Yu-Hsiang Su

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EDUCATION

The University of Manchester, Manchester, UK — Sept. 2020 — June 2024
PhD in Electrical and Electronic Engineering

- Supervised by Prof. Alexander Lanzon
- Research Interests: Multi-Agent Systems, Multi-Robot Systems, Cooperative Control, Autonomous Vehicles, Robust Control Theory, Negative Imaginary (NI) Systems Theory

The University of Manchester, Manchester, UK — Sept. 2018 — Sept. 2019
MSc with Distinction in Advanced Control and Systems Engineering

- Supervised by Prof. William Heath
- Overall GPA: 83.83/100

National Chiao Tung University, Hsinchu, Taiwan — Sept. 2013 — June 2017
BSc in Mechanical Engineering

- Overall GPA: 82.09/100

Shanghai Jiao Tong University, Shanghai, China — Feb. 2017 — June 2017
Exchange Student in the School of Mechanical and Power Engineering

AWARDS

Scholarships

- *Full PhD Scholarship*, Department of Electrical and Electronic Engineering, The University of Manchester
- *ICRA Travel Grant*, IEEE Robotics and Automation Society, 2023, 2022

Fellowships

- *Associate Fellow of the Higher Education Academy (AFHEA)*, Advance HE

Academic Awards

- *Rosenbrock Prize Award* (the best overall performance in the taught element of the MSc course), Department of Electrical and Electronic Engineering, The University of Manchester, 2019
- Nominated for the *Faculty's Distinguished Achievement Award (PGT Student of the Year)*, Faculty of Science and Engineering, The University of Manchester, 2019
- *Academic Excellence Award*, Department of Mechanical Engineering, National Chiao Tung University, 2017

Competition Awards

- *Second place in the Autonomous Buggy Control*, Department of Electrical and Electronic Engineering, The University of Manchester, 2019
- *First place in the Final Project Presentation Competition*, Corning Display Technologies, 2018

Course Certificates

- *IEEE RAS Summer School on Multi-Robot Systems*, Czech Technical University in Prague, 2023
- *Supervised Machine Learning: Regression and Classification*, Stanford (Coursera), 2024
- *Robotics: Aerial Robotics*, University of Pennsylvania (Coursera), 2021

PUBLICATIONS

Journal Publications

- **Y.-H. Su**, P. Bhowmick, and A. Lanzon, "Properties of interconnected negative imaginary systems and extension to formation-containment control of networked multi-UAV systems with experimental validation results," *Asian Journal of Control*, vol. 27, no. 1, pp. 99–116, Jan. 2025. (Paper | Video)
- **Y.-H. Su**, P. Bhowmick, and A. Lanzon, "A fixed-time formation-containment control scheme for multi-agent systems with motion planning: Applications to quadcopter UAVs," *IEEE Transactions on Vehicular Technology*, vol. 73, no. 7, pp. 9495–9507, July 2024. (Paper | Video)
- **Y.-H. Su**, P. Bhowmick, and A. Lanzon, "A robust adaptive formation control methodology for networked multi-UAV systems with applications to cooperative payload transportation," *Control Engineering Practice*, vol. 138, p. 105608, Sept. 2023. (Paper | Video)

Conference Publications

- **Y.-H. Su**, P. Bhowmick, and A. Lanzon, "Output-feedback-based affine formation manoeuvre control of multi-agent systems applying negative imaginary systems theory," in *Proceedings of the 63rd IEEE Conference on Decision and Control (CDC)*, Milan, Italy, Dec. 2024, pp. 6939–6944. (Paper)

- **Y.-H. Su**, P. Bhowmick, and A. Lanzon, "A negative imaginary solution to an aircraft platooning problem," in *Proceedings of the 22nd European Control Conference (ECC)*, Stockholm, Sweden, June 2024, pp. 2580–2585. (Paper)
- **Y.-H. Su**, P. Bhowmick, and A. Lanzon, "A negative imaginary theory-based time-varying group formation tracking scheme for multi-robot systems: Applications to quadcopters," in *Proceedings of the 40th IEEE International Conference on Robotics and Automation (ICRA)*, London, UK, May 2023, pp. 1435–1441. (Paper | Video)
- **Y.-H. Su**, P. Bhowmick, and A. Lanzon, "Cooperative control of multi-agent negative imaginary systems with applications to UAVs, including hardware implementation results," in *Proceedings of the 21st European Control Conference (ECC)*, Bucharest, Romania, June 2023. (Paper | Video)
- **Y.-H. Su**, and A. Lanzon, "Formation-containment tracking and scaling for multiple quadcopters with an application to choke-point navigation," in *Proceedings of the 39th IEEE International Conference on Robotics and Automation (ICRA)*, Philadelphia, USA, May 2022, pp. 4908–4914. (Paper | Video)
- **Y.-H. Su**, D. F. Morales Aldana, and W. P. Heath, "System identification and control design for a tip tilt nanopositioning system," in *Proceedings of the 21st IFAC World Congress*, Berlin, Germany, July 2020, pp. 8577–8584. (Paper)

