Dr. Yang WANG

Shanghai Leading Talent Program (overseas) Award

Shanghai YangFan Talent Program Award

Tenure-Track Assistant Professor

PhD Advisor, Principal Investigator

Female, Birth: 1991.06.19 Addr: Office SIST 1D-201.E

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RESEARCH INTEREST

Adaptive control; Nonlinear system; Output regulation; Dynamic modeling; Active noise control; Datadriven Control; Multi-agent System; Motion control of UAVs and AUVs

PhD Thesis: Output Regulation of Uncertain Linear Systems

NOMINATION OF ERYL CADWALLADER DAVIES PRIZE OF IMPERIAL COLLEGE LONDON (TOP 5%)

MULTI-AGENT AND INTELLIGENT CONTROL - MAGIC LAB

Main On-going Projects:

- Output regulation; Composite adaptive learning control; Unknown Input Observer-based Regulator Design
- Sparse Nonlinear Dynamic Modelling, Active Noise Control
- Flight control of quadrotor; Motion control of robotic fish; Manipulator Control

Lab Members (PI + 3Ph.D. + 10 Master)

BACKGROUND

ShanghaiTech University, Shanghai, China Assistant Professor, PI, PhD Supervisor

2020.01 - now

- · Lab Director, PI, PhD Supervisor
- · Course Teaching: 'Introduction of Control' (EE160 & EE160P), 6 Credits; 'Adaptive Control', 4 Credits

Imperial College London, London, UK

Ph. D.

2015.01-2019.06

• Supervised by Prof. Thomas Parisini (IEEE Fellow) and Prof. Andrea Serrani (IEEE TCST Associate Editor)

Imperial College London, London, UK

Master

2013.09-2014.09

Major: Control System (Master of Engineering, Graduation with distinction, 84.6/100)

Tongji University, Shanghai, China

Bachelor

2009.09-2013.06

• Major: Automation (Bachelor of Engineering, G.P.A. 4.59/5.0)

Ohio State University, Ohio, USA

Visiting Scholar

2015.11-2018.11

• Dreese Laboratories, Research on periodic disturbance rejection problem, supervised by Prof. Andrea Serrani (IEEE TCST Associate Editor)

Cambridge University, Cambridge, UK

Visiting Scholar

2014.09-2015.01

• Computational and Biological Learning Lab, Research on the Visuomotor feedback control and forward models in the sensorimotor system of human being, Supervised by Prof. David D. Franklin

FUND RAISING AND PARTICIPATION

Fund Raising - As Host

- ShanghaiTech, 2020F0203-000-04, ShanghaiTech Startup Funding, 2 million RMB
- Yangfan Talents Program under Grant 21YF1429600, from Shanghai Municipal Science and Technology Committee, 200k RMB

Fund Raising from the Industry – As Host

Module vehicle automatic docking project, Shanghai Zhixing Technology Co., LTD, 100K RMB

TEACHING EXPERIENCE

Undergraduate Course:

- Course Title: Introduction of Control (EE160 &EE160P)
- · Course Instructor, 6 credits, 64 teaching hours, Course Developer
- 2020-2021 Fall Semester; 2021-2022 Fall Semester, 2022-2023 Fall Semester, 2022-2023 Spring Semester
- Latest Course Evaluation Score: 4.83 out of 5

Graduate Course:

- Course Title: Adaptive Control
- 4 credits, 64 teaching hours, Course Developer
- 2019-2020 Spring Semester, 2020-2021 Spring Semester, 2021-2022 Spring Semester, 2023-2024 Fall
- · Latest Course Evaluation Score: 4.75 out of 5

PUBLICATIONS

Papers Under Review & In-Press

- Yang Wang, Gilberto Pin, Andrea Serrani*, and Thomas Parisini, Switching-based Adaptive Feedforward Control of Uncertain Linear Systems with Unknown Multi-sinusoidal Disturbances, regular paper, need to resubmission
- Yizhou Gong, Jiangkun Xu and **Yang Wang***, Multi-sinusoidal Disturbance Rejection for Uncertain Discrete-Time Linear Systems, Submitted to TAC, second review.
- Fuxiang, Hengzhang, YuTing Yang, Yang Wang*, SongLiu*, High-order Iterative Learning Control for Offaxis Insitu Rotation of Nanorobots inside SEM, major revision under IEEE TMech.
- Yizhou Gong, Gilberto Pin, Yang Wang*, Direct Model Reference Adaptive Control under Unknown Control Direction: A Novel Parameter-dependent Input Normalization-based Approach, resubmission to Automatica.
- Yizhou Gong, Chengyang Ji, Song Liu*, and **Yang Wang***, Switching-based Adaptive Active Control for Periodic Noises in Unknown 3D Environment, TASE, Submitted.
- Yang Wang, Yizhou Gong, Chenyang Ji, Gilberto Pin, Andrea Serrani*, Thomas Parisini, Adaptive and Switching Internal Model Design - Robust Adaptive Feedforward Techniques For Stable Systems, Submitted to CSM Special Issue on Internal Model Principle, Conditionally Accept.
- Jiwei Wang, Wenbing Song, Yicheng Fan, Yang Wang*, Xiaopei Liu*, An Ultra-Efficient Hybrid Simulation

