

Zekai Chen

PhD in Control and Optimization

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PERSONAL PROFILE

I have a strong background in **math, control system design, computer programming, academic writing, and presentation delivery**, with rich experience working with interdisciplinary and international teams to achieve challenging goals.

My research interests lie in optimization, robust decision making of systems under dynamic environments, optimal control, learning-based control, and data-driven control. For more details, please see the "publication" section.

Beyond academia, **I am committed to contributing to a more sustainable society for our future generation.** I have participated in community volunteering activities with 500 total of hours accumulated. Furthermore, I gained entrepreneurial experience as a co-founder of a startup in the Netherlands, focused on developing robotic solutions to alleviate the workload of healthcare professionals in the surgical preparation process.

EDUCATION

University of British Columbia, *PhD. Mechanical Engineering* Jan 2026-Jan 2030

• Supervisor: [Ryozo Nagamune](#)

Delft University of Technology, *M.Sc. System and Control* Sep 2022-Jan 2025

• Faculty of Mechanical Engineering

• GPA: 8.22/10 (Last year GPA: 8.78/10); Top 10% of Graduates

• Thesis Topic: [LiDAR Enhanced Closed-Loop Active Wake Mixing Control](#) (Grade: 8.5/10)

• Supervisor: [Jan-Willem van Wingerden](#)

Beijing Institute of Technology, *B.Sc. Automation Technology* Sep 2018-Jun 2022

• Faculty of Electrical Engineering

• GPA: 88.5/100 (conversion: 3.85/4.0); Top 10% of Graduates

HONORS AND AWARDS

• **President's Academic Excellence Initiative PhD Award** (UBC) 2026.

• **Best Startup Pitch Presentation** (TU Delft, Roland Berger) 2024.

• **Outstanding Student Scholarship** (BIT) 2019-2021 (x3).

• **Outstanding Bachelor Student Researcher** (BIT) 2020.

• **First prize of "Challenge Cup National Academic and Technological Competition"** (BIT) 2019.

RESEARCH EXPERIENCE

Master Thesis (Final Thesis Grade 8.5/10), *Delft University of Technology*, Delft, NL Feb 2024-Jan 2025

• Supervisor [Prof. Jan-Willem van Wingerden](#)

• Conducted a comprehensive literature review on wind farm flow control and identified a key research gap: **the lack of closed-loop systems leveraging LiDAR-sampled wind flow data for wake mixing control (Helix approach).**

• Designed and implemented a **closed-loop control framework integrating continuous-wave LiDAR measurements with advanced control strategies**, including Internal Model Control, Smith Predictor, and robust \mathcal{H}_∞ control. The framework incorporates an aerodynamic model acquired through system identification to handle system delays and uncertainties.

• Performed mid-fidelity wind farm simulations using QBlade and MATLAB across diverse wind conditions.

• The designed framework **enables adaptive pitch control under uncertainties** (e.g., wind shear and gusts) and **demonstrates a 5% increase in power production** under wind shear, outperforming conventional open-loop systems.

Research Assistant, *Carnegie Mellon University*, Pittsburg, PA, USA May 2020-Aug 2020

• Supervisor [Prof. Min Xu](#)

- Conducted a literature review on the use of computer vision techniques in 3D cell structure reconstruction, identifying a key gap: **current methods rely on physical anchor points for image alignment, while anchor-free approaches remain unexplored.**
- Designed and developed **an end-to-end anchor-free image alignment algorithm based on YOLOv3** with the PhD student, and conducted comparative experiments against conventional anchor-based methods.
- The proposed method **performs comparably to traditional approaches in basic alignment tasks using Cryo-ET cell slice data**; performance limitations remain for complex cellular structures due to the absence of anchors.
- Authored a technical report, automated the data processing pipeline, and was in charge of the labeling process of the dataset creation.

Research Assistant, *Chinese Academy of Science, Institute of Automation*, Beijing Aug 2019-Feb 2020

- Supervisor [Prof. Shiming Xiang](#)
- Conducted a literature survey on cloud removal techniques for climate data using generative adversarial networks (GANs), **identifying a research gap in the use of deeper network architectures.**
- Studied, implemented, and summarized major object detection algorithms as foundational knowledge for model design.
- Assisted PhDs in **implementing an improved cloud removal algorithm based on GANs with a modified network structure.**
- The proposed method achieves comparable performance to traditional methods with increased computational cost.

JOURNAL PUBLICATIONS

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|--|------|
| LiDAR-enhanced Closed-Loop Active Helix Approach , <i>under review</i> | 2025 |
| • Zekai Chen , Aemilius.A.W (Mees) van Vondelen, Jan-Willem van Wingerden | |

