Brett Hannigan
Lengghalde 5
8008 Zürich
Switzerland

Academic

ETH Zürich   Zürich, Switzerland
PhD Candidate — Health Sciences and Technology   *September 2021 – Present*

- Scientific assistant at the Biomedical and Health Technology (BMHT) Lab.
- Thesis topic: combining materials, electronics, and algorithms to enable human motion tracking using unobtrusive textile strain sensors (supervisor: Prof. Carlo Menon).
- Expected thesis defence — *March – April 2024*

Simon Fraser University   Burnaby, Canada
PhD Candidate — Mechatronic Systems Engineering   *January 2019 – August 2021*

- Faculty of Applied Science Graduate Fellowships — *Spring 2020, Spring – Summer 2021*
- Courses: deep learning systems, design optimization.
- Moved along with doctoral supervisor to his newly established group at ETH Zürich. — *September 2021*

University of British Columbia   Vancouver, Canada
Master of Applied Science — Electrical and Computer Engineering   *September 2016 – December 2018*

- 91% average.
- Thesis topic: applying optimal control theory to rationally design high-performance analog-to-digital converter circuits while maintaining stability (supervisor: Prof. Guy A. Dumont).
- Teaching assistant for capstone student project course.
- Courses: adaptive control, multivariable feedback control, biophotonics.

Simon Fraser University   Burnaby, Canada
Bachelor of Applied Science (Honours) — Biomedical Engineering   *September 2009 – April 2015*

Work Experience

ESS Technology   Kelowna, Canada
Mitacs Accelerate Fellowship   *November 2017 – November 2018*

- Translated M.A.Sc. research to the industry project: high fidelity data converters for medical electronics.
- Delivered software tools and complete documentation to enable the design of high-performance data converters, reducing the amount of computationally-expensive simulation time required over empirical methods.

Lungpacer Medical   Burnaby, Canada
Software Developer   *January 2015 – August 2016*

- Designed control algorithms for optimizing phrenic nerve stimulation with a prototype medical device.
- As part of a small team of software developers, implemented the logic and GUI for controlling the device.
- Devised and ran pre-clinical experiment protocols used to evaluate algorithms then presented experimental results within the company to guide development.
- Developed experiment data acquisition and processing software allowing real-time synchronization, calculation, display, and logging of experiment data collected from many independent sources.

Selected Publications/Projects

1. <u>Brett C. Hannigan</u>, Tyler J. Cuthbert, Chakaveh Ahmadizadeh, et al. (2024). "Distributed Sensing Along Fibres for Smart Clothing". *Science Advances* 10.12, eadj9708

   - Connections between rigid electronics and comfortable, soft garments are an obstacle to the reliability and adoption of "e-textiles" in everyday life.
   - I developed a prototype garment, impedance spectroscopy readout electronics, and a machine learning algorithm to measure strain from multiple points along a continuous fibre with a single connection.

2. <u>Brett C. Hannigan</u>, Tyler J. Cuthbert, and Carlo Menon (2023). "HACS4x: Four-Ply Helical Auxetic Capacitive Sensors for Strain Sensing E-Textiles". In: *5th International Conference on the Challenges, Opportunities, Innovations and Applications in Electronic Textiles*. Vol. 52. 1. Ghent: MDPI Engineering Proceedings, p. 24

   - An extension of the helical auxetic sensors using four component yarns.
   - Won best paper of the 2023 E-Textiles Conference — *November 2023*

3. <u>Brett C. Hannigan</u> and Carlo Menon (2023). "Fast, analytical method for structured identification of SISO RC-ladder-type systems". *IEEE Transactions on Circuits and Systems II: Express Briefs*. [Early Access]

   - I developed an optimization-free, analytical system identification algorithm to reconstruct distributed sensing measurements from data, which can be used for strain sensing.

4. Tyler J. Cuthbert, <u>Brett C. Hannigan</u>, et al. (2023). "HACS: Helical Auxetic Yarn Capacitive Sensors that Go Beyond the Theoretical Sensitivity Limit". *Advanced Materials* 35.10

   - We designed capacitive strain sensors using a yarn structure with auxetic properties—allowing higher than expected and tunable sensitivity.
   - I was involved in modelling of the yarn complex and investigation of the auxetic mechanism.

5. <u>Brett C. Hannigan</u>, Tyler J. Cuthbert, Wanhaoyi Geng, et al. (2021). "Understanding the Impact of Machine Learning Models on the Performance of Different Flexible Strain Sensor Modalities". *Frontiers in Materials* 8.44, pp. 1–23

   - I compared several soft strain sensor technologies and their accuracy when paired with simple machine learning models, leading to our investigation into novel capacitive strain sensors.

6. <u>Brett C. Hannigan</u>, Christian L. Petersen, et al. (2020). "An Optimization Framework for the Design of Noise Shaping Loop Filters with Improved Stability Properties". *Circuits, Systems, and Signal Processing* 39.12, pp. 6276–6298

   Full list:

   - Master's research project outcome: an algorithm to design digital-to-analog converters using robust control methods and optimization.

Skills

Programming (General)	Programming (Scientific)	Hardware	Instruments	Software	Techniques
• Python	• MATLAB	• CAD	• Electronics testing	• SolidWorks	• Control design
• Verilog/VHDL	• R	• PCB design	• Impedance analyzer	• KiCAD	• Modelling and system ID
• C/C++	• Keras	• Rapid prototyping	• Tensile tester	• Maple	• Machine learning
• LaTeX	• LabVIEW	• Machining	• Polymer extruder	• Photoshop	• DSP/embedded systems
		• Textile processing	• General laboratory	• Illustrator	

Languages

English: Native   German: A2–B1