- System for Flight Controller Design and Evaluation of Unmanned Aerial Vehicles, Accepted by Si-graph, Asia.
- Shicheng, Yang Wang, Sibei Yang*, Eyes Wide Open: Ego Proactive Video-LLM for Streaming Video, Submitted to Neurips 2025.
- Gilberto Pin, Yizhou Gong, **Yang Wang***, Filtered Regressors Derivative Compounding: New Adaptive Law for Augmented-error MRAC without Signal Growth Analysis, submitted to CDC 2025.
- Yizhou Gong, Yang Wang*, Switching-based Adaptive Feedforward Control for Uncertain Linear Multivariable Systems: Periodic Disturbance Cancellation, CDC2025.

Published Journal Papers

- Yang Wang, G. Pin, Andrea Serrani*, and Thomas Parisini, Removing SPR-Like Conditions in Adaptive Feedforward Control of Uncertain Systems, IEEE Transactions on Automatic Control, vol. 65, no. 6, pp. 2309-2324, June 2020, doi: 10.1109/TAC.2019.2934394.
- Yang Wang, Jing Yao, and Guanrong Chen, An Evolving Super-Network Model with Inter-Vehicle Communications, Journal of the Franklin Institute, 2018.
- Gilberto Pin, Yang Wang, Boli Chen, and Thomas Parisini*, Identification of Multi-Sinusoidal Signals with Direct Frequency Estimation: An Adaptive Observer Approach, Automatica, Volume 99, 2019, pp. 338-345, doi.org/10.1016/j.automatica.2018.10.026
- [4]. Heng Zhang, Xiang Fu, Song Liu*, and **Yang Wang***, Iterative Learning Embedded Composite Model Reference Adaptive Control for Off-Axis In-Situ Rotation in Nanorobotic Manipulation, in IEEE Control Systems Letters, vol. 8, pp. 291-296, 2024, doi: 10.1109/LCSYS.2023.3336545.
- yizhou Gong, Fanglai Zhu, and **Yang Wang***, Robust Output Regulation for Uncertain Nonlinear Minimum Phase Systems under Unknown Control Direction, Systems & Control Letters, Volume 185,2024, 105747, ISSN 0167-6911.
- Heng Zhang, Yangyang Zhao, Lin Liu, and **Yang Wang***, Adaptive neural network control of robotic manipulators with input constraints and without velocity measurements. IET Control Theory Appl. 1–16 (2024). https://doi.org/10.1049/cth2.12660
- Yizhou Gong, Fanglai Zhu, and Yang Wang*, Robust Output Regulation of Uncertain Nonlinear Minimum Phase Systems Perturbed by Unknown External Disturbances, European Journal of Control, Volume 77,2024, 100992, ISSN 0947-3580.
- Fanglai Zhu*, Jiancheng Zhang, Shenghui Guo, **Yang Wang**, Andrea Serrani, Joint unknown input observer for descriptor system based on interval observer, ISA Transactions, 2024,ISSN 0019-0578, https://doi.org/10.1016/j.isatra.2024.05.028.
- ^[9] Yizhou Gong, **Yang Wang***, A Novel Plug-and-Play Cooperative Disturbance Compensator for Heterogeneous Uncertain Linear Multi-Agent Systems, IEEE Control Systems Letters, vol. 8, pp. 2811-2816, 2024, doi: 10.1109/LCSYS.2024.3514822.
- [10]. Xiaozhu Lin, Xiaopei Liu and Yang Wang*, Learning Agile Swimming: An End-to-End Approach Without CPGs, in IEEE Robotics and Automation Letters, vol. 10, no. 2, pp. 1992-1999, Feb. 2025, doi: 10.1109/LRA.2025.3527757.
- Mingyue Wang, Siyuan An, Zhenghuan Sun, Jiaqi Li, **Yang Wang** and Song Liu*, Selective, Robust, and Precision Manipulation of Particles in Complex Environments with Ultrasonic Phased Transducer Array and Microscope, in IEEE Transactions on Robotics, vol. 41, pp. 887-904, 2025, doi: 10.1109/TRO.2024.3521858.
- Yang Wang, Xinlong Li, Jing Yao*and Wei Zhang, The Evolutionary Fairness Dynamics on Multiplex Networks with Information Reliability and Time Delays, Chaos, Solitons & Fractals, Volume 198, 2025, 116516,ISSN 0960-0779, https://doi.org/10.1016/j.chaos.2025.116516.
- [13]. Wenbin Song, Heng Zhang, Yang Wang*, Xiaopei Liu*, Creating Fluid-Interactive Virtual Agents by

