LinkedIn

Hao Chen

hao.chen@okstate.edu • 4053348469

Stillwater, Oklahoma, USA, 74075

Personal Web

Profile

- Expertise in navigation, localization, perception, control, and sensor fusion of UAV/Robotics.
- 7+ years of programming experience in UAV/Robotics by using C++/MATLAB/Python/ROS.
- 7+ years of hands-on experience in UAV/Robotics.
- Ability to use various machine learning methods to solve engineering problems.

Education

Ph.D. candidate in Mechanical and Aerospace Engineering. GPA: 4.00/4.00 Sep 2019 – Dec 2023 (Expected)
OKLAMOHA STATE UNIVERSITY (OSU) *Stillwater, OK, USA*
B.E. in Automation. GPA: 3.62/4.00 Sep 2015 – Jun 2019
SOUTHWEST UNIVERSITY OF SCIENCE AND TECHNOGY (SWUST) *Mianyang, Sichuan, China*

Technical Skills

Algorithms:

- Navigation/Localization /Perception algorithms**:** Bayesian estimation, Bayesian smoothing, distributed estimation, KF, EKF, Multiplicative EKF (MEKF), invariant EKF (IEKF), SLAM
- Control algorithms: PID, LQR, MPC, nonlinear controller, adaptive controller, optimal controller
- Machine Learning algorithms: linear/logistic regression, DNN, CNN, RNN, LSTM

Knowledge Framework:

- System theory: system dynamics, linear system, nonlinear system, digital system, stochastic system, multi-agent system, system identification
- Control theory: classical control, modern control, nonlinear control, adaptive control, optimal control
- Other theory: Bayesian analyze, mathematical statistics, machine learning, robotics

Programming: MATLAB, Python, C++, C, and R
Simulation&Tool: Simulink, ROS, Gazebo, Git
Embedded System: Arduino/STM32/Raspberry Pi
Language: English (fluent), Mandarin (native)

Research/Project Experience

➢ **NSF-NRI: Safe Wind-Aware Navigation for Collaborative Autonomous Aircraft in Low Altitude Airspace.**
Research Assistant Sep 2019 – Dec 2023 (Expected)
Control, Robotics and Automation Lab (CoRAL), OSU *Stillwater, OK, USA*

- **System modeling:** build mathematical models for nonlinear quadcopter dynamics which are integrated with various drag, thrust and wind models.
- **IEKFs design for single UAV states and wind estimation:** develop the nominal IEKF by taking advantage of system symmetry, and IEKFs show less transient error and faster convergence speed compared to EKFs; develop IEKFs with IMU biases and various drag, thrust and wind models.
- **Estimation and fusion algorithms design for multi-UAV system states and wind estimation:** extend EKFs/IEKFs from single UAV to multi-UAV system and develop a sequential covariance intersection (SCI) method and a sequential weighted exponential product (SWEP) method for the information fusion.
- **Machine learning implementations for states and wind estimation:** train a DNN for obtaining the accurate thrust; train a LSTM model for wind estimation; integrate the RBF and NN wind model with EKFs and IEKFs.
- **MATLAB/Simulink simulation validation**: develop a quadcopter MATLAB/Simulink model integrating quadcopter dynamics, motor/rotor models, sensor models, wind models, estimators, controllers, and path planners; extend the single quadcopter model to the quadcopter swarm model. The simulation results show the effectiveness

of designed IEKFs and data fusion methods.

- **Indoor/outdoor experiments validation:** build a thrust stand for obtaining thrust models, a ROS-based mobile robot with the anemometer for ground truth wind collection, and integrate a small-size quadcopter, a motion capture system, a mobile robot and a wind generator for indoor flight test; conduct multiples outdoor experiments by using a large-size quadcopter SK8 for flight test and the true wind is measured by the wind sensor on the SK8 and wind tower. The experimental results further verify the superiority of designed algorithms.

➢ **"Challenge Cup" National College Student Curricular Academic Science and Technology Works Competition: Multi-robot Collaboration System for Education and Experimental Purpose in Structured Environment.**

Research Assistant — Sep 2016 – May 2018
Special Environment Key Laboratory of Sichuan Province, SWUST — *Mianyang, Sichuan, China*

- Develop path planning and collision avoidance strategy based on improved A star algorithm for multi-robot system in grid space.

➢ **Lab Project: The upper computer software design of XY axis drawing robot**

Research Assistant — Jul 2017 – Nov 2017
Special Environment Key Laboratory of Sichuan Province, SWUST — *Mianyang, Sichuan, China*

- Develop a MATLAB GUI which can achieve image processing, such as image graying, image binarization, image boundary extraction, and image filling.

➢ **Robot Competition: 2017 (2nd) University Robot Competition of Sichuan Province**

Team Member — Mar 2017 – Jul 2017
Special Environment Key Laboratory of Sichuan Province, SWUST — *Mianyang, Sichuan, China*

- Develop the navigation and obstacle avoidance strategy of the robot based on SLAM.
- Implement the robot chassis control based on Mecanum Wheel.

Other Experience

Teaching Assistant — 2020 Fall, 2021 Spring, 2023 Spring
OKLAHOMA STATE UNIVERSITY — *Stillwater, OK, USA*

- Work as the teaching assistant for the course MAE3724-SYSTEM DYNAMICS.

Internship — Jun 2018 - Jul 2018
Sichuan Changhong Electric Co., Ltd — *Mianyang, Sichuan, China*

- Learn PLC programming and equipment maintenance at air conditioning/TV manufacturing assembly line.

Internship — Jun 2018
XbotPark Startup Incubator — *Dongguan, Guangdong, China*

- Learn market research, designing definition tools and constructing design solutions.

Service: IEEE member | Reviewer

Publications

- Chen, H., Bai, H. and Taylor, C.N., 2022, June. Invariant-EKF design for quadcopter wind estimation. In 2022 American Control Conference (ACC) (pp. 1236-1241). IEEE. (Published)
- Chen, H. and Bai, H., 2022. Incorporating thrust models for quadcopter wind estimation. IFAC-PapersOnLine, 55(37), pp.19-24. (Published)
- Chen, H. and Bai, H., 2023. Wind Field Estimation Using Multiple Quadcopters. Modeling, Estimation and Control Conference 2023. (Accepted)
- Chen, H. and Bai, H., 2024. Model-based invariant filters for quadcopter wind estimation. IEEE Transactions on Aerospace and Electronic Systems. (Submitted)
- Chen, H., Bai, H., Jacob, J. and Revard, B., 2024. Experimental validation of dynamics-based wind estimation for quadcopters. AIAA Science and Technology Forum and Exposition. (In preparation)
- Chen, H. and Bai, H., 2024. Temporal-spatial wind field estimation using multiple quadcopters. IEEE Transactions on Aerospace and Electronic Systems. (In preparation)