

# Yi Zhang

PhD Candidate, Department of Engineering, University of Cambridge

yz892@cam.ac.uk | +44 7405 318022

## EDUCATION

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**PhD in Agri-Food Robotics, University of Cambridge, UK** | Oct 2023–Present

- Supervisor: Prof. Fulvio Forni. Advisor: Prof. Fumiya Iida.
- Research focus: physics-based controller for contact-rich robotic manipulation and interaction.

**MSc in Robotics and Autonomous Systems, First Class, University of Lincoln, UK** | Oct 2022–Sep 2023

**BEng in Mechanical Engineering, Osaka University, Japan** | Apr 2017–Mar 2022

**Exchange (non-degree), University of California, Berkeley, USA** | Aug 2019–Jun 2020

## RESEARCH EXPERIENCE

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**PhD, University of Cambridge** | Oct 2023–Present

Developing physics-based, interaction-driven robot controllers for contact-rich manipulation, which offers interpretability, safe physical interaction and robustness. My work departs from conventional trajectory-tracking approaches by unifying motion planning and control through virtual mechanisms, allowing behavior to emerge from interaction between the robot, task and environment. This has enabled robust performance under uncertainty and environmental variation.

- **Compliant reaching under uncertainties** — Developed virtual model controllers that integrate motion planning and control for safe reaching in cluttered, partially known environments; validated virtual mechanism designs on a 17-DoF upper-body humanoid robot, showing predictable and adaptable behavior under known and unknown obstacles. (*IROS 2024*)
- **Robust robotic cutting via virtual model control** — Designed a virtual-mechanism-based controller for rocking chop motions without explicit trajectory planning, using controlled switching and regulated energy injection to produce stable periodic cutting. Demonstrated robust cutting across different vegetables, knife geometries, cutting-board heights, and robot platforms. (*under review for IJRR*)
- **Distributed virtual model control for human-robot collaboration** — Developed a decentralized, agent-agnostic control framework for shared workspaces with humans and robots. Introduced force-based deadlock detection and negotiation, reducing probability of robots getting stuck from to zero in experiments and demonstrating scalability to multiple humans and robots. (*ICRA 2026*)
- **Passive data-driven iFIR control for robotics** — Developed a passive, data-driven velocity controller learned from a few minutes of probing data using VRFT, allowing improved tracking through data-driven approach while offering passivity-based stability guarantees. Experimental validation on the Franka Research 3 showed up to 74.5% reduction in tracking error over an optimized PID baseline and recovery of performance after dynamics changes through re-learning. (*under review for RA-L*)
- **Event-based variable-stiffness control inspired by neuron models** — Explored neuromorphic inspired virtual mechanisms for explosive and rhythmic motion generation, using state-dependent virtual springs and damping to achieve event-triggered task completion without explicit trajectory generators. Validated on robotic throwing and adaptive drumming tasks.

**MSc, University of Lincoln** | Oct 2022–Sep 2023

- Studied controller-based reinforcement learning, combining a roughly tuned controller with TD3 to improve learning efficiency.

**Undergraduate, Osaka University** | Apr 2021–Mar 2022

- Developed tactile-feedback-based cooperative object transportation with mobile robots equipped with flexible tactile sensors.

**Research Assistant, UC Berkeley** | 2019–2021

- Interaction prediction for autonomous driving and earlier projects in combustion modelling and experimentation.

## PUBLICATION

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- Zhang, Y., Wang, Z., Forni, F. "Passive iFIR filters for data-driven velocity control in robotics." Under review / arXiv: , 2026.
- Zhang, Y., Faris, O., Sirithunge, C., Chu, K.-F., Iida, F., Forni, F. "Distributed Virtual Model Control for Scalable Human-Robot Interaction in Shared Workspace." ICRA 2026 (IEEE International Conference on Robotics and Automation).
- Zhang, Y., Iida, F., Forni, F. "Periodic robust robotic rock chop via virtual model control." Under review / arXiv: 2508.02604,2025, 2025.
- Wang, Z., Zhang, Y., Forni, F. "Dissipative iFIR filters for data-driven design." European Journal of Control, 2025.
- Zhang, Y., Larby, D., Iida, F., Forni, F. "Virtual Model Control for Compliant Reaching under Uncertainties." IROS 2024 (IEEE/RSJ International Conference on Intelligent Robots and Systems).
- Zhang, Y., Sueoka, Y., Ishihara, H., Kawasetsu, T., Osuka, K., "A Decentralized Approach to Cooperative Object Transportation with Robots Equipped with Flexible Tactile Sensors", DARS 2022 (16<sup>th</sup> International Symposium on Distributed Autonomous Robotic Systems)
- Zhang, Y., Sueoka, Y., Ishihara, H., Kawasetsu, T., Osuka, K., "A Decentralized Approach to Cooperative Object Transportation with Robots Equipped with Flexible Tactile Sensors", RSJ 2021 (39<sup>th</sup> annual conference of the Robotics Society of Japan)

