Hun Chan (Bryan) Lee

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EDUCATION

Boston University — **Boston, MA**
Ph.D., Mechanical Engineering — *09.02.2021 – 01.16.2026*
Advisor: Prof. Sheila Russo

Purdue University — **West Lafayette, IN**
Master of Science, Mechanical Engineering — *08.22.2016 – 08.03.2018*
Advisor: Prof. Raymond Cipra — *GPA: 3.81 / 4.00*

Purdue University — **West Lafayette, IN**
Bachelor of Science, Mechanical Engineering — *08.13.2012 – 05.07.2016*
(Highest Distinction) — *GPA: 3.96 / 4.00*

RESEARCH EXPERIENCE

Dupont Lab, Boston Children's Hospital & Harvard Medical School — *Oct. 2025 - Present*
Advisor: Prof. Pierre Dupont

- Engineering a transcatheter mitral and tricuspid annuloplasty system, utilizing Finite Element Analysis (FEA) to optimize structural integrity and mechanical performance of the deployed device.
- Characterized valvular biomechanics through ex-vivo porcine heart studies, quantifying the mechanical properties of the annulus and the influence of surrounding tissue on device integration.

Material Robotics Lab, Boston University — *Sept. 2021 – Sept. 2025*
Advisor: Prof. Sheila Russo

- Architected an autonomous ROS 2-based robotic platform for laser-assisted surgery, integrating a soft-rigid hybrid end-effector with custom pneumatic syringe pumps
- Deployed a deep learning-based sensor fusion model to process soft-rigid hybrid robot's optical proprioceptive sensor data, reaching 99% accuracy in detecting end-effector deformation and positioning and implemented a model-free closed-loop control system using online Jacobian correction, reducing trajectory following time by 10% and enhancing real-time responsiveness.
- Developed a layer-by-layer fabrication process—involving laser machining, plasma etching, and lamination—for soft-rigid hybrid robots. This enabled monolithic integration of a soft actuator, ionic resistive sensor, and rigid-flexible mechanical controller into a single system with a 90 % manufacturing success rate.
- Designed and prototyped an innovative Miura-ori pattern-inspired soft retractor with a capacitive sensor for neurosurgical applications, enhancing precision and adaptability in surgical procedures.

Cipra Lab, Purdue University — *Aug. 2016 - Aug. 2018*
Advisor: Prof. Raymond Cipra

- Developed and optimized the design of a wearable, 3D-printed prosthetic hand with compliant joints, utilizing rapid prototyping techniques.
- Utilized MATLAB image processing techniques to analyze the motion of the prosthetic hand.

Vlachos Research Group, Purdue University — *Jan. 2015 - May 2016*
Advisor: Prof. Pavlos Vlachos

- Constructed and optimized a realistic circulation loop and compliance chamber model, accurately replicating the intricate blood flow patterns in cerebral aneurysms

WORK EXPERIENCE

IntheSmart Co., Ltd. — **Seoul, South Korea**
Research and Design Team Member — *Aug. 2018 - Aug. 2021*

- Optimized hardware design and manufacturing workflows of the fluorescence laparoscopy system for mass production.
- Developed and implemented over 20 experiment/calibration protocols and designed electro-mechanical test jigs and fixtures to improve the functionality of fluorescence laparoscopy systems.
- Shadowed over 150 preclinical and clinical trial cases across various general surgery divisions and directly worked with clinicians to gather and incorporate their feedback to refine surgical imaging systems.
- Led the hardware research and development for the Laser Speckle Contrast Imaging (LSCI) system, a laser-based blood flow meter, and acquired Korean Good Manufacturing Practice (K-GMP) certification for the system.

- Integrated a YOLOv5 object detection machine learning model (94.7% precision) into a handheld RGB and NIR dual-imaging system with a 19.5 ms processing time, enhancing parathyroid gland (PG) identification rates and viability diagnostic accuracy.

PUBLICATIONS (J: Journal Article, C: Conference Proceeding, P: Patent, *Equally Contributed)

Journal Articles

J1. Shain, A., Leslie, D, **Lee, H.C.**, McCandless, M., Lee, H., Russo, S., Wang, D., and Wason, S., 2026. In vitro testing of a novel soft robotic anti-retropulsion device for use during ureteroscopy lithotripsy. Journal of Endoluminal Endourology [Accepted]

J2. **Lee, H.C.**, Cho, H., Kothandaraman, A., Dembrow, D., Kwon, J., and Russo, S., 2025. Model-free control of a soft-rigid hybrid robot for laser-assisted surgery. *IEEE Robotics and Automation Letters*, vol. 11, no. 1, pp. 906-913

J3. **Lee, H.C.**, Elder, N., Leal, M., Stantial, S., Vergara Martinez, E., Jos, S., Cho, H., and Russo, S., 2024. A fabrication strategy for millimeter-scale, self-sensing soft-rigid hybrid robots. *Nature Communications*, *15*(1), p.8456. **Cover Article**

J4. **Lee, H.C.**, Pacheco, N.E., Fichera, L. and Russo, S., 2022. When the end effector is a laser: A review of robotics in laser surgery. ***Advanced Intelligent Systems***, *4*(10), p.2200130.

