ZEHUI LU

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Google Scholar: https://scholar.google.com/citations?user=j73ZnVYAAAAJ&hl=en&oi=ao

EDUCATION

Purdue University — West Lafayette, IN, USA
Ph.D. in Aeronautical and Astronautical Engineering — 08/2020 – 08/2024
Advisor: Dr. Shaoshuai Mou
GPA: 3.97/4

University of Michigan — Ann Arbor, MI, USA
M.S.E. in Mechanical Engineering — 09/2018 – 12/2019
Advisor: Dr. Ram Vasudevan
GPA: 3.88/4

University of Wales Trinity Saint David — Swansea, Wales, UK
B.E. in Automotive Engineering — 09/2015 – 08/2018
GPA: 4/4 (First Class Honours)

Wuhan University of Technology — Wuhan, Hubei Province, China
B.S.E in Automotive Engineering — 09/2014 – 06/2018
GPA: 3.8/4

EMPLOYMENT

Visiting Assistant Professor
Purdue University, School of Aeronautics and Astronautics — 08/2024 – Present
- Proposal writing
- Mentor PhD students
- Perform research on Li-ion battery fast charging, AI chip thermal management, robot motion planning, etc.
- Instructor, AAE 364: Control Systems Analysis, AAE 203: Aeromechanics I

Technical Consultant
- Serving as a technical consultant for Mitsubishi Electric Research Laboratories — 09/2024 – Present

Research Intern
Mitsubishi Electric Research Laboratories — 08/2023 – 05/2024
Supervisor: Dr. Yebin Wang
- Co-design of motors, motions, and controls for robotic manipulators
- Differentiable dynamics modeling for mobile manipulators to enable integrated motion planning and actuator (motor) design
- Published one conference and one journal paper; submitted two journal papers; filed two US patent applications
- Ongoing projects at Mitsubishi Electric Research Laboratories are kept confidential until patent filed

Research Engineer
UM Ford Center for Autonomous Vehicles, University of Michigan — 01/2020 – 07/2020
Supervisor: Dr. Ram Vasudevan
- Proposed a fast collision-aware inverse kinematic solver for manipulators
- Built a communication pipeline for a bipedal walking robot Agility Cassie (UDP, Simulink)
- Designed a controller for safe and aggressive quadrotor flights (Python, MATLAB, TCP/IP) YouTube
- Developed a trajectory tracking controller and an interface for a quadrotor Parrot Mambo (Python, PID, asyncio, customized UDP protocol) GitHub

AWARDS & COMPETITIONS

Best Student Paper, "Multi-Robot Formation Control with Human-on-the-loop
IEEE International Conference on Industrial Cyber-Physical Systems (ICPS), 2024
- As research mentor to the first author Tianyu Zhou; Tianyu Zhou's first-ever paper

Second place, Quanser's Self-Driving Competition
American Control Conference, 2023
- As team manager, led the design and implementation of a self-driving car framework using ROS, integrating SLAM, traffic sign detection, road segmentation, navigation, path planning, and motion planning; deployed the system on a Quanser car with NVIDIA Jetson TX2

Hsu Lo Fellowship
Purdue University, 2023
- Awarded for Ph.D. students with Chinese heritage who have passed qualifying exams and demonstrate outstanding research and academic performance

Third runner-up, DoD's challenge "AI Tracks at Sea"
The Naval Information Warfare Center Pacific, Office of Naval Research, U.S. Department of Defense, 2021
- As team manager, led the design of a CNN-based machine learning algorithm to automatically generate georeferenced tracks of maritime vessel traffic based on a monocular camera mounted on the ego vessel

Ross Fellowship
Purdue University, 2020
- Awarded for academic excellence, including four years of salary and tuition coverage

RESEARCH INTEREST

- Sustainable energy storage
- High C-rate Lithium-ion battery fast charging and active thermal management
- AI-chip energy-efficient cooling control and thermal management
- Control-informed learning and learning-enhanced control
- Dynamics modeling, motion planning, and control for mechatronics and servo motion systems
- Differentiable dynamics modeling and motion planning for mobile manipulators
- Real-time, distributed optimization, control, planning, and scheduling for multi-robot systems
- Multidisciplinary system control and co-design for motors, mobile manipulators, EV, eVTOL aircraft
- Trust-aware human-multi-robot interaction and teaming
- Energy-efficient electric propulsion for sustainable transportation and aviation

PUBLICATIONS & PATENTS

***: As corresponding author or research mentor**

Journal

[01] **Zehui Lu**, and Yebin Wang. "A Differentiable Dynamic Modeling Approach to Integrated Motion Planning and Actuator Physical Design for Mobile Manipulators." Journal of Field Robotics, 2024. Video

[02] **Zehui Lu**, Hao Tu, Huazhen Fang, Yebin Wang, and Shaoshuai Mou. "Integrated Optimal Fast Charging and Active Thermal Management of Lithium-Ion Batteries in Extreme Ambient Temperatures." IEEE Transactions on Control Systems Technology, 2024.

