Brett Hannigan
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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. Brett C. Hannigan, 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. Brett C. Hannigan, 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. Brett C. Hannigan 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* 71.4, pp. 2234–2238
   - 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, Brett C. Hannigan, 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. Brett C. Hannigan, 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. Brett C. Hannigan, 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
   - Master's research project outcome: an algorithm to design digital-to-analog converters using robust control methods and optimization.

Full list:

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