Xiangyu Wu

Singapore | +65 84529570 | wuxiangyuucb@gmail.com | https://xiangyu-wu.github.io/

EDUCATION

University of California, Berkeley   *August 2017 - June 2022*
Ph.D. in Robotics   GPA: 3.91/4.00
Advisor: Prof. Mark W. Mueller
Research Field: Navigation, Controls, and Localization of Mobile Robots

Beijing Institute of Technology   *September 2013 - June 2017*
Bachelor of Science in Vehicle Engineering   GPA: 3.96/4.00
Department of Mechanical Engineering   Ranking: top 1%

WORK EXPERIENCE

Motional

Software Engineer in Controls   *August 2023 - Present*

· Improve the lane change performance and safety of Motional's autonomous driving vehicle running on public roads in Las Vegas.
· Develop novel path planning and control methods for the autonomous driving vehicle to improve its handling of emergencies (e.g. harsh braking of leading vehicles, pop-up pedestrians).

Autel Robotics

Path Planning Engineer   *September 2022 - December 2022*

· Improved the performance of the target localization and tracking modules, which enable the drone to track and take photos of the user-defined target autonomously.
· Upgraded the target localization and tracking modules from ROS1 to ROS2, optimized and deployed them on the latest drone model of Autel Robotics – EVO MAX.

University of California, Berkeley

Research Assistant   *August 2017 - June 2022*

· Worked with Prof. Mark W. Mueller on the autonomy of aerial robots.
· Conducted research on the path planning, control, state estimation, and novel design of unmanned aerial vehicles (UAVs).

TECHNICAL SKILLS

Modeling: AutoCAD, Solidworks, CATIA.
Robotics: ROS, MPC, Nonlinear Controls, Kalman Filters, Path Planning, PX4, SLAM.
Programming: C++, Python, MATLAB, TensorFlow.

AWARDS

Winner of the DARPA Subterranean Challenge (member of team CERBERUS)   *September 2021*
J.K. Zee Fellowship and the Graduate Division Block Grant Award (UC Berkeley)   *December 2020*
Graduate Division Block Grant Award (UC Berkeley)   *November 2018*
Graduate Division Block Grant Award (UC Berkeley)   *April 2018*
Outstanding Graduate of Beijing   *July 2017*
Outstanding Graduate Award (Beijing Institute of Technology)   *July 2017*
Chinese National Scholarship   *November 2014*

PUBLICATIONS

[1] J. Zha, **X. Wu**, R. Dimick, M. W. Mueller, "Design and control of a collision-resilient aerial vehicle with an icosahedron tensegrity structure", *IEEE/ASME Transactions on Mechatronics*, 2024.

[2] W. Park, **X. Wu**, D. Lee, S.J. Lee, "Design, Modeling and Control of a Top-loading Fully-Actuated Cargo Transportation Multirotor", *IEEE Robotics and Automation Letters (RA-L)*, 2023.

[3] M. Tranzatto, M. Dharmadhikari, L. Bernreiter, M. Camurri, S. Khattak, F. Mascarich, P. Pfreundschuh, D. Wisth, S. Zimmermann, M. Kulkarni, V. Reijgwart, B. Casseau, T. Homberger, P. De Petris, L. Ott, W. Tubby, G. Waibel, H. Nguyen, C. Cadena, R. Buchanan, L. Wellhausen, N. Khedekar, O. Andersson, L. Zhang, T. Miki, T. Dang, M. Mattamala, M. Montenegro, K. Meyer, **X. Wu**, A. Briod, M. Mueller, M. Fallon, R. Siegwart, M. Hutter, K. Alexis, "Team CERBERUS Wins the DARPA Subterranean Challenge: Technical Overview and Lessons Learned", *accepted by Field Robotics*.

[4] D. Zhang, A. Loquercio, **X. Wu**, A. Kumar, J. Malik, M .W. Mueller, "A Zero-Shot Adaptive Quadcopter Controller", *in 2023 International Conference on Robotics and Automation (ICRA)*.

[5] **X. Wu**, S. Chen, K. Sreenath, and M. W. Mueller, "Perception-aware receding horizon trajectory planning for multicopters with visual-inertial odometry", *IEEE Access*, 2022.

[6] **X. Wu**, J. Zeng, A. Tagliabue, and M. W. Mueller, "Model-free online motion adaptation for energy efficient flights of multicopters", *IEEE Access*, 2022.

[7] M. Tranzatto, F. Mascarich, L. Bernreiter, C. Godinho, M. Camurri, S. Khattak, T. Dang, V. Reijgwart, J. Löje, D. Wisth, S. Zimmermann, H. Nguyen, M. Fehr, L. Solanka, R. Buchanan, M. Bjelonic, N. Khedekar, M. Valceschini, F. Jenelten, M. Dharmadhikari, T. Homberger, P. De Petris, L. Wellhausen, M. Kulkarni, T. Miki, S. Hirsch, M. Montenegro, C. Papachristos, F. Tresoldi, J. Carius, G. Valsecchi, J. Lee, K. Meyer, **X. Wu**, J. Nieto, A. Smith, M. Hutter, R. Siegwart, M. Mueller, M. Fallon, and K. Alexis, "CERBERUS: Autonomous Legged and Aerial Robotic Exploration in the Tunnel and Urban Circuits of the DARPA Subterranean Challenge", *Field Robotics*, 2022.