[03] **Zehui Lu**, Tianpeng Zhang, and Yebin Wang. "Torque Constraint Modeling and Reference Shaping for Servo Systems." IEEE Control Systems Letters, 2024.

[04] **Zehui Lu***, and Shaoshuai Mou. "Distributed Optimization under Edge Agreement with Application in Battery Network Management." IEEE Transactions on Control of Network Systems, Under Review, 2024.

[05] Zihao Liang, Tianyu Zhou, **Zehui Lu***, and Shaoshuai Mou. "Online Control-Informed Learning." Transactions on Machine Learning Research, Under Review, 2024.

[06] Jose D. Hoyos, Tianyu Zhou, **Zehui Lu***, and Shaoshuai Mou. "Reward-Based Collision-Free Algorithm for Trajectory Planning of Autonomous Robots." IEEE Transactions on Automation Science and Engineering, Under Review, 2024. YouTube

[07] Jui-Te Lin, **Zehui Lu**, and Yebin Wang. "Closing the Robot Co-Design Loop: A Framework for Motors, Motions and Feedback Controller Design under Disturbances." IEEE Robotics and Automation Letters, Under Review, 2024.

[08] **Zehui Lu**, Tianyu Zhou, and Shaoshuai Mou. "Real-time Multi-Robot Mission Planning in Cluttered Environment." Robotics, 2024. YouTube

[09] **Zehui Lu***, and Shaoshuai Mou. "Distributed optimization under edge agreements: A continuous-time algorithm." Systems & Control Letters, 2024.

[10] Wanxin Jin, Todd D. Murphey, **Zehui Lu**, and Shaoshuai Mou. "Learning from human directional corrections." IEEE Transactions on Robotics, 2022. YouTube

Conference

[11] Sidhdharth D. Sikka, **Zehui Lu***, Ayush Rai, Daniel DeLaurentis, and Shaoshuai Mou. "On Orbit Object Transportation with Spacecraft Swarms." 2025 AIAA SciTech Forum, Under Review.

[12] Wenjian Hao, **Zehui Lu***, Devesh Upadhyay, and Shaoshuai Mou. "A Distributed Deep Koopman Learning Algorithm for Control." 2025 Learning for Dynamics & Control Conference (L4DC), Under Review.

[13] Tianyu Zhou, Zihao Liang, **Zehui Lu***, and Shaoshuai Mou. "Online Intention Prediction via Imitation Learning." 2025 Learning for Dynamics & Control Conference (L4DC), Under Review.

[14] Min Dai, **Zehui Lu**, Na Li, and Yebin Wang. "Enhanced Agility and Safety in Mobile Manipulators through Centroidal Momentum-Based Motion Planning." 2025 European Control Conference (ECC), Under Review. Video

[15] **Zehui Lu**, Hao Tu, Huazhen Fang, Yebin Wang, and Shaoshuai Mou. "A Real-time High C-rate Lithium-ion Battery Fast Charging Strategy." 2025 American Control Conference (ACC), Under Review.

[16] **Zehui Lu**, Yebin Wang, Yusuke Sakamoto, and Shaoshuai Mou. "Distributed Co-Design of Motors and Motions for Robotic Manipulators." In 2024 European Control Conference (ECC).

[17] Tianyu Zhou, **Zehui Lu***, and Shaoshuai Mou. "Multi-Robot Formation Control with Human-on-the-loop." In 2024 IEEE International Conference on Industrial Cyber-Physical Systems (ICPS), **Best Student Paper**. YouTube

[18] **Zehui Lu**, and Shaoshuai Mou. "Variable Sampling MPC via Differentiable Time-Warping Function." In 2023 American Control Conference (ACC).

[19] **Zehui Lu**, Wanxin Jin, Shaoshuai Mou, and Brian DO Anderson. "Cooperative Tuning of Multi-Agent Optimal Control Systems." In 2022 IEEE Conference on Decision and Control (CDC).