## LEADERSHIP, SERVICE AND PROFESSIONAL ACTIVITIES

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- Leader, Women in Robotics Cambridge (Feb 2026–Present): building partnerships with Robotics Inclusive and UK-RAS STEPS to enable networking opportunities in robotics across UK and across roles, planning networking activities and future workshops.
- Member, Women in Robotics Cambridge (July 2024–Present): maintaining website and LinkedIn account, and supporting organization of networking activities and workshops (Robotics Networking Event supported by UK-RAS network and Robotics Inclusive, Cambridge Festival at Newnham College, CHIA Robotics and Embodied Workshop). More Information on <https://sites.google.com/view/wir-cambridge/home>.
- Member, AgriFoRwArdS CDT Advisory Board (Jun 2023–Present): contribute to discussions on CDT development by providing feedback on events, student communications, and alumni engagement.
- Member, AgriFoRwArdS CDT Student Panel (Mar 2023–Present): represent student perspectives and relay feedback on CDT events and initiatives, including summer schools, annual conferences, and seminar series.
- Co-Chair, Autonomous Systems breakout session, Embodied Intelligence Conference 2025.
- Delivered research presentations and live robot demonstrations to diverse audiences at Cambridge Festival 2025, ICRA 2024, IFE (International Food and Drink) Manufacturing 2024, and REAP (Realising the Economic and Agricultural Potential conference) 2023/2024, Hardwick and Cambourne Community Primary School 2023, communicating both technical research outcomes and their potential real-world applications across academia, industry, and public engagement settings.

## TEACHING AND WORK EXPERIENCE

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- Supervision for Engineering Tripos Part IIB Project
  - Supervised three students in total with projects involving robot control and sensing
- Supervision for Engineering Tripos Part IIA, 3F1: Signals and Systems
- Demonstrator for Engineering Tripos Part IIA, 3F2: Systems and Control, GF1: Control Systems
- Research Assistant at Osaka University (April 2022–Sep 2022)
- Intern at HCI Co., Ltd (Japan, Sep 2020–Jan 2021)
  - Led the development of a robot hand that can play rock-paper-scissors with people.
  - Taught a Fanuc robot to complete a series of tasks using different hand/tool.
  - Programming and electrical wiring with FANUC, Mitsubishi, Yasukawa etc.'s robot.

## TECHNICAL SKILLS

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- Programming: Python, Julia, MATLAB, C/C++.
- Robotics and tools: ROS, MuJoCo, OpenCV, Arduino, Ubuntu, SolidWorks, Fusion 360, LaTeX.
- Languages: Mandarin Chinese, Japanese, English.

## SELECTED PRESENTATIONS

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- “Virtual model control for robotic manipulation” — oral, Invited seminar 2025 at Tadakuma lab, Osaka University, Japan.
- “Virtual model control for robust cutting” — oral, Embodied Intelligence Conference 2025; poster, 25 Years of Embodied Intelligence Conference 2025, Lausanne Switzerland.
- “Virtual model control for compliant reaching under uncertainties” — oral, Embodied Intelligence Conference 2024; oral and poster, IROS 2024, Abu Dhabi.
- “Virtual model control for manipulation and path planning under uncertainties” — oral, UKACC PhD Showcase 2024, London.
- “Controller-based Reinforcement Learning in Robotics Manipulation” — poster, TAROS 2023 / Joint Robotics CDT Annual Conference 2023.