J5. Kim, Y.*, **Lee, H.C. *,** Kim, J.*, Oh, E., Yoo, J., Ning, B., Lee, S.Y., Ali, K.M., Tufano, R.P., Russell, J.O. and Cha, J., 2022. A coaxial excitation, dual‐red‐green‐blue/near‐infrared paired imaging system toward computer‐aided detection of parathyroid glands in situ and ex vivo. ***Journal of Biophotonics***, *15*(8), p.e202200008.

J6. Oh, E., **Lee, H.C.**, Kim, Y., Ning, B., Lee, S.Y., Cha, J. and Kim, W.W., 2022. A pilot feasibility study to assess vascularity and perfusion of parathyroid glands using a portable hand‐held imager. ***Lasers in Surgery and Medicine***, *54*(3), pp.399-406. ****Cover Article****

J7. **Lee, H.C.** and Cipra, R., 2020. Design of a Novel Locking Ratcheting Mechanism for a Body-Powered Underactuated Hand. **Journal of Medical Devices**, 14(1), p.011101.

Conference Proceedings

C1. **Lee, H.C.,** Cho, H., Kothandaraman, A., Dembrow, D., Kwon, J., and Russo, S., 2025, A Soft-Rigid Hybrid Robot with Optical Proprioceptive Sensing for Laser-Assisted Surgery, ***The Hamlyn Symposium on Medical Robotics***

C2. Van Lewen D., Wang C., **Lee H.C.**, Devaiah A., Upadhyay U., and Russo S., 2024. Monitoring Forces in Soft Robotic Brain Retraction via Origami Sensing Modules. ***The Hamlyn Symposium on Medical Robotics***

C3. Van Lewen, D., Wang, C., **Lee, H.C.**, Devaiah, A., Upadhyay, U. and Russo, S., 2024, May. Capacitive Origami Sensing Modules for Measuring Force in a Neurosurgical, Soft Robotic Retractor. In ***2024 IEEE International Conference on Robotics and Automation (ICRA)*** (pp. 5302-5308). IEEE.

C4. Bhrugubanda, S., **Lee, H.C.**, Kifle, N., Kim, Y. and Cha, J., 2023, March. Multi-directional adjustable two-camera housing module for medical applications**. In Design and Quality for Biomedical Technologies XVI** (Vol. 12370, p. 1237002). SPIE.

Patent

P1. Jaepyeong, Cha. and **Lee, H.C.**, Optosurgical LLC, 2023. Method and apparatus for biometric tissue imaging. **U.S. Patent Application** 17/854,084. **[*Pending*]**

TEACHING EXPERIENCE

Teaching Assistant

Electromechanical Design *Sept. 2022 - May. 2023*

- Assisted the electromechanical system design lab sessions (Topics: Arduino, electromechanical system design)

Machine Design *Jan. - May 2017 & Jan. - May 2018*

- Instructed the machine design lab sessions (Topics: the kinetics and kinematics of machines, the stress analysis of machine components)

Mechanical Engineering Design, Innovation, and Entrepreneurship *Aug. - Dec. 2016 & Aug. - Dec. 2017*

- Instructed the design lab session and guided in applying engineering principles to open-ended problems.

Conference Presentations

- A Monolithic Fabrication Method for Proprioceptive Soft-Foldable Robots, Oral Presentation at *Society of Engineering Science (SES),* Minneapolis, MN, October 8-11, 2023
- A Monolithic Fabrication Strategy for Millimeter-Scale, Self-Sensing Actuators, Oral Presentation at *Materials Research Society (MRS),* San Francisco, CA, April 25-27, 2023

Honors and Awards

- Distinguished Mechanical Engineering Fellowship *2021*

- Dean's List *2012-2016*
- Semester Honor *2012-2016*
- EPICS AMD Design Award *2014*
- School of Mechanical Engineering Scholarship *2013*

Technical Skills

- **3D Modeling**: SOLIDWORKS, CATIA
- **Simulation:** Abaqus
- **PCB Designing**: Altium
- **Programming**: Python, MATLAB, C, ROS2, PyTorch
- **Fabrication**: Laser micromachining, Plasma Etching, Lamination, 3D Printing