Preprint

[20] Wenjian Hao, **Zehui Lu**, Zihao Liang, Tianyu Zhou, and Shaoshuai Mou. "Adaptive Policy Learning to Additional Tasks." Available on arXiv.

[21] Wenjian Hao, Paulo C. Heredia, Bowen Huang, **Zehui Lu**, Zihao Liang, and Shaoshuai Mou. "Policy Learning based on Deep Koopman Representation." Available on arXiv.

Patent

[22] US patent application filed, Systems and Methods for Joint Design of Actuators and Control for Robots

[23] US patent application filed, Systems and Methods for Controlling a Motor with Dynamically Parameterized Trajectory Estimation

MENTORING EXPERIENCE

[1] Tianyu Zhou, PhD student at Purdue; won the Best Student Paper award at 2024 ICPS for his first-ever paper; research on human-multi-robot interaction; paper under review by L4DC 2025; preparing a paper for IEEE RA-L
[2] Zihao Liang, PhD at Purdue; paper under review by Transactions on Machine Learning Research; research on control-informed learning and learning-enhanced control
[3] Wenjian Hao, PhD student at Purdue; research on control-informed learning and learning-enhanced control; paper under review by L4DC 2025
[4] Jose D. Hoyos, PhD student at Purdue; paper under review by IEEE Transactions on Automation Science and Engineering; research on human-guided robot motion planning
[5] Sidhdharth D. Sikka, PhD student at Purdue; research on cooperative orbit object transportation with spacecraft swarms; paper under review by AIAA SciTech Forum 2025
[6] Shunan Yin, PhD student at Purdue; research on model-free Bayesian-based intention prediction; preparing a paper for IEEE RA-L
[7] Yuxuan Fang, PhD student at Purdue; research on learning-based human-multi-robot interaction; preparing a paper for IEEE RA-L
[8] Lan Shi, PhD student at Purdue; research on distributed algorithms and residential solar battery energy management; preparing a paper for CCTA 2025
[9] Nicolas I. Miguel, PhD student at Purdue; research on safe learning-based control

TEACHING EXPERIENCE

Instructor, *Purdue University*

- AAE 364: Control Systems Analysis 2024 Fall
  - Mid-term teaching evaluation featured comments:
    - ◊ *The professor does a good job of using MATLAB in class; since that's what we'll most likely use in industry, it's great to see how our theory applies to these real world tools.*
    - ◊ *Answers questions thoroughly, and explains them well to clear up confusion easily. Also provides a lot of assistance, and explanation of homework in class, and how it relates to the content we just covered.*
    - ◊ *I like the inclusion of Matlab examples to visualize how signals look compared to the math alone.*
- AAE 364: Control Systems Analysis, AAE 203: Aeromechanics I 2025 Spring

Teaching Assistant, *Purdue University*

- AAE 666: Nonlinear Dynamics, Systems, And Control 2023 Spring

Robotics Open-Source Tutorials

[1] A tutorial on CasADi with CPP (C++, CMake) GitHub
[2] A tutorial on TCP/IP and UDP communications (Python, MATLAB) GitHub
[3] A tutorial on Qualisys Motion Capture System (Python, MATLAB) GitHub
[4] An implementation of Consensus-Based Bundle Algorithm for multi-robot scheduling (Python) GitHub
[5] A genetic algorithm to solve collision-aware traveling salesman problems (C++) GitHub
[6] A quadrotor trajectory tracking controller and interface to motion capture systems (Python) GitHub
[7] A path-finding algorithm implementation for Lazy Theta* (C++, Python) GitHub

[8] A path-finding algorithm implementation for A* (C++, Python) GitHub

[9] Solution to Quanser's Self-Driving Competition: a self-driving car framework using ROS, integrating SLAM, traffic sign detection, road segmentation, navigation, path planning, and motion planning (working on public release)

PROFESSIONAL SERVICE

- **Session Chair:** ICPS Engineering I, 2021 IEEE International Conference on Industrial Cyber-Physical Systems
- **Session Co-Chair:** Reinforcement Learning II (RI Session), 2022 American Control Conference
- **Moderator:** 2021 ICON Outstanding Student Research Symposium, Purdue University
- **Session Host & Student Volunteer:** 2021 American Control Conference (online)
- **Stenographer:** The Summit on Trusted Autonomy Research & Technology, Purdue University & Office of the Undersecretary of Defense for Research and Engineering, U.S. Department of Defense, 2022.
- **Reviewer**