[8] S. Chen, **X. Wu**, M. W. Mueller, and K. Sreenath, "Real-time Geo-localization Using Satellite Imagery and Topography for Unmanned Aerial Vehicles", *in 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.

[9] J. Lee*, **X. Wu***, S. J. Lee, and M. W. Mueller, "Autonomous flight through cluttered outdoor environments using a memoryless planner", *in 2021 International Conference on Unmanned Aircraft Systems (ICUAS)*. ($*$ Share first authorship. Names alphabetical ordered.)

[10] **X. Wu** and M. W. Mueller, "In-flight range optimization of multicopters using multivariable extremum seeking with adaptive step size", *in 2020 International Conference on Robotics and Automation (IROS)*.

[11] J. Zha, **X. Wu**, J. Kroeger, N. Perez and M. W. Mueller, "A collision-resilient aerial vehicle with icosahedron tensegrity structure", *in 2020 International Conference on Robotics and Automation (IROS)*.

[12] **X. Wu** and M. W. Mueller, "Using multiple short hops for multicopter navigation with only inertial sensors", *in 2020 International Conference on Robotics and Automation (ICRA)*.

[13] A. Tagliabue, **X. Wu**, and M. W. Mueller, "Model-free online motion adaptation for optimal range and endurance of multicopters", *in 2019 International Conference on Robotics and Automation (ICRA)*.

[14] **X. Wu** and M. W. Mueller, "Towards a consequences-aware emergency landing system for unmanned aerial systems", *in 2018 International Conference on Unmanned Aircraft Systems (ICUAS)*.

[15] G. Zhang, J. Alcala, J. Ng, M. Chen, **X. Wu**, M. W. Mueller and Y. Chen, "Embedding Consequence Awareness in Unmanned Aerial Systems with Generative Adversarial Networks", in *2018 International Conference on Unmanned Aircraft Systems (ICUAS)*.

RESEARCH PROJECTS

Perception-aware motion planning of quadcopters with visual-inertial odometry
HiPeRLab, University of California, Berkeley   *Auguest 2021 - August 2022*

· Introduced a planner that improves the state estimation quality of visual-inertial odometry (VIO) and reduces its failure rate.
· The planner generates collision-free trajectories that navigate the vehicle toward the goal while avoiding regions with few visual features and overly aggressive flight behavior.
· We propose a perception cost function considering both the motion blur of the visual features and their locations, with a natural adaptation of the trajectory's aggressiveness under environments with different light levels

Model-free online motion adaptation for energy efficient flights of multicopters
HiPeRLab, University of California, Berkeley   *May 2018 - December 2021*

· Introduced an approach to find the optimal flight time and optimal flight distance velocities and heading angles of multicopters.
· This method is based on Extremum Seeking Control with adaptive step size and does not require any power consumption model of the vehicle, can be executed online, and guarantees adaptation to unknown disturbances. It also converges faster than the traditional Extremum Seeking Control.
· This method is especially useful in applications where a multicopter carries an unknown payload.

Collision-resilient tensegrity quadcopter design and control
HiPeRLab, University of California, Berkeley   *March 2020 - November 2022*

· Designed a novel icosahedron tensegrity quadcopter that is lightweight and can withstand collisions with a speed up to 7.2 m/s.
· Adopted the inertial navigation method (using only the inertial measurement unit for sensing), so that the tensegrity vehicle can perform autonomous flights without external sensing in challenging environments.

DARPA Subterranean Challenge
Member of the CERBERUS team, winner of the challenge.   *December 2018 - August 2021*

· Developed an ultra-wideband (UWB) based localization system for robot localization.
· Developed an algorithm for localizing electronic artifacts based on Bluetooth.
· Implemented a computationally-efficient collision avoidance path planner for aerial robots in cluttered environments.

Motion planning for the inertial navigation of multicopters
HiPeRLab, University of California, Berkeley   *March 2019 - March 2020*

· Proposed a motion planning strategy for drastically reducing the inertial navigation state estimation error of multicopters. The strategy breaks a long-duration flight into multiple short-duration hops, between which the vehicle remains stationary on the ground.
· When the vehicle is stationary, zero-velocity pseudo-measurements are introduced to an Extended Kalman Filter to reduce the state estimation error.
· This method is useful in certain challenging environments, such as inside buildings on fire, where the main sensors used for multicopter localization can become unavailable.

Consequences-aware Emergency Landing for multicopters

HiPeRLab, University of California, Berkeley   *August 2017 - May 2018*

· Presented an algorithm with which an aerial robot is capable of planning consequence-aware flight paths and performing emergency landings.
· Focused on faults that would force the vehicle to land in a short time, and created a system that allows the vehicle to reason about its ability to execute a safe emergency landing from its current state.
· Such a system can improve the safety and reduce the economic cost of aerial robots, by allowing them to operate more flexibly while still achieving suitable safety.

ACADEMIC SERVICES

Journal Reviewer

- IEEE Transactions on Aerospace and Electronic Systems

- IEEE Robotics and Automation Letters (RA-L)

- IEEE Access

- Autonomous Robots (AURO)

- Nonlinear Dynamics

- Archive of Mechanical Engineering

Conference Reviewer

- IEEE International Conference on Robotics and Automation (ICRA)

- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

- International Conference on Unmanned Aircraft Systems (ICUAS)

- ASME Dynamic Systems and Control Conference (DSCC)

- IFAC Symposium on Mechatronic Systems

- International Conference on Motion and Vibration Control