SERVICE

Seminar Organiser

- Organised the Control Seminar, Department of Electrical and Electronic Engineering, The University of Manchester

Student Representative

- Represented the MSc course in Advanced Control and Systems Engineering, The University of Manchester

Peer Reviewer

- *IEEE Transactions on Automatic Control*
- *IEEE Control Systems Letters*
- *IEEE Transactions on Network Science and Engineering*
- *International Journal of Robust and Nonlinear Control*
- *Nonlinear Dynamics*
- *IEEE Robotics and Automation Letters*
- The 22nd European Control Conference, 2024
- The 14th United Kingdom Automatic Control Council International Conference on Control, 2024

TEACHING EXPERIENCE

Graduate Teaching Assistant, The University of Manchester Manchester, UK
EEEN60109 State-Space and Multivariable Control 2020 — 2024

- Lead Graduate Teaching Assistant responsible for delegating work to five graduate teaching assistants, including lab material preparation, lab training organisation, lab report grading, and grade release
- Created questions for formative quizzes using Blackboard
- Drafted questions and solutions for coursework and final exams
- Assisted over 80 postgraduate students during lab sessions
- Tutored students on concepts of state-space control, full-state feedback control design and observer design

EEEN30232 Control Systems II 2023 — 2024

- Prepared lecture materials for digital control and created questions for formative quizzes and final exams
- Assisted over 200 undergraduate students during lab sessions
- Provided tutoring on state-space control, optimal control, discrete-time systems, and digital control concepts

EEEN30002 Numerical Analysis 2021 — 2022

- Prepared solutions for tutorial questions and delivered them to a small group of undergraduate students during tutorial sessions

EEEN20131 Signals and Systems 2022 — 2023

- Taught students the fundamentals of MATLAB and its usage in signals and systems during lab sessions

EEEN20030 Control Systems I 2020 — 2023

- Lead Graduate Teaching Assistant responsible for delegating work to ten graduate teaching assistants
- Created questions for formative quizzes using Blackboard and crafted both questions and solutions for coursework and final exams
- Assisted over 200 undergraduate students during lab sessions
- Tutored students on fundamental concepts of control theory, covering topics such as transfer functions, root locus, Nyquist plots, and PID control design

WORK EXPERIENCE

Corning Display Technologies Taichung, Taiwan
Summer Intern July 2018 — Aug. 2018

- Applied Big Data knowledge to the Finishing process and developed a machine learning model in Python to predict the quality of the manufacturing process
- Learned to access data from Microsoft SQL and MySQL using SQL language
- Gained an understanding of the display glass manufacturing process and the system structure of SCADA

SELECTED PROJECTS

Cooperative control of multi-agent systems: Theory and applications to multi-UAV systems
PhD Thesis Sept. 2020 — June 2024

- Developed a robust adaptive formation controller for multi-UAV systems subjected to disturbances and demonstrated cooperative payload transportation missions using multi-UAV systems with cable-suspended payloads
- Developed a hierarchical cooperative control scheme that incorporates motion planning objectives and fixed-time formation-containment control for multi-agent systems
- Established the closed-loop stability for the interconnection of networked double integrator NI systems and distributed Strictly Negative Imaginary (SNI) controllers
- Developed an output dynamic feedback distributed SNI control law for achieving cooperative control objectives
- Established the closed-loop stability for the interconnection of networked double integrator NI systems and distributed 'mixed' SNI plus Strictly Passive controllers
- Developed an output dynamic feedback distributed SNI + Strictly Passive control law for achieving formation tracking and containment control
- Developed an aircraft platoon control scheme employing NI systems theory to provide an effective flight guidance and control system for managing aircraft landings
- Developed an output feedback based-affine formation manoeuvre control scheme employing NI systems theory for multi-agent systems

System identification and control design for a tip tilt nanopositioning system
MSc Dissertation May 2019 — Sept. 2019

- Developed MIMO linear position and force models for the tip tilt nanopositioning stage with 2 DOF for inclined motion
- Designed a SISO integral controller, a MIMO robust H-infinity controller with loop shaping design, and a SISO position/force feedback controller for the tip tilt nanopositioning stage
- Validated the feedback control systems through simulations in MATLAB/Simulink and hardware experiments conducted with LabVIEW

TECHNICAL SKILLS

- C/C++
- MATLAB
- Simulink
- Python
- LabVIEW
- SQL
- LaTeX
- Ardunio
- Crazyflie drone
- SolidWorks
- AutoCAD