- Efficient Control-based Local-domain Simulator, ACM Transactions on Graphics, Volume 44, Issue 4, No.: 103, Pages 1 19.
- Lin Liu, Guoyang Hong, Jianqing Peng, **Yang Wang**, Yongping Pan, Modeling and Control of Independent-Setup Variable Stiffness Actuator with Focus on Physical Stiffness Actuation, RAL, Accept.

Published Conference Papers

- Gilberto Pin, Yang Wang, Boli Chen, and Thomas Parisini*, Semi-Global Direct Estimation of Multiple Frequencies with an Adaptive Observer having Minimal Parameterization, 2015 54th IEEE Conference on Decision and Control (CDC), 2015, pp. 3693-3698, doi: 10.1109/CDC.2015.7402792.
- Yang Wang, Gilberto Pin, Andrea Serrani*, and Thomas Parisini, Removing SPR-like Conditions in Adaptive Feedforward Control of Uncertain Systems, 2016 IEEE 55th Conference on Decision and Control (CDC), 2016, pp. 4728-4733, doi: 10.1109/CDC.2016.7798990.
- Yang Wang, Boli Chen, Gilberto Pin, and Thomas Parisini*, Estimation of a Damped Sinusoid: an Observer-based Approach, 20th World Congress of the International Federation of Automatic Control (IFAC), Toulouse, France, July, 2017. https://doi.org/10.1016/j.ifacol.2017.08.486.
- Yang Wang, Gilberto Pin, Andrea Serrani*, and Thomas Parisini, Switching-based Sinusoidal Disturbance Rejection for Uncertain Stable Linear Systems, 2018 Annual American Control Conference (ACC), 2018, pp. 4502-4507, doi: 10.23919/ACC.2018.8431832.
- Yang Wang, Gilberto Pin, Andrea Serrani*, and Thomas Parisini, Switching-based Regulation of Uncertain Stable Linear Systems Affected by an Unknown Harmonic Disturbance, IFAC-PapersOnLine, Volume 52, Issue 16, 2019, Pages 604-609, doi.org/10.1016/j.ifacol.2019.12.028
- Yang Wang, Gilberto Pin, Andrea Serrani*, and Thomas Parisini, Switching-based Rejection of an Unknown Harmonic Disturbance in Uncertain Stable Linear Systems under Measurement Noise, 2019 American Control Conference (ACC), 2019, pp. 3020-3025, doi: 10.23919/ACC.2019.8815279.
- Yang Wang, Gilberto Pin, Andrea Serrani*, and Thomas Parisini, Switching-based Rejection of Multi-sinusoidal Disturbance in Uncertain Stable Linear Systems under Measurement Noise, 2019 IEEE 58th Conference on Decision and Control (CDC), 2019, pp. 6112-6117, doi: 10.1109/CDC40024.2019.9029441.
- Gilberto Pin, Yang Wang, Andrea Serrani*, and Thomas Parisini, Dynamic Certainty Equivalence Adaptive Control by Nonlinear Parameter Filtering, 2020 59th IEEE Conference on Decision and Control (CDC), 2020, pp. 1454-1459, doi: 10.1109/CDC42340.2020.9304426.
- Heng Zhang and **Yang Wang***, Adaptive Neural Network Control of an Uncertain Robotic Manipulator with Input Constraint and External Disturbance, 2021 IEEE 10th Data Driven Control and Learning Systems Conference (DDCLS), 2021, pp. 1302-1308, doi:10.1109/DDCLS52934.2021.9455611.
- Guanqi He, **Yang Wang***, Gilberto Pin, Andrea Serrani, and Thomas Parisini, Switching-based Adaptive Output Regulation for Uncertain Systems Affected by a Periodic Disturbance, 2022 American Control Conference (ACC), Atlanta, GA, USA, 2022, pp. 5030-5036, doi:10.23919/ACC53348.2022.9867879.
- Gilberto Pin, **Yang Wang**, and Andrea Serrani*, Direct-Adaptive Control of Relative-Degree-Two Systems with Certifiable Derivative Error Bound, 2022 IEEE Conference on Control Technology and Applications (CCTA), Trieste, Italy, 2022, pp. 634-639, doi: 10.1109/CCTA49430.2022.9966163.
- [12]. Gilberto Pin, Andrea Serrani, and **Yang Wang***, Parameter-dependent Input Normalization: Direct-Adaptive control with Uncertain Control Direction, 2022 IEEE 61st Conference on Decision and Control (CDC), Cancun, Mexico, 2022, pp. 2674-2680, doi:10.1109/CDC51059.2022.9993011.

