

# 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  $\mathcal{H}_\infty$  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

**LiDAR-enhanced Closed-Loop Active Helix Approach**, *under review* 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](https://doi.org/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](https://doi.org/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](https://doi.org/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](https://doi.org/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

**Control Engineer**, *Formula Student Team Delft*, Delft, NL Aug 2023-Sep 2024

- Acted as a technical lead in the autonomous team. Conducted technical requirement analysis and architected the complete autonomous system framework, covering perception, vehicle modeling, state estimation, and control. Created documentations, visualizations, and presentations for the designed framework.

- Used Python3 to build a robust state estimation based on first-principle vehicle models and a Kalman filter to reconstruct all the race car states using sensor data (LiDAR, IMU, Gyroscope).
- Developed a new 2 DOF control system that generates control inputs through real-time optimization using Model Predictive Control (MPC) using Python3 on the ROS platform, eliminating instability issues caused by the decoupled PI and Stanley controllers. This significantly enhanced the system's robustness and performance.
- Led weekly technical code reviews for platform components in Python, MATLAB, and C++. Implemented and maintained source control to code across platform components using Git and Docker.
- Integrated systems via ROS and led cross-department system deployment and testing on the DUT24 race car. The built system is able to finish Skidpad racing robustly (90% team failed).
- Represented the team in high-impact technical presentations to sponsors (KLM and Shell) and showcased the system at the public car roll-off event.
- **Achieved 4<sup>th</sup> place globally at Formula Student Germany (FSG) 2024.**

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

May 2021-Nov 2021

- Developed an automated data-processing pipeline in Python , enabling seamless data ingestion, NaN handling, restructuring, correlation analysis, and key feature extraction.
- Modeled Ericsson 5G baseband communication station in Beijing (serving a population of 22 million) using XGBoost. The model achieved 80% accuracy on real-world data, effectively capturing system dynamics while maintaining interpretability for engineers and researchers.
- Developed a fault detection module based on a clustering algorithm in Python3 for anomaly detection and root cause analysis. Created a visualization of the result using Power BI, enabling 3 times faster detection and providing interpretable error factors for debugging.
- Authored technical documentation for the 5G Machine Learning Toolkit and contributed to pattern recognition research in 5G systems as part of a multinational engineering team.
- Coordinated weekly technical meetings, interviews, and guest lectures in both English and Chinese. Also contributed to cross-department event planning, including knowledge-sharing sessions and collaborative initiatives.

## 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.

## 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