Sepehr Moalemi

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Education

M.Sc. Mechanical Engineering (Thesis)
McGill University | 2022 - 2025 (Expected)
Supervisor: Prof. James Richard Forbes

B.Eng. Mechanical Engineering (Honors), Minor in Computer Science, Minor in Mathematics
McGill University | 2017 - 2022

Publications

Peer-Reviewed

[C] **S. Moalemi** and J. R. Forbes, "Passivity-Based Gain-Scheduled Control with Scheduling Matrices," *IEEE Conference on Control Technology and Applications (**CCTA**)*, pp. 7-13, 2024.

[C] **S. Moalemi** and J. R. Forbes, "Input-Output Stability of Gradient Descent: A Discrete-Time Passivity-Based Approach," *American Control Conference (**ACC**)* [To Appear].

[J] **S. Moalemi** and J. R. Forbes, "Matrix-Scheduling of QSR-Dissipative Systems," *IEEE Transactions on Automatic Control (**TAC**)* [To Appear].

Research Experience

M.Sc. Thesis Candidate
McGill Dynamics, Estimation, and Control in Aerospace and Robotics (DECAR) Group | 2022 - Present
Supervisor: Prof. James Richard Forbes

Thesis topic: Optimization as a Control Problem.

Developed a novel matrix-gain-scheduling architecture within the context of passivity-based control theory. The use of scheduling matrices is a generalization of the scalar scheduling signals used in the literature, and allows for greater design freedom.

Showed that for a class of functions with sector-bounded gradients, gradient descent method can be interpreted as a passive controller in negative feedback with a very strictly passive system. Consequently, used the passivity theorem to guarantee the input-output stability, as well as the global convergence, of the gradient descent method.

Undergraduate Honors Thesis
McGill Computational Aerodynamics Group | 2020 - 2021
Supervisor: Prof. Siva Nadarajah

Thesis: "Discontinuous Galerkin Isogeometric Analysis of Hyperbolic PDEs," McGill University, 2021.

Developed a higher order 3D grid reader in `C++` to read files into the `deal.II` finite element library and solve various hyperbolic PDEs.

Research Assistant
McGill Computational Aerodynamics Group | Summer 2020
Supervisor: Prof. Siva Nadarajah

Developed a `C++` program to solve the 2D Laplace equation using a higher order discontinuous Galerkin method with non-uniform rational B-spline (NURBS) basis functions.

Presentations

Passivity-Based Gain-Scheduled Control with Scheduling Matrices
The 8th IEEE Conference on Control Technology and Applications (CCTA)
Newcastle upon Tyne, UK | Aug 21, 2024

Input-Output Stability of First-Order Optimization Algorithms: A Passivity Approach
The 25th International Symposium on Mathematical Programming (ISMP)
Montreal, Canada | Jul 24, 2024

Discontinuous Galerkin Isogeometric Analysis of Hyperbolic PDEs
McGill Mechanical Engineering Undergraduate Honors Thesis Presentations
Montreal, Canada | Nov 27, 2020

Awards

Graduate Research Enhancement and Travel (GREAT) Award: $800	Winter 2025
McGill Engineering Undergraduate Student Masters Award (MEUSMA): $35,000	2022 - 2024
Graduate Excellence Fellowship Award (GEF): $3,000	Winter 2023
Tomlinson Engagement Award for Mentoring (TEAM): $600	Fall 2021
NSERC Undergraduate Summer Research Award (USRA): $5,625	Summer 2020
Tomlinson Engagement Award for Mentoring (TEAM): $600	Fall 2019

Teaching

McGill University

Teaching Assistant and Grader
Led weekly tutorials, graded assignments, held office hours, and invigilated exams for the following course:

Mech 309: Numerical Methods	Instructor: Prof. James Richard Forbes	Fall 2022

Teaching Assistant
Led weekly tutorials and held office hours for the following courses:

Math 264: Advanced Calculus	Instructor: Mr. Sean Bibby	Summer 2022
Math 262: Intermediate Calculus	Instructor: Dr. Kevin Church	Fall 2021
Math 262: Intermediate Calculus	Instructor: Prof. Charles Roth	Winter 2020
Math 264: Advanced Calculus	Instructor: Prof. Biji Wong	Fall 2019
Math 262: Intermediate Calculus	Instructor: Prof. Dmitry Jakobson	Summer 2019
Math 262: Intermediate Calculus	Instructor: Prof. Charles Roth	Winter 2019

Engineering Peer Tutoring Service (EPTS) Tutor
Held office hours twice a week and conducted midterm/final exam review sessions for the following courses:

Math 262/263/264: Intermediate Calculus, ODEs, and Advanced Calculus	Fall 2021 - Winter 2022
Math 262/263: Intermediate Calculus and ODEs	Fall 2020 - Winter 2021
Math 133/140/141: Linear Algebra, Calculus 1, and Calculus 2	Fall 2019 - Winter 2020

Coding Workshops
Prepared and led the following coding workshops:

Introduction to `MATLAB` workshop for McGill Engineering Undergraduate Society students	Winter 2025
Introduction to `MATLAB` workshop for McGill Biomedical Engineering students	Fall 2024
Intermediate `MATLAB` workshop for McGill BioDesign team	Fall 2023
Introduction to `MATLAB` workshop for McGill BioDesign team	Fall 2022
Introduction to `Python` workshop for McGill Shad program	Summer 2022

Leadership

Vice President Academic
McGill Engineering Undergraduate Society (EUS) | 2021-2022

- Represented over 3,000 engineering undergraduates in faculty meetings focused on academic affairs.
- Chaired a committee responsible for allocating over $500k in academic funds and lab equipment.
- Hired EPTS tutors and organized academic workshops, review sessions, and feedback forums.

Program Assistant
McGill Shad | Summer 2022

- Led academic workshops and provided mentorship for the cohort of Shad program, a month-long enrichment initiative focused on STEAM and entrepreneurship for selected students across Canada.
- Organized and led a `Python` workshop and a chess workshop for the participants.

Technology and Involvement Coordinator
McGill Engineering Orientation Week (Frosh) | Summer 2021

- Collaborated with a team of 11 to organize an orientation week for 800+ incoming engineering students.
- Set up and managed the online server, live streams, and a chess tournament.

Vice President Academic
McGill Association of Mechanical Engineers (MAME) | 2020-2021

- Represented mechanical engineering undergraduate students in departmental meetings.
- Created and managed the MAME online server during remote semesters of the COVID-19 pandemic.
- Attended and voted on the Mechanical Engineering curriculum review meetings aimed at restructuring the undergraduate program.

Reviewing

American Control Conference (ACC) | 2024
Conference on Decision and Control (CDC) | 2025

Programming Languages

`Python`, `MATLAB`, `LaTeX/TikZ`, `C++`, `Java`, `Bash`, `MIPS Assembly Language`, `OCaml`

Professional Memberships

IEEE Graduate Student Member
Research Group in Decision Analysis (GERAD) Member