

Thomas W. Secord

Curriculum Vitae

CONTACT INFORMATION

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POSITIONS HELD

- University of St. Thomas** · St. Paul, Minnesota **September 2016 - Present**
Program Director, Master of Science in Mechanical Engineering (Summer 2024 - Present)
Associate Professor, Mechanical Engineering (Fall 2022 - Present)
Assistant Professor, Mechanical Engineering (Fall 2016 - Spring 2022)
- Medtronic** · Mounds View, Minnesota **July 2010 - August 2016**
Principal R&D Engineer, Structural Heart Product Development (July 2015 - August 2016)
Senior R&D Engineer, Structural Heart Product Development (July 2010 - July 2015)
- Massachusetts Institute of Technology** · Cambridge, Massachusetts **September 2005 - June 2010**
Postdoctoral Associate, d'Arbeloff Laboratory (May 2010 - June 2010)
Research Assistant, d'Arbeloff Laboratory (September 2005 - May 2010)
- Medtronic** · Fridley, Minnesota **November 2002 - April 2005**
Design Engineering Intern, Cardiac Rhythm Disease Management - Therapy Delivery

EDUCATION

- Massachusetts Institute of Technology** · Cambridge, Massachusetts **September 2005 - June 2010**
Ph.D., Mechanical Engineering (June 2010)
S.M., Mechanical Engineering (February 2007)
- University of Minnesota** · Minneapolis, Minnesota **September 2001 - May 2005**
Bachelor of Mechanical Engineering, *summa cum laude*
Minor in Mathematics

CERTIFICATIONS

- Licensed Professional Engineer, Minnesota (LN: 52692)** **June 2015 - Present**
- Black Belt, Medtronic Design for Reliability and Manufacturability** **May 2015 - August 2016**

CONSULTING EXPERIENCE

- Quartus Engineering, March 2023 - Present
- Anteris Technologies, March 2023 - Present
- Adona Medical, August 2022
- Audrey DeClue, D.V.M., June 2018 - October 2018, April 2024 - Present
- Fathom Engineering, September 2017 - November 2017

TEACHING EXPERIENCE

- University of St. Thomas** · St. Paul, Minnesota **Fall 2016 - Present**
Associate Professor, Mechanical Engineering (Fall 2022 - Present)
Assistant Professor, Mechanical Engineering (Fall 2016 - Spring 2022)
Courses Taught:
- ENGR 410 - Control Systems and Automation (Lecture and Lab Instructor)
 - ENGR 322 - Dynamics (Lab Instructor)
 - ENGR 150 - Introduction to Engineering
 - ETLS 555 - Advanced Product Design
 - ETLS 810 - Advanced Control Systems
 - ENGR 480 & 481 - Engineering Design Clinic (Project Advisor)

Medtronic · Mounds View, Minnesota
Design for Reliability and Manufacturability Course Instructor

Fall 2013 – Summer 2016

University of Minnesota · Minneapolis, Minnesota
Guest Lecturer, Engineering Modeling (ME 4080)

Summer 2012 and Fall 2012

Massachusetts Institute of Technology · Cambridge, Massachusetts
Teaching Assistant, 2.12 - Introduction to Robotics (Fall 2006, Fall 2008)

Fall 2006 – Spring 2008

Grader, 2.160 - System Identification, Estimation, and Learning (Spring 2008)

Solution Writer and Grader, 2.140 - Analysis and Design of Feedback Control Systems (Spring 2007)

HONORS AND AWARDS

- Medtronic Technical Contributor of the Year (Member of 6-person team selected from 18,000+ technical employees), 2014
- Medtronic Global Preclinical Excellence Award Nominee, 2014
- Best Paper Award (Best of 113 total papers), IFAC Symposium on Mechatronic Systems, 2010
- Best Automation Paper Finalist (Top 4 of 850 total papers)– IEEE International Conference on Robotics and Automation, 2008
- Martin Fellowship – MIT Laboratory for Energy and the Environment, 2005-2006
- United States Youth Biathlon Team, 2001
- Eagle Scout Rank, Boy Scout Troop 399, New Brighton, Minnesota, 2000