TECHNICAL PUBLICATIONS

- | | |
|--|------|
| A Model Predictive Control Approach for Quadrotor Cruise Control | 2025 |
| • Journal of Physics Conference Series | |
| • Zekai Chen , Leon Kehler | |
| • DOI: 10.48550/arXiv.2504.13286 | |
| Literature Review: LiDAR-enhanced closed-loop Active Wake Mixing Control | 2024 |
| • Delft University of Technology, Delft Center of System and Control | |
| • Zekai Chen | |
| • DOI: 10.13140/RG.2.2.17006.11848 | |
| Control System Design for the Bi-wing Aircraft | 2023 |
| • Delft University of Technology, Delft Center of System and Control | |
| • Zekai Chen | |
| • DOI: 10.13140/RG.2.2.10855.56484 | |
| A Concatenated Approach based on Transfer Learning and PCA for Classifying Bees and Wasps | 2021 |
| • Journal of Physics Conference Series, IWECAI 2021 | |
| • Jiahong Zhang, Hongxiang Guo, Zekai Chen (co-first author) | |
| • DOI: 10.1088/1742-6596/1873/1/012058 | |

SKILLS

- **Computer Skills** Linux, Windows, Git, C, C++, Python, MATLAB.
- **AI and Data:** PyTorch, TensorFlow, scikit-learn, Matplotlib, Numpy, Pandas.
- **Modeling and Control System Analysis:** MATLAB, Simulink, ROS, QBlade.
- **Languages:** English (TOEFL 110/120), Chinese, Dutch (limited working proficiency), Japanese (limited working proficiency).
- **Other Skills:** LaTeX, Microsoft Office Suite.

WORK EXPERIENCE

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|---|-------------------|
| Control Engineer , <i>Formula Student Team Delft</i> , Delft, NL | Aug 2023-Sep 2024 |
| • Chief engineer in Vehicle Dynamics and Control Department; led design and development of the autonomous racing system. | |
| • Developed the system architecture , including perception, state estimation, and control subsystems. | |
| • Built a vehicle model (dynamic bicycle model) , achieving 75% accuracy in real-world testing. | |

- **Designed and implemented a Kalman Filter–based state estimator** for real-time model-based vehicle state acquisition and sensor fusion.
- **Upgraded control strategy from PI Stanley to Model Predictive Control (MPC).**
- Integrated systems via ROS on Ubuntu 22.04; led **system deployment** and testing on the DUT24 race car.
- Delivered **technical presentations** to sponsors and the public.
- **Achieved 4th place globally at Formula Student Germany (FSG) 2024.**

R&D Engineer Internship, *Ericsson*, Beijing, China

May 2021–Nov 2021

- Joined as a System and Application Engineering Intern, responsible for the **fault detection component of the 5G AI (Machine Learning Based) Toolkit.**
- **Automated data-processing pipeline and modeled a 5G baseband communication system using XGBoost**, achieving 80% accuracy on real-world data. The model captures system dynamics while remaining explainable to engineers and researchers.
- **Developed a fault detection module based on a clustering algorithm for rapid anomaly identification and root cause analysis** based on XGBoost, enabling 3 times faster detection and providing interpretable error factors for debugging.
- Contributed to **pattern recognition research in 5G** with a multinational team by authoring technical reports and optimizing the codebase.
- Coordinated key team activities, including interviews and weekly technical meetings.

PROJECTS EXPERIENCE

Optimal Control System for Agriculture Greenhouse, *Dynamic Programming and Stochastic Process Control 9.7/10*, TU Delft

Apr 2023–Jun 2023

- **Defined and set up the dynamic programming problem in the standard form**, integrating the system's dynamic, state space, action space, disturbance, and corresponding cost functions.
- **Led a group of 6 in designing an optimal control system based on the dynamic programming techniques and the model of the agricultural greenhouse**, reducing energy costs by 30% and increasing yield by 20% compared to the uncontrolled system.

10MW Wind Turbine Control System Design, *Wind Turbine Design 9/10*, TU Delft

Nov 2022–Jun 2023

- **Led the decision-making of wind turbine location selection** based on wind distribution modeling in Western Europe, and provided a quantitative analysis report.
- Participated in the design of static and dynamic turbine parameters, **leading MATLAB and OpenFAST-based simulations and steady-state analysis.**
- **Led the design of blade pitch, yaw, and torque control systems** with a group of 5 engineers, ensuring safe operation in the wind speed from 3 – 20 m/s with a stable 9.9 MW output.
- Wrote the technical report of the designed wind turbine and the control system part.

EXTRACURRICULAR AND ENTREPRENEURIAL EXPERIENCE

Startup Cofounder ROBOCO, *Surgical Robot Service*, Delft, NL

Mar 2024–Jun 2024

- Cofounded ROBOCO, a company focusing on **streamlining surgical preparation using computer vision and robotics technologies.**
- **Conducted interviews** with doctors, business owners, and researchers for **market research and feasibility analysis** in the biomedical engineering sector.
- **Led business development and strategic planning** in collaboration with Roland Berger consultants.
- Authored comprehensive business and financial plans.
- Represented the team as **lead pitch speaker** at startup events hosted by Yes!Delft and Roland Berger, and were **awarded the jury prize.**

Volunteer, *China International Fair for Trade in Services*, Beijing, China

Aug 2021–Sep 2021

- **Provided hosting and translation (English) support** for international guests at CIFTIS 2021.
- Assisted with event coordination and interview organization.

ACTIVITIES

Kickboxing and Muay Thai, *Fighter*

2022–present

Piano *Central Conservatory of Music of piano level 8*

2003–present

Volunteer *Accumulated volunteering hours 500*

2015–present