

# Ryan Zeyuan Chen

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🌐 <https://ryan-zeyuan-chen.github.io/>

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📍 Toronto, ON, Canada

## Education

Toronto, ON, Canada  
Sep 2022 – Aug 2024

**M.A.Sc. in Mechanical Engineering**, University of Toronto  
Advisor: Prof. Andrew Goldenberg  
*Collaborative Specialization in Robotics*

Toronto, ON, Canada  
Sep 2017 – Apr 2022

**B.A.Sc. in Engineering Science**, University of Toronto  
Advisor: Prof. Jessica Burgner-Kahrs  
*Robotics Engineering Major, Artificial Intelligence Engineering Minor, Engineering Business Certificate*

## Research Experience

Toronto, ON, Canada  
Sep 2022 – Ongoing

**Robotics Institute, University of Toronto** | Graduate Student  
*Supervised by Prof. Andrew Goldenberg, Robotics and Automation Laboratory*

- Exploring the development of a data-efficient and generalizable framework for learning robot kinematics, with an application to concentric tube continuum robots (CTCRs).
- Conducted a comprehensive literature review on learning-based robot kinematic modeling, identifying key challenges related to training data in the learning process.
- Developing a transfer learning framework designed to effectively address and mitigate the data-related obstacles in modeling robot kinematics.

Boston, MA, USA  
May 2023 – Sep 2023

**Brigham and Women's Hospital, Harvard Medical School** | Research Intern  
*Supervised by Prof. Jayender Jagadeesan, Surgical Imaging and Mechatronics Laboratory*

- Developed a novel dynamics model for tendon-driven continuum robots (TDCRs) with the inclusion of frictional forces.
- Explored the integration of machine learning techniques to enhance the computational speed and convergence capabilities of the dynamics model.
- Conducted animal experiments to showcase the potential of TDCRs as advanced robotic catheters in cardiac procedures, highlighting their capability in a clinical context.

Toronto, ON, Canada  
May 2021 – Apr 2022

**Robotics Institute, University of Toronto** | Research Assistant  
*Supervised by Prof. Jessica Burgner-Kahrs, Continuum Robotics Laboratory*

- Conducted an in-depth investigation into solving the forward and inverse kinematics of concentric tube continuum robots (CTCRs) utilizing machine learning.
- Comprehensively reviewed the existing physics-based and data-driven modeling approaches for CTCRs by analyzing relevant literature.
- Implemented a feed-forward neural network (FNN) model for learning the direct forward kinematics mapping between joint space and task space for CTCRs using PyTorch.
- Explored a novel hybrid approach that combines machine learning with differential inverse kinematics to compute the inverse kinematics of CTCRs.
- Rigorously tested and evaluated the performance of these approaches using data generated from both simulation and a physical CTCR prototype.

Toronto, ON, Canada  
May 2019 – Apr 2020

**Robotics Institute, University of Toronto** | Research Assistant  
*Supervised by Prof. Xinyu Liu, Microfluidics and BioMEMS Laboratory*

- Developed an antifreezing, ambient-stable and highly stretchable ionic skin with strong surface adhesion for wearable sensing and soft robotics applications.
- Conducted an extensive literature review to evaluate existing hydrogel-based ionic skin designs, gaining insights into current trends and challenges in the field.
- Executed the fabrication of the ionic skin, encompassing elastomer synthesis, material doping, and stretchable device integration.
- Performed comprehensive testing of the ionic skin's mechanical, electrical, antifreezing, and surface adhesion properties under various environmental conditions.
- Demonstrated the functional capabilities of the hydrogel-based ionic skin, utilizing its piezoresistive properties to independently control the fingers of a robotic hand via Arduino.

## Industry Experience

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San Jose, CA, USA Jun 2020 – May 2021	<b>Wired and Wireless Group, Xilinx</b>   SerDes Application Design Intern (Remote) <i>FPGA Software Development, SerDes System Engineering Team</i> <ul style="list-style-type: none"><li>Developed SDK test cases across different test suites to validate the functionality of APIs designed for the Kintex UltraScale+ FPGA using C++.</li><li>Verified developed software test cases on both virtual machines and physical hardware prototypes constructed by the hardware team.</li><li>Validated developed software test cases under various network communication protocols utilizing different network testing devices.</li><li>Regression tested developed software test cases in response to hardware upgrades to ensure performance consistency.</li></ul>
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## Publications

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2023	1. <b>Chen, R. Z.</b> , Shentu, C., Grassmann, R. M., Liang, N. & Burgner-Kahrs, J. Learning-Based Differential Inverse Kinematics for Concentric Tube Continuum Robots. <i>Manuscript in Preparation</i> (2023).
2022	2. Grassmann, R. M., <b>Chen, R. Z.</b> , Liang, N. & Burgner-Kahrs, J. <i>A Dataset and Benchmark for Learning the Kinematics of Concentric Tube Continuum Robots</i> in <i>IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)</i> (2022), 9550–9557.
2021	3. Ying, B., <b>Chen, R. Z.</b> , Zuo, R., Li, J. & Liu, X. An Anti-Freezing, Ambient-Stable and Highly Stretchable Ionic Skin with Strong Surface Adhesion for Wearable Sensing and Soft Robotics. <i>Advanced Functional Materials</i> <b>31</b> , 2104665 (2021).

## Presentations

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2023	<b>National Center for Image-Guided Therapy (NCIGT) Summer Research Retreat</b> , Brigham and Women's Hospital Speaker at the Continuum Robotics session, "Robotic Assisted Intracardiac Echocardiography (ICE) Catheter."
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## Honors and Awards

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2021	<b>Faculty of Applied Science and Engineering Dean's Innovation Fellowship</b> , University of Toronto Awarded to undergraduate engineering students conducting research in the areas of "Smart Cities, Smart Health, and The Internet of Things."
2019	<b>Undergraduate Student Research Award</b> , Natural Sciences and Engineering Research Council of Canada (NSERC) Awarded to undergraduate students pursuing research in the natural sciences and engineering, based on outstanding academic record and demonstrated research aptitude.
2017	<b>Albert and Rose Jong Entrance Scholarship</b> , University of Toronto Presented for demonstrating leadership in the Chinese-Canadian community as a first-year student in the Electrical Engineering or Engineering Science program.
2017	<b>Faculty of Applied Science and Engineering Admission Scholarship</b> , University of Toronto Awarded for outstanding academic achievement in the prerequisite courses as a first-year engineering student.
2017	<b>Halton Newcomer Recognition Award</b> , Halton Newcomer Strategy Honored for having a positive impact on the community through commitment to business, education, youth, and volunteering.

## Technical Skills

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**Robotics:** Robot Modeling, Control Theory, Machine Learning, Computer Vision, Human-Robot Interaction

**Software Development:** Python, PyTorch, C, C++, CMake, MATLAB, Simulink, Git, GitHub, HTML

**Hardware Development:** Verilog, ModelSim, Assembly Language, SPICE, Analog Circuit Design