VOLUNTEER AND MENTORING EXPERIENCE

- Minnesota Youth Ski League coach, 2016 - Present
- Medtronic manager and mentor, U. of Minnesota and Cornell co-op students, September 2010 – Summer 2016
- FIRST Robotics Team Mentor, Irondale High School, September – November 2010
- Science, Technology, Engineering, and Mathematics (STEM) Mentor, MIT, October 2009 – May 2010

PUBLICATIONS

Journal Publications (Refereed)

- [J1] E. Lazarus, H. Liu, **T. Secord**, S. Laflamme, and I. Rivero, "Flexible shape memory structures with low activation temperatures through investigation of the plasticizing effect," *Materials Research Express*, vol. 12, no. 5, 055310, May 2025, <https://doi.org/10.1088/2053-1591/add651>
- [J2] E. Lazarus, L. Barnum, J. Quint, S. Laflamme, **T. Secord**, S. Ramesh, T. Schmidt, A. Tamayol, and I. Rivero, "Engineering tools for stimulating wound healing," *Applied Physics Reviews*, vol. 11, no. 2, pp. 021304-1 – 021304-40, 2024. <https://doi.org/10.1063/5.0173663>
- [J3] **T. Secord**, M. Vukicevic, C. Gaulke, C. Eldredge, E. Westman, K. Coyne, D. Winkoski, and S. Little, "A high fidelity and high frequency physical simulator for mitral annulus kinematics," *IEEE Transactions on Medical Robotics and Bionics*, vol. 4, no. 3, pp. 708-719, 2022, <https://doi.org/10.1109/TMRB.2022.3193425>
- [J4] H. Liu, S. Laflamme, E. Zellner, A. Aertsens, S. Bentil, I. Rivero, and **T. Secord**, "Soft elastomeric capacitor for strain and stress monitoring on sutured skin tissues," *ACS sensors*, vol. 6, no. 10, pp. 3706-3714, 2021. <https://doi.org/10.1021/acssensors.1c01477>
- [J5] **T. Secord**, T. Louwagie, and R. Kopas, "Design of discretely-tunable resonant actuators using additive inertial units," *ASME Journal of Dynamic Systems Measurement and Control*, vol. 142, no. 3, pp. 031009-1 - 031009-13, 2020. <https://doi.org/10.1115/1.4045562>
- [J6] L. Koerner and **T. Secord**, "An embedded electrical impedance analyzer based on the AD5933 for the determination of voice coil motor mechanical properties," *Sensors and Actuators A: Physical*, vol. 295, pp. 99-112, 2019. <https://doi.org/10.1016/j.sna.2019.05.037>
- [J7] K. Seino, **T. Secord**, M. Vig, S. Kyllonen, and A. DeClue, "Three-dimensional kinematic motion analysis of shivers in horses: a pilot study," *Journal of Equine Veterinary Science*, vol. 79, pp. 13-22, 2019. <https://doi.org/10.1016/j.jevs.2019.03.006>

- [J8] **T. Secord** and M. Audi, "A tunable resonance cantilever for cardiac energy harvesting," *Cardiovascular Engineering and Technology*, vol. 10, no. 2, pp. 380-393, 2019. <https://doi.org/10.1007/s13239-019-00402-9>
- [J9] **T. Secord** and A. J. Gerenz, "Development of a robotic surgery game for use as a full spectrum engineering project," *Transactions on Techniques in STEM Education*, vol. 3, no. 1, pp. 41-47, 2017. (Reprint of [C9])
- [J10] **T. Secord**, S. C. Mantell, and K. A. Stelson, "Scaling analysis and a critical thickness criterion for thermosetting composites," *ASME Journal of Manufacturing Science and Engineering*, vol. 133, no. 1, 2011. <https://doi.org/10.1115/1.4003338>
- [J11] **T. Secord** and H. H. Asada, "A variable stiffness PZT actuator having tunable resonant frequencies," *IEEE Transactions on Robotics*, vol. 26, no. 6, pp. 993-1005, 2010. <https://doi.org/10.1109/TRO.2010.2076850>
- [J12] J. Ueda, **T. Secord**, and H. H. Asada, "Large effective-strain piezoelectric actuators using nested cellular architecture with exponential strain amplification mechanisms," *IEEE/ASME Transactions on Mechatronics*, vol. 15, no. 5, pp. 770-782, 2010. <https://doi.org/10.1109/TMECH.2009.2034973>

