

# Zekai Chen

PhD applicant in AI, Optimization, and Control

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[ResearchGate Profile](#)

[LinkedIn Profile](#)

## 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**. My Master's research focuses on developing advanced control strategies for complex MIMO systems with time delays, with application in wind farm flow 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

**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

- **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 for University Students"** (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

- *Wind Energy Science* (Citescore 6.9)
- **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

- **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 4<sup>th</sup> 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