

# Bo Fu

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<https://bofu.page>

## EDUCATION

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### University of Michigan

Ann Arbor, MI

Ph.D. in Robotics

Sep 2019-Present

GPA: 4.00/4.00

### Carnegie Mellon University

Pittsburgh, PA

Master of Science in Mechanical Engineering

Sep 2017-May 2019

GPA: 4.00/4.00

Courses: Computer Vision (rank 1/137), Engineering Optimization, Planning and Decision-making in Robotics, AI and Machine Learning in Engineering Design, Robot Localization and Mapping

### Tongji University

Shanghai, China

Bachelor of Engineering in Vehicle Engineering (Automotive Electronics)

Sep 2012-Jul 2017

GPA: 4.90/5.00 (rank 1/197)

Courses: Automatic Control Theory, Simulation and Design for Control Systems, Signal and System

## SKILLS

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**Engineering:** C/C++, Python, MATLAB/Simulink, LaTeX, ROS, OpenCV, Inventor, Autocad, Altium Designer

**Languages:** English (Fluent), German (Fluent), Mandarin (Native)

## PUBLICATIONS

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- **B. Fu**, B. Fu, T. Kathuria, D. Rizzo, M. Castanier, X. J. Yang, M. Ghaffari, and K. Barton, “Simultaneous human-robot matching and routing for multi-robot tour guiding under time uncertainty,” *Journal of Autonomous Vehicles and Systems*, vol. 1, no. 4, p. 041005, 2021.
- M. Deng, **B. Fu**, and C. Menassa, “Room match: Achieving thermal comfort through smart space allocation and environmental control in buildings,” in *Proceedings of the 2021 Winter Simulation Conference*. Phoenix, AZ., 2021.
- **B. Fu**, W. Smith, D. Rizzo, M. Castanier, M. Ghaffari, and K. Barton, “Robust task scheduling for heterogeneous robot teams under capability uncertainty,” *arXiv preprint arXiv:2106.12111*, 2021. [Under review]
- **B. Fu**, W. Smith, D. Rizzo, M. Castanier, and K. Barton, “Heterogeneous vehicle routing and teaming with Gaussian distributed energy uncertainty,” in *2020 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE, 2020, pp. 4315-4322
- **B. Fu**, K. S. Shankar, N. Michael, “Rad-VIO: Rangefinder-aided downward visual-inertial odometry,” in *2019 International Conference on Robotics and Automation (ICRA)*. IEEE, 2019, pp. 1841–1847.
- J. Hao, Z. Yu, Z. Zhao, X. Zhan, **B. Fu**, and P. Shen, “Development and optimization of energy management strategy for four-wheel-drive plug-in hybrid electric vehicle,” *Mechatronics Journal*, 2018, no. 8, pp.12-19, 30.
- Zhiguo Zhao, **Bo Fu**, Dongsheng Li, “A small-sized wet-membrane humidifier for automotive air-conditioner”, [China Invention Patent Publication No. CN106004350B] [Date: Jan 25, 2019]

## RESEARCH PROJECTS

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- Resilient Vehicle Teaming in Uncertain Environments (Advisor: Prof. Kira Barton)** June 2019-Present  
*Barton Research Group, University of Michigan* *Ann Arbor, MI*
- Establish probabilistic models that learn and quantify the vehicle and task heterogeneities and environmental uncertainties across a broad range of missions.
  - Develop a planning framework that optimizes user-defined objectives in the presence of uncertainties and generates robust and agile teams.
  - Develop a model update and plan repair scheme to capture and adapt to environmental changes while minimizing additional repair costs.

- Multirotor Downward Visual-Inertial Tracker (Advisor: Prof. Nathan Michael)** Sep 2017-May 2019  
*Resilient Intelligent Systems Lab, Carnegie Mellon University* *Pittsburgh, PA*
- Built a quadrotor state estimator based on a downward camera, laser and IMU which operates at 150 Hz and can be used for high speed closed loop control
  - Developed a homography based frame to frame visual tracking algorithm that improves the accuracy and robustness compared to related previous publications
  - Investigated an Extended Kalman Filter model, which is suitable for camera, laser, IMU fusion on multirotor  
Video: <https://youtu.be/6LGKj8MTYQ8>

- Control Strategy for 4WD Plug-in Hybrid Electric Car (Advisor: Prof. Zhiguo Zhao)** Aug 2016-Jun 2017  
*Clean Energy Automotive Engineering Center, Tongji University* *Shanghai, China*
- Developed a rule-based control strategy, which achieved a 24.41% fuel consumption decrease in simulation compared to result of the original internal combustion engine vehicle
  - Optimized strategy parameters based on genetic algorithm and achieved an additional 1.53% fuel consumption reduction
  - Conducted hardware-in-the-loop test of hybrid control unit to prove the function, reliability, robustness

## EXPERIENCE

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- Bosch Engineering GmbH/EPT-CN, Robert Bosch Investment (China) Ltd.** Shanghai, China  
*Intern, Software Group* *Aug-Dec 2016*
- Constructed, tested Simulink models for two hybrid electric vehicle structures, whose simulation results used for project bidding
  - Built a hybrid control unit strategy of hybrid electric vehicle (including torque-limitation, torque-demand, torque-distribution blocks), which was used in a sample vehicle of a domestic automobile corporation

## COURSE PROJECTS

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- H-infinity Control on the Cubli System (Guide: Prof. Peter Seiler)** Mar-Apr 2020  
*University of Michigan* *Ann Arbor, MI*
- Implemented H-infinity control on the Cubli system and stabilize it to the upright unstable equilibrium points
  - Developed a simulation platform for the Cubli that evaluates and visualizes the performance of the control system  
Demo link: <https://youtu.be/wlQBQwDsPbM>

**Spider Legged Robot Climbing in 3D Block World (Guide: Prof. Maxim Likhachev)**

Oct-Dec 2018

*Carnegie Mellon University**Pittsburgh, PA*

- Developed algorithms for a simulated spider robot with sticky feet that climbs in a 3D block map with optimal global path and leg motion that avoids collision with the environment
- Implemented the global path planning with weighted A\* search, footstep planning based on a list of motion primitives, leg motion planning with RRT\* algorithm to achieve the functionality

Demo link: <https://youtu.be/5sN6tYRFDEo>**Image Alignment Using Robust Loss Functions (Guide: Prof. Jeremy J. Michalek)**

Mar-May 2018

*Carnegie Mellon University**Pittsburgh, PA*

- Applied sequential quadratic programming with BFGS on a homography based image alignment problem using least squares, Huber, Tukey, and a Gaussian weighted cost functions
- Demonstrated that Tukey cost function with finite difference implementation generated the most robust alignment performance on images with noise and outliers that broke the planar assumption of the homography constraint

**ACTIVITIES**

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**Electric Vehicle Racing Club, Tongji University**

Shanghai, China

*Member, Electric Control Group**Oct 2013-Jun 2015*

- Designed motor controller packaging; designed and manufactured instrument panel and controller; attended national contests

**AWARDS/HONORS**

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Best Student Lightning Talk Finalist at Automotive Research Center Program Review (2021)

Shanghai Outstanding Graduate (2017)

Excellent Graduation Thesis of Tongji University (2017)

China National Scholarship (2015-2016/2014-2015/2012-2013)

Excellent Student of Tongji University (2015-2016/2014-2015/2013-2014/2012-2013)

First Class of Learning Scholarship of Tongji University (2015-2016/2014-2015/2012-2013)