Khoi Ly

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Robotic Materials, Embedded Sensing, Dynamic Modeling & Control Theory

Education

- **University of Colorado Boulder** — Boulder, USA
  Paul M. Rady Mechanical Engineering - Ph.D. Candidate — *August 2017 – December 2021*
- **Texas Tech University** — Texas, USA
  Magna Cum Laude with Highest Honor, Mechanical Engineering - Undergraduate — *August 2014 – May 2017*

Research Experience

- **Electro-hydraulic Rolling Soft Robot**, *Project Lead* — **Submitted to IEEE Transactions on Robotics**
  - Designing and characterizing a rolling soft robot propelled by electro-hydraulic actuators.
  - Modeling the robot's locomotion based on a hybrid dynamic state-space model.
  - Developing a model predictive controller using particle swarm optimization algorithm for real-time speed regulation.
  - Implementation of real-time controller using concurrent programming on C++
- **2.5D Active Shape-changing Soft Surface**, *Team Member* — **On-going**
  - Designing and testing the layout for an array of 10x10 grid of HASEL actuators.
  - Developing a large scale soft, stretchable, magnetic Ecoflex skin with high speed, high resolution sensing for the shape-changing surface.
- **Embedded Magnetic Sensing for Soft Electro-hydraulic Actuators**, *Project Co-lead* — **On-going**
  - Inventing and testing a magnetic-based high speed, high resolution displacement sensing setup for high voltage electro-hydraulic actuators
  - Designing and controlling a soft 3D pan-tilt platform using the embedded magnetic sensing technique
- **Self-Sensing for Electrostatic Transducers**, *Project Lead* — **Published in Soft Robotics, 2020**
  - Inventing a low voltage coupling self-sensing method for high voltage capacitive electrostatic transducers.
  - Validating the self-sensing capability of the embedded circuit with an application of a closed loop PID control for a soft robotic arm driven by high voltage Peano HASEL actuators.
- **Dual-Mode PID Controller for a HASEL Actuator**, *Team Member* — **Published in IEEE RA-L, 2020**
  - Implementing the dual-mode PID controller on a microcontroller for real-time, high-speed displacement regulation.
- **Joystick Controller for a Soft-Robotic Tentacle**, *Team Member* — **Published in Advanced Science, 2019**
  - Developing a high voltage polarity reversing technique for a miniature driver circuit of a HASEL-actuator driven soft robotic tentacle.
  - Designing and testing the human-in-the-loop controller with a joystick interface for the tentacle's heading angle.

Patents: Provisional Applications

- "**Capacitive Self-sensing for Electrostatic Transducers with High Voltage Isolation**," Application No 63/032,209.
- "**Embedded Magnetic Sensing Method for Soft Actuators**," Application No 63/189,571.

Honors and awards

- Texas Tech Ph.D Presidential Fellowship Award Offered, 2017.
- Undergraduate Research Scholar Award 2017.
- Texas Tech President Honor Roll 2015, 2016, 2017.
- Texas Tech Honors College Scholarship Award 2015.

Peer-Reviewed Publications

1. "Miniaturized Circuitry for Capacitive Self-sensing and Closed-Loop Control of Soft Electrostatic Transducers"
   ***K. Ly**, N. Kellaris, D. McMorris, B. Johnson, E. Acome, V. Sundaram, M. Naris, S.Humbert, M. Rentschler, C. Keplinger, N. Correll*
   Soft Robotics 2020

2. "Identification and Control of a Nonlinear Soft Actuator and Sensor System"
   *B. Johnson, V. Sundaram, M. Naris, E. Acome, **K. Ly**, N. Correll, C. Keplinger, J. Humbert and M. Rentschler*
   IEEE Robotics and Automation Letters 2020

3. "An Easy-to-Implement Toolkit to Create Versatile and High-Performance HASEL Actuators for Untethered Soft Robots"
   *S. Mitchell, X. Wang, E. Acome, T. Martin, **K. Ly**, N. Kellaris, VG. Venkata, and C. Keplinger*
   Advanced Science 2020

Peer Reviewing

- **Journals**: Science, Science Robotics, Soft Robotics, International Journal of Robotics Research, Transactions on Robotics, IEEE RA-L
- **Conferences**: Robotics Science and Systems, IEEE Robosoft, IEEE ICRA, IEEE IROS, ISER

Teaching & Mentoring

- **Department of Mechanical Engineering, CU Boulder**, *Teaching Assistant* **Fall 2019, Fall 2020**
  - **System Dynamics (4043)**: Teaching and delivering hand-on workshops on Control Implementation Labs
  - **Solid Mechanics (2063)**: Teaching Assistant Team Lead
- **Department of Computer Science, CU Boulder**, *Mentor* **Spring 2018 - present**
  - **Kyle Martinaitis, Undergraduate Research**: Force Characterization for Electro-hydraulic Rolling Soft Robot
  - **Jatin Mayerkar, Master Thesis**: Electro-hydraulic Rolling Soft Robot
  - **Dade McMorris, Undergraduate Research**: Self-sensing of High Voltage Electrostatic Transducers.

Technical Skills

- **Theoretical Knowledge**: Classical and State Space Modeling, Statistical Estimation, System Identification, Controller Design and Implementation, Solid Mechanics, Power Electronics, Signal Processing, Neural Network.
- **Programming Languages**: C, C++, RTOS, Python, LATEX.
- **Software Proficiency**: SolidWork, Altium Designer, MATLAB, LabView, Adobe Premiere Pro, Adobe Illustrator, Inkscape.
- **Hardware Proficiency**: PCB Design, 3D Modeling and Printing, Laser Cutting, Machining, Wet Lab Skills.

References

- **Dr. Nikolaus Correll**, Ph.D Advisor
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