Book Chapters

- [BC1] **T. Secord** and H. H. Asada, "Cellular muscle actuators with variable resonant frequencies," *Robotics: Science and Systems*, pp. 249-256, 2009. <https://doi.org/10.15607/RSS2009.V.032>

Books

- [B1] **T. Secord**, *Control Systems and Automation: Fundamentals of Logic, Modeling, Feedback, and Robotics*, (Writing in process, anticipated publication by John Wiley and Sons, Inc.: September 2026)

Conference Publications (Refereed)

- [C1] M. Musa, A. Jaeger, H. Liu, A. Camacho-Bentacourt, Z. Li, A. Iyanalu, T. Secord, R. Whitehead, M. Kim, I. Rivero, S. Laflamme, "Smart Adaptable Multistable Building Facades," *SPIE Smart Structures and Nondestructive Evaluation*, March 2026.
- [C2] Z. Li, M. Musa, A. Camacho-Bentacourt, A. Jaeger, K. Boaz, H. Liu, S. Laflamme, **T. Secord**, A. Iyanalu, R. Whitehead, I. Rivero, M. Kim, "[Data-Efficient Design of Multistable, Robust Structures for Additive Manufacturing Using Bayesian Optimization](#)," *Solid Freeform Fabrication Symposium 2025*, August 2025.
- [C3] H. Liu, S. Laflamme, E. Zellner, S. Bentil, I. Rivero, **T. Secord**, and A. Tamayol, "Corrugated compliant capacitor for smart bandage application," *IEEE International Instrumentation and Measurement Technology Conference*, pp. 1-6, Virtual Conference, May 2021. <https://doi.org/10.1109/I2MTC50364.2021.9459892>
- [C4] **T. Secord** and T. Louwagie, "Bidirectional resonant propulsion and localization for AUVs," *IEEE International Conference on Robotics and Automation*, pp. 878-884, Virtual Conference, June 2020. <https://doi.org/10.1109/ICRA40945.2020.9197363>
- [C5] **T. Secord**, L. Koerner, and R. Kopas, "An integrated I2C sensor network for transcatheter heart valves," *ASME Design of Medical Devices Conference*, Vol. 83549, Virtual Conference, April 2020. <https://doi.org/10.1115/DMD2020-9016>
- [C6] **T. Secord**, A. Tenhoff, M. Audi, A. Lorch, "A multi-actuator approach to high bandwidth *in vitro* cardiac kinematic simulation," *IEEE International Conference on Biorobotics and Biomechatronics*, pp. 833-838, Enschede, Netherlands, May 2018. <https://doi.org/10.1109/BIOROB.2018.8487781>
- [C7] **T. Secord**, M. Audi, "A high efficiency tunable resonance pump for biomedical applications," *Design of Medical Devices Conference*, DMD2018-6917, Minneapolis, Minnesota, April 2018 (**Finalist for 3-in-5 Competition**). <https://doi.org/10.1115/DMD2018-6917>
- [C8] **T. Secord** and A. J. Johnson, "A tunable-resonance Faraday device for dual cardiac sensing and energy harvesting," *IEEE Medical Measurements and Application Symposium*, pp. 257-262, Rochester, Minnesota, May 2017. <https://doi.org/10.1109/MeMeA.2017.7985885>
- [C9] **T. Secord** and A. J. Gerenz, "Development of a robotic surgery game for use as a full spectrum engineering project," *ASEE North Midwest Section Conference*, Minneapolis, Minnesota, June 2017.