  Journal (43 reviews in total)
  - IEEE Transactions on Robotics
  - IEEE Robotics and Automation Letters
  - IEEE Transactions on Control Systems Technology
  - IEEE Control Systems Letters
  - IEEE Transactions on Power Electronics
  - IEEE Transactions on Vehicular Technology
  - IEEE Transactions on Aerospace and Electronic Systems
  - IEEE Transactions on Human-Machine Systems
  - Elsevier Systems & Control Letters
  - Springer Autonomous Robots
  - ASME Letters in Dynamic Systems and Control
  - ASME Journal of Autonomous Vehicles and Systems
  - AIAA Journal of Aerospace Information Systems
  - Nature Communications Engineering

  Conference (50 reviews in total)
  - IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
  - IEEE International Conference on Robotics and Automation (ICRA)
  - IEEE Conference on Decision and Control (CDC)
  - American Control Conference (ACC)
  - European Control Conference (ECC)
  - IEEE International Conference on Automation Science and Engineering (CASE)
  - The International Symposium on Distributed Autonomous Robotic Systems (DARS)
  - IEEE International Conference on Industrial Cyber-Physical Systems (ICPS)
  - IEEE International Conference on Human-Machine Systems (ICHMS)

FUNDING

[01] Preparing an NSF STTR proposal

[02] Preparing an NSF EPCN proposal

[03] Funded by Office of Naval Research, DoD & Saab Inc., 05/2024 – Present

[04] Hsu Lo Fellowship, Purdue University, 06/2023 – 08/2023
[05] 2023 American Control Conference (ACC) Student Travel Grant, 03/2023
[06] Graduate Research Assistantship, funded by DEVCOM Analysis Center, Army Research Laboratory, DoD, 01/2023 – 08/2023
[07] Graduate Research Assistantship, funded by Saab, Inc., 12/2021 – 12/2022
[08] Graduate Research Assistantship, funded by Northrop Grumman Corporation, 08/2020 – 11/2021
[09] Graduate Research Assistantship, funded by NASA University Leadership Initiative (ULI), 08/2020 – 11/2021
[10] Ross Fellowship, Purdue University, 08/2020

ACADEMIC PRESENTATIONS

[01] Technical talk, "Distributed Co-Design of Motors and Motions for Robotic Manipulators", In 2024 European Control Conference, Stockholm, Sweden.
[02] Teaching seminar, "A Fundamental Principle in Kinematics: Basic Kinematic Equation", School of Aeronautics and Astronautics, Purdue University, 2024.
[03] Technical talk, "Variable Sampling MPC via Differentiable Time-Warping Function", In 2023 American Control Conference, San Diego, CA, USA.
[04] Technical talk, "Distributed Real-time Multi-Agent Mission Planning in Cluttered Environment", Inaugural ICON Student Conference, Purdue University, 2023.
[05] Invited technical talk, "Distributed Real-time Multi-Agent Mission Planning in Cluttered Environment", Autonomous Control & Information Technology Institute, North Carolina A & T State University, 2022.
[06] Technical talk, "Cooperative Tuning of Optimal Control Systems", In 2022 IEEE Conference on Decision and Control, Cancún, Mexico.
[07] Technical talk, "Experiments on Learning from Human Directional Corrections", Second Workshop on Human-Autonomy Interaction and Integration, 2022 American Control Conference, Atlanta, GA, USA.
[08] Technical talk, "Distributed Real-time Multi-Agent Mission Planning in Cluttered Environment", Secure and Safe Assured Autonomy 2022 Annual Meeting, NASA University Leadership Initiative.
[09] Technical poster, "Distributed Real-time Multi-Agent Mission Planning in Cluttered Environment", 2022 Innovation Tech Showcase and Smart Cities Event, Purdue Research Foundation & College of Engineering.
[10] Technical talk & experiment demo, "Distributed Real-time Multi-Agent Mission Planning in Cluttered Environment", 2021 Northrop Grumman Corporation University Research Symposium.

FEATURED SKILLS

- **Programming Languages:** C++, Python, MATLAB, Julia
- **Operating Systems:** ROS, Linux
- **Motion Capture Systems:** layout setup, calibration, real-time data-streaming (PhaseSpace, Qualisys, Vicon)
- **Others:** CMake, Git, Bash, Simulink, Gazebo, NumPy, SciPy, Numba, Eigen, IPOPT, CasADi, C code auto-generation, multithreading, concurrent, Extended Kalman Filter, dynamics modeling (Newton-Euler, Featherstone)