Seigan Hayashi

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Education

May 2025 **Doctor of Philosophy**
in Mechanical Engineering
University of Canterbury, New Zealand

Feb 2017 - Nov 2020 **Bachelor of Engineering (Hons)**
with First Class Honours in Mechatronics Engineering
University of Canterbury, New Zealand
GPA: 8.21/9.00

Research Experience

Aug 2021 - Dec 2024 **Evaluating control-based continuation for investigating micro-electromechanical systems.**
Department of Mechanical Engineering, University of Canterbury

Jan 2021 - Apr 2021 **Artificial cochlea amplifier for sound detection technology.**
Department of Mechanical Engineering, University of Canterbury

Feb 2020 - Nov 2020 **Electromyography sensor for myoelectric hand prosthesis.**
Taska Prosthetics Limited

Nov 2019 - Feb 2020 **Theoretical investigations of sound detection technology.**
Department of Mechanical Engineering, University of Canterbury

Teaching Activities

Feb 2023 - Jun 2023 **Lecturer (Casual)**
Department of Mechanical Engineering, University of Canterbury
ENME403 — Linear Systems Control and System Identification.

July 2021 - Current **Teaching Assistant**
Department of Mechanical Engineering, University of Canterbury
ENME202 — Stress, Strain, and Deformation (1 Semester).
ENME203 — Dynamics and Vibrations (5 Semesters).
ENME303 — Controls and Vibrations (3 Semesters).
ENME403 — Linear Systems Control and System Identification (5 Semesters).
ENME412 — Advanced Vibrations (2 Semesters).

School of Mathematics and Statistics, University of Canterbury
EMTH118 — Engineering Mathematics 1A (1 Semester)
EMTH119 — Engineering Mathematics 1A (4 Semesters)
EMTH171 — Mathematical Modelling and Computation (1 Semester)
MATH199 — Advancing in Mathematical Sciences (AIMS) (10 Semesters)

Employment

Nov 2018 - Feb 2019	**Systems Engineering Summer Intern** *Dynamic Controls Limited*

Awards and Honours

2024	**ENOC2024 Young Investigator Prize - 1st Place**
2021, 2022	UC Foundation Doctoral Publication Prize
2020	UC Aho Hīnātore - UC Accelerator Scholarship
2019	UC Summer Research Scholarship
2017	UC Entrance Undergraduate Scholarship
2017	UCA Scholarship of Excellence
2016	AIMS Scholarship

Student Supervision

Jul 2023 - Nov 2023	**Low-cost hardware for control-based continuation.** *Independent Course of Study — UC Department of Mechanical Engineering*
Aug 2024 - Dec 2024	**Exploring non-linear MEMS for human cochlea modelling and enhanced sensitivity applications.** *Independent Course of Study — UC Department of Mechanical Engineering*
Apr 2025 - Ongoing	**Numerical and experimental investigation of parametrically excited active MEMS.** *Visiting Research Assistant — TU Ilemanu / UC Department of Mechanical Engineering*

Miscellaneous Commitments

Nov 2024	**Conference Session Chair** *New Zealand Mathematics and Statistics Postgraduate Conference*
May 2021 - Feb 2023	**Secretary** *University of Canterbury Robotics Club*
Apr 2020 - Nov 2020	**Class Representative** *Mechatronics — Class of 2020*

Technical Skills

Vibration testing equipment
Electrodynamic vibration shakers, IEPE sensors, impact hammer, laser vibrometer

Instrumentation
Oscilloscope, signal generator

Embedded Systems
Arduino, Teensy, RedPitaya

Manufacturing
Lathe, milling machine, drill press

Programming languages
MATLAB/Simulink, Python, C, Arduino, Maxima, LaTeX, Git

Software packages
MATCONT, Solidworks, ControlDesk, Gimp, CorelDraw, Adobe Premiere

Misc
Prusa 3D printing

Technical Communications — Publications and Conferences

Up-to-date information is best found on Google Scholar page or ResearchGate. Otherwise, the following list is curated based on subject. *Last updated: May 8, 2025.*

Doctoral Thesis

Thesis	S. Hayashi, "Evaluating control-based continuation for investigating micro-electromechanical systems," PhD thesis, University of Canterbury, Christchurch, New Zealand, May 2025

Experiments in control-based continuation

Conference	S. Hayashi, "Control-based continuation for probing real systems," en, ser. Dynamical Systems in NZ, Auckland, New Zealand, Nov. 2022
Conference	S. Hayashi, S. Gutschmidt, R. Murray, *et al.*, "Control-based continuation of an externally excited MEMS self-oscillator," en, ser. European Nonlinear Oscillations Conference, Delft, The Netherlands, 2024. [Online]. Available: `https://enoc24.dryfta.com/`
Invited Talk	S. Hayashi, "Control-based continuation of an externally excited MEMS self-oscillator", en, University of Exeter, United Kingdom, Jul 2024
Journal	S. Hayashi, S. Gutschmidt, R. Murray, *et al.*, "Experimental bifurcation analysis of a clamped beam with designed mechanical nonlinearity," en, Jun. 2024. DOI: `10.1007/s11071-024-09873-5`
Preprint	S. Hayashi, C. Cameron, S. Gutschmidt, *et al.*, "Experimentally characterising the dynamical landscape of an active mems cantilever," *Preprint*, 2025. DOI: `10.21203/rs.3.rs-6424847/v1`
Conference *(upcoming)*	S. Hayashi, S. Gutschmidt, R. Murray, *et al.*, "A numerical and experimental validation of a self-oscillating mems using experimental continuation," en, ser. International Conference on Experimental Continuation in Nonlinear Dynamics, Liége, Belgium, Aug. 2025

Numerical modelling of micro-electromechanical systems

Journal	N. Lam, S. Hayashi, and S. Gutschmidt, "A novel MEMS sensor concept to improve signal-to-noise ratios," en, *International Journal of Non-Linear Mechanics*, vol. 139, Mar. 2022, ISSN: 0020-7462. DOI: `10.1016/j.ijnonlinmec.2021.103863`
Journal	S. Hayashi, C. J. Cameron, and S. Gutschmidt, "A novel sensing concept utilizing targeted, complex, nonlinear MEMS dynamics," en, *Journal of Computational Dynamics*, Apr. 2022. DOI: `10.3934/jcd.2022012`
Conference	S. Gutschmidt, S. Hayashi, N. Lam, *et al.*, "Active MEMS Amplifier for Improved Signal-to-Noise Ratios," Dynamical Systems - Theory and Applications, Dec. 2021
Conference	S. Gutschmidt, A. McKendry, C. Cameron, *et al.*, "Improved spatial-temporal sound perception using active MEMS," *The Journal of the Acoustical Society of America*, vol. 154, no. 4_supplement, A227–A227, 2023, Publisher: AIP Publishing

In Acknowledgments

Journal	C. Lenk, P. Hövel, K. Ved, *et al.*, "Neuromorphic acoustic sensing using an adaptive microelectromechanical cochlea with integrated feedback," en, *Nature Electronics*, vol. 6, no. 5, pp. 370–380, May 2023, ISSN: 2520-1131. DOI: `10.1038/s41928-023-00957-5`