- [C10] **T. Secord** and H. H. Asada, "Scaling analysis of large stroke piezoelectric cellular actuators," IFAC Symposium on Mechatronic Systems, pp. 131–136, Boston, Massachusetts, September 2010 (**Best Paper Award**). <https://doi.org/10.3182/20100913-3-US-2015.00061>
- [C11] **T. Secord** and H. H. Asada, "The present role of actuator technology in surgical robotic devices," ASME Design of Medical Devices Conference, Minneapolis, Minnesota, April 2010.
- [C12] **T. Secord**, A. Mazumdar, and H. H. Asada, "Piezoelectric device for tunable resonance actuation and energy harvesting," IEEE International Conference on Robotics and Automation, pp. 2169–2176, Anchorage, Alaska, May 2010. <https://doi.org/10.1109/ROBOT.2010.5509158>
- [C13] **T. Secord** and H. H. Asada, "A variable stiffness PZT cellular actuator with tunable resonance for cyclic motion tasks," IEEE International Conference on Robotics and Automation, pp. 176–181, Kobe, Japan, May 2009. <https://doi.org/10.1109/ROBOT.2009.5152288>
- [C14] J. Ueda, **T. Secord**, and H. H. Asada, "Piezoelectric cellular actuators using nested rhombus multilayer mechanisms," ASME Dynamic Systems and Control Conference, vol. 2008, pp. 203–210, Ann Arbor, Michigan, October 2008. <https://doi.org/10.1115/DSCC2008-2128>
- [C15] **T. Secord**, J. Ueda, and H. H. Asada, "Dynamic analysis of a high-bandwidth, large-strain, pzt cellular muscle actuator with layered strain amplification," IEEE International Conference on Robotics and Automation, pp. 761–766, Pasadena, California, May 2008 (**Finalist for Best Automation Paper Award**). <https://doi.org/10.1109/ROBOT.2008.4543297>
- [C16] J. Ueda, **T. Secord**, and H. H. Asada, "Static lumped parameter model for nested pzt cellular actuators with exponential strain amplification mechanisms," IEEE International Conference on Robotics and Automation, pp. 3582–3587, Pasadena, California, May 2008. <https://doi.org/10.1109/ROBOT.2008.4543759>
- [C17] **T. Secord**, J. Ueda, and H. H. Asada, "Static analysis of an artificial muscle system based on pzt strain amplification," SPIE - The International Society for Optical Engineering, vol. 6932, San Diego, California March 2008. <https://doi.org/10.1117/12.775868>
- [C18] J. Ueda, **T. Secord**, and H. H. Asada, "Design of pzt cellular actuators with power-law strain amplification," IEEE International Conference on Intelligent Robots and Systems, pp. 1160–1165, San Diego, California, October 2007. <https://doi.org/10.1109/IROS.2007.4399299>
- [C19] **T. Secord** and H. H. Asada, "A humanoid foot with polypyrrole conducting polymer artificial muscles for energy dissipation and storage," IEEE International Conference on Robotics and Automation, pp. 2904–2909, Rome, Italy, April 2007. <https://doi.org/10.1109/ROBOT.2007.363912>
- [C20] D. McCombie, **T. Secord**, and H. H. Asada, "Modeling and observer design for polypyrrole conducting polymer actuator control systems," IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechatronics, pp. 432–436, Pisa, Italy, February 2006. <https://doi.org/10.1109/BIOROB.2006.1639126>
- [C21] **T. Secord**, K. Stelson, and S. Mantell, "Scaling analysis and a critical thickness criterion for thermosetting composites," ASME IMECE, pp. 205–211, Chicago, Illinois, November 2006. <https://doi.org/10.1115/IMECE2006-15344>

Extended Abstracts

- [A1] C. Gaulke, E. Westman, K. Coyne, C. Eldredge, **T. Secord**, "Design of a Mitral Annulus Motion Simulator for Accelerated Structural Testing of Mitral Repair and Replacement Devices," Written and Video Abstract (**Student competition finalist**), Cardiovascular Device Implant Durability Conference, Monterey, California, April 2022
- [A2] **T. Secord**, F. Harewood, C. McVeigh, B. Nadian, and E. Donnelly, "Copula based probabilistic modeling of use conditions for self-expanding transcatheter valve structural components," Proceedings –ASME/FDA First Annual Frontiers in Medical Devices Conference: Applications of Computer Modeling and Simulation, September 2013. <https://doi.org/10.1115/FMD2013-16170>

Patents

- [Pa1] J. Quill, P. Rothstein, **T. Secord**, and B. Johnson, "Transcatheter valve prosthesis delivery system with recapturing feature and method," US Patent 20140128963.

[Pa2] J. Ueda, H. H. Asada, and T. **Secord**, “Strain amplification devices and methods,” US Patent 20090115292.

