Kai Wang

CONTACT INFO

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POSITIONS

Research Associate
Department of Aeronautical and Automotive Engineering, Loughborough University, Loughborough, United Kingdom (07/2024 – Present)

PhD Researcher
Department of Engineering Cybernetics, Norwegian University of Science and Technology (NTNU), Trondheim, Norway (10/2020 – 06/2024)

EDUCATION

Norwegian University of Science and Technology (NTNU) 10/2020 – 10/2024
Ph.D., Decision-Making Under Uncertainty, Department of Engineering Cybernetics

ShanghaiTech University 09/2017 – 08/2020
M.E., Computer Science&Control Theory, School of Information Science and Technology

Xidian University 08/2013 – 07/2017
B.E., Space Information and Digital Technology, School of Telecommunications Engineering

RESEARCH INTERESTS

- Control Theory: nominal, robust, stochastic, distributionally robust, offset-free tracking MPC
- Numerical Optimization: distributed, robust, stochastic optimization
- Measure and Probability Theory, Chance Constrained Optimization
- Dynamic Programming, Markov Decision Processes, Reinforcement Learning, Learning&Control.

THESES

- **MSc Thesis**, "Robust Model Predictive Control Based on Distributed Optimization", 08/2020
  ShanghaiTech University, supervised by Prof. Boris Houska.
- **PhD Thesis**, "Model-Based Predictive Control Under Uncertainty", 10/2024
  Norwegian University of Science and Technology (NTNU), supervised by Prof. Sébastien Gros.

PUBLICATIONS

1. **K. Wang**, S. Zhang, S. Gros, S. Raković. Tube MPC with Time-Varying Cross-Sections. IEEE Transactions on Automatic Control, 2024.
2. **K. Wang**, K.T. Hoang and S. Gros. Robustifying Model Predictive Control of Uncertain Linear Systems with Chance Constraints. In *Proceedings of the 63rd IEEE Conference on Decision and Control (CDC),* Milan, Italy, 2024

3. **K. Wang**, S. Gros. Solving Mission-Wide Chance-Constrained Optimal Control Using Dynamic Programming. In *Proceedings of the IEEE 61th Conference on Decision and Control (CDC),* Cancun, Mexico, December, 2022.
4. **K. Wang**, S. Gros. Recursive Feasibility of Stochastic Model Predictive Control with Mission-Wide Probabilistic Constraints. In *Proceedings of the IEEE 60th Conference on Decision and Control (CDC),* Austin, Texas, USA, December, 2021.
5. **K. Wang**, J. Oravec, M.E. Villanueva, B. Houska. Parallel Explicit Tube Model Predictive Control. In *Proceedings of the IEEE 58th Conference on Decision and Control (CDC),* Nice, France, December, 2019.
6. J. Su, Y. Zha, **K. Wang**, M.E. Villanueva, R. Paulen, B. Houska. Interval Superposition Arithmetic for Guaranteed Parameter Estimation. In *Proceedings of the IFAC 12th Symposium on Dynamics and Control of Process Systems (DYCOPS),* Florianopolis, Brazil, April, 2019, *IFAC-PapersOnLine,* Volume 52(1), pp. 574-579.

SUBMISSIONS

1. **K. Wang**, J. Liu, Y. Yan, W. Chen. Model Predictive Control with λ–Contractive Terminal Sets. submitted to *Automatica*. (Under Review) .

ONGOING PROJECTS

- Model Predictive Control with Disturbance Modeling, Preview and Observation, in collaboration with Dr. Yunda Yan and Prof. Wenhua Chen.
  - This project aims to enhance MPC by integrating advanced disturbance modeling, preview mechanisms, and observation techniques. My contributions include formulating the theoretical framework, designing practical algorithms, and validating the approaches through simulations.
- INSECT: A Software Toolkit for Invariant Sets Computation and Tube Model Predictive Control, in collaboration with PhD Candidate Rui Huang.
  - This project develops a C++ toolkit with MATLAB and Python interfaces for polyhedral computations and set-based robust control, including Tube MPC. My role includes reviewing algorithms, creating demos for MATLAB and Python users, conducting numerical analyses for robustness and efficiency, and contributing to documentation.

PROGRAMMING LANGUAGES:

- **MATLAB** (primary usage for research and development)
- **Python** (occasional use for specific tasks and projects)
- **C/C++ and Java** (learned during bachelor's courses, very limited practical experience)

TEACHING

- Guest Lecturer for COMP0211 Control 2, Model Predictive Control: Robust, Stochastic and Distributionally Robust, University College London (UCL), London, December 2024.
- Teaching Assistant, Numerical Analysis, ShanghaiTech University, Shanghai, Fall 2018, Fall 2019.
- Teaching Assistant, Introduction to Control, ShanghaiTech University, Shanghai, Fall 2017.

RESEARCH EXPERIENCE

- Contribution to the GitHub repository `robust-tube-mpc` (MATLAB, 451 stars).
- Visiting Scholar, Institute for Information Engineering, Automation, and Mathematics, Slovak University of Technology in Bratislava, Slovakia, October, 2018

- Co-organizer, International Workshop on Advanced Methods for Control and Estimation of Dynamic Systems (AMCEDS 2018), ShanghaiTech University, Shanghai, China, July 23, 2018