models; invited to give short plenary lecture at CT21
- Leveraged Matlab skills to efficiently manipulate and decompose large data structures (dmperm) into sub-problems to isolate important connectivity properties of control systems for efficient control and motion planning design
- Led and co-organized Nonlinear Systems and Control seminar for department's graduate student research group
- Designed stabilizing controllers for synchronizing coupled oscillators for smart power grid systems
- Simulated control algorithm on complex IEEE test cases in Matlab/Simulink
- Earned departmental recognition for research contributions (Keyser Prize)

RELEVANT EXPERIENCE

Lab Curriculum Developer Summer 2015
Queen's University *Kingston, ON (Canada)*

- Created Simulink-based lab curriculum for swing-up/stabilization of inverted rotary pendulum and stabilization/estimation of rotary flexible beam for Modern Control Theory course
- Generated equations of motion for physical systems using Euler-Lagrange method
- Setup data acquisition for encoders, strain gauges, servo motors to interface with Matlab/Simulink (QUARC) and tuned parameters for physical systems/gear ratios/moments
- Developed control (pole-placement, LQR) and estimation (Luenberger) algorithms and created lab manual questions and deliverables to guide students through control design

OTHER EXPERIENCE

Teaching Fellow Jan. 2021 - June 2022
University of California, San Diego *La Jolla, CA*

- Taught Nonlinear Systems graduate course (input-to-state stability, Lyapunov stability, perturbation theory, control); provided one-on-one tutoring for PhD students for analyzing nonlinear control systems
- Instructed Programming for Engineering Analysis undergrad course (structures, data manipulation, selection statements)
- Led programming lab and guided students with final Matlab programming projects

Visiting Researcher Summer 2019
University of Sevilla *Andalusia (Spain)*

- Invited to participate in doctorate course on the control of infinite-dimensional systems, including flexible beams, time-delay systems, and multi-agent swarm control
- Contributed to research project on high-performance estimation for lithium-ion battery state-of-charge models
- Disseminated research to leading international controls community in Spain

SKILLS

Software Matlab/Simulink, Python
Language English (native), French (fluent)

SELECTED PUBLICATIONS

- **Drew Steeves** and Miroslav Krstic, "Prescribed-Time Stabilization Robust to Measurement Disturbances", American Control Conference, 2022
- Sven Brüggemann, **Drew Steeves**, and Miroslav Krstic, "Simultaneous Lane-Keeping and Obstacle Avoidance by Combining Model Predictive Control and Control Barrier Functions" IEEE Conference on Decision and Control, 2022 *(to appear)*
- Imoleayo Abel, **Drew Steeves**, and Miroslav Krstic, "Prescribed-Time Safety Design for a Chain of Integrators", American Control Conference, 2022
- **Drew Steeves**, Nicolas Espitia, Miroslav Krstic, and Wilfrid Perruquetti, "Input Delay Compensation in Prescribed-Time of Boundary-Actuated Reaction-Diffusion PDEs", American Control Conference, 2021
- **Drew Steeves**, Bahman Gharesifard, and Abdol-Reza Mansouri. (2019) "Controllability of Coupled Parabolic Systems with Multiple Underactuations, Part 1: Algebraic Solvability", SIAM Journal on Control and Optimization, 2019