Invited Presentations

- [Pr1] T. **Secord**, “Energy Efficient Mechanisms for Improving Building Efficiency,” University of St. Thomas Faculty Lightning Talks, April 24, 2025
- [Pr2] T. **Secord**, “Marrying Patient Diversity with Manufacturing Variances to Predict Outcomes Statistically,” Cardiovascular Device Implant Durability Conference, Monterey, California, April 2022.
- [Pr3] T. **Secord**, “Accelerated Medical Device Testing for Fatigue Failure: Current Technology and Challenges,” Alliance of Advanced Biomedical Engineering, March 4, 2019. <https://aabme.asme.org/knowledge-center/recorded-webinars/webinar-accelerated-medical-device-testing-for-fatigue-failure-current-technology-and-challenges>

Podcasts

- [Po1] T. **Secord**, “Energy Efficient Mechanisms that Allow Buildings to Adapt to the Environment,” The Professor Podcast, To be released in April 2026
- [Po2] T. **Secord**, “Robotics and Heart Therapy,” Alliance of Advanced Biomedical Engineering, June 21, 2018 <https://aabme.asme.org/posts/podcast-robotics-and-heart-therapy>

EXTERNAL FUNDING

Applications

- [Ap1] NSF Collaborative Research Grant, Total Award Amount: **\$751,674** (Funded), “Multistable Organic Structural Systems (MOSS),” Involvement: Co-PI, PI: Simon Laflamme (Iowa State), Jan. 2025 – Dec. 2025
- [Ap2] NIH R01, Total Award Amount: **\$3,121,634** (Declined for funding), “Multimodal Negative Pressure Wound Therapy Systems,” Involvement: Consultant to University of Connecticut – Health, PI: Ali Tamayol (UConn Health), Apr. 2025 – Mar. 2030
- [Ap3] NIH R01, Total Award Amount: **\$3,322,697** (Declined for funding, 3 attempts), “Multimodal Smart Dressings for the Treatment of Chronic Wounds,” Involvement: Consultant to Rochester Institute of Technology, PI: Tannin Schmidt (UConn Health), Sep. 2024 – Nov. 2028
- [Ap4] NSF Collaborative Research Grant, Total Award Amount: **\$751,674** (Declined for funding), “Controlling Surface Stress Distributions using Multi-stable Surface Textures,” Involvement: Co-PI, PI: Simon Laflamme (Iowa State), Aug. 2021 – Aug. 2024
- [Ap5] NIH R15, Total Award Amount: **\$590,393** (Declined for funding), “An Electro-Optical Sense and Stimulation Headstage for Investigation of Brain Functional Connectivity,” Involvement: Co-Investigator, PI: Heather Orser (University of St. Thomas), Apr. 2023 – Apr. 2026
- [Ap6] NIH R15, Total Award Amount: **\$362,966** (Funded), “A Digital and Open-Source Amplifier for Oocyte Ion Channel Measurements,” Involvement: Co-Investigator, PI: Lucas Korner (University of St. Thomas), Sep. 2020 – Aug. 2023
- [Ap7] CDMRP (Congressionally Directed Medical Research Programs), DoD, Total Award Amount: **\$389,219** (Declined for funding), “Measuring Musculoskeletal Tissue Healing Biomechanics with Flexible Sensor,” Involvement: Co-PI, PI: Iris Rivero (Rochester Institute of Technology), Nov. 2020 – Nov. 2022
- [Ap8] NIH R22 (Trailblazer), Total Award Amount: **\$470,711** (Declined for funding, 2 attempts): “Development of a Communication Network and Sensor Modules for Stent-Based Medical Devices,” Involvement: PI, Jul. 2020 – Jul. 2023

Funded Projects

- [FP1] NSF Collaborative Research Grant, Award Number 2431767, Total Award Amount: **\$751,674**, “Multistable Organic Structural Systems (MOSS),” Involvement: Co-PI, PI: Simon Laflamme (Iowa State), Jan. 2025 – Dec. 2025

- [FP2] NIH R15, Project Number 1R15NS116907-01A1, Total Award Amount: **\$362,966**, "A Digital and Open-Source Amplifier for Oocyte Ion Channel Measurements," Involvement: Co-Investigator, PI: Lucas Korner (University of St. Thomas), Sep. 2020 - Aug. 2024
- [FP3] Private Grant from The Bright Foundation, Total Award Amount: **\$25,000**, "Powered Wheelchair Safety Enhancement," Involvement: PI, Apr. 2021 - Aug. 2021