- Yang Wang, Yizhou Gong, Gilberto Pin, Fanglai Zhu, Andrea Serrani*, and Thomas Parisini, Unknown Input Observer-based Output Regulation for Uncertain Minimum Phase Linear Systems Affected by a Periodic Disturbance, 2022 IEEE 61st Conference on Decision and Control (CDC), Cancun, Mexico, 2022, pp. 2544-2551, doi: 10.1109/CDC51059.2022.9992590.
- Yizhou Gong, Linyan Lu, and **Yang Wang***, Unknown Input Observer-based Finite-time Frequency Estimator for a Biased Multi-sinusoidal Signal, 2022 China Automation Congress (CAC), Xiamen, China, 2022, pp. 3036-3041, doi: 10.1109/CAC57257.2022.10055295.
- Yexin Zhang, Jiaqi Li, Yuyu Jia, Teng Li, **Yang Wang**, David C. Jeong, Hu Su*, and Song Liu*, Noncontact Particle Manipulation on Water Surface with Ultrasonic Phased Array System and Microscopic Vision 2023 IEEE International Conference on Robotics and Automation (ICRA), London, United Kingdom, 2023, pp. 5459-5465, doi: 10.1109/ICRA48891.2023.10160724.
- Jiangkun Xu, Song Liu, Jia Jia, **Yang Wang***, Robust Output Regulation for Uncertain Discrete-Time Linear Systems under the Effect of a Sinusoidal Disturbance, IFAC-PapersOnLine, Volume 56, Issue 2, 2023, Pages 2895-2902, ISSN 2405-8963.
- Yangyang Zhao, Heng Zhang, Xiaopei Liu, **Yang Wang***, Iteration Learning Control for Uncertain Nonlinear Systems with Time-Varying Output Constraint, IFAC-PapersOnLine, Volume 56, Issue 2, 2023, Pages 11867-11873, ISSN 2405-8963.
- Yizhou Gong, Fanglai Zhu, **Yang Wang***, Robust Output Regulation for Uncertain Linear Minimum Phase Systems under Unknown Control Direction, IFAC-PapersOnLine, Volume 56, Issue 2, 2023, Pages 4563-4569, ISSN 2405-8963.
- [19] C. Liu, Y. Wang, F. Mo, X. Li and J. Jiang, Active Lane Change for Safety Enhanced Autonomous Driving, 2023 7th International Conference on Automation, Control and Robots (ICACR), Kuala Lumpur, Malaysia, 2023, pp. 180-184.
- [20]. Xiaozhu Lin, Wenbin Song, Xiaopei Liu, Xuming He and **Yang Wang***, Exploring Learning-Based Control Policy for Fish-Like Robots in Altered Background Flows," 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Detroit, MI, USA, 2023, pp. 2338-2345.
- Yuqi Pan, Binling He, Junyi Geng and **Yang Wang***, Decentralized Formation Control With Prescribed Distance Constraints and Shape Uniqueness, 2023 American Control Conference (ACC), San Diego, CA, USA, 2023, pp. 1345-1352.
- Heng Zhang, QiLong Zhang, Song Liu and **Yang Wang***, Iterative Learning Embedded Model Reference Adaptive Control for Perturbed Nonlinear MIMO Systems, 2023 62nd IEEE Conference on Decision and Control (CDC), Singapore, Singapore, 2023, pp. 5618-5624.
- Qilong Zhang, BinLin He, Yangyang Zhao, Song Liu and **Yang Wang***, Enhancing Convergence Speed of Multi-Agent Formation Control via Laplacian Functions, 2023 IEEE International Conference on Robotics and Biomimetics (ROBIO), Koh Samui, Thailand, 2023.
- Qingxiao Ma, Yizhou Gong and **Yang Wang***, Adaptive Output Regulation for Uncertain Nonlinear Systems: An Additive Decomposition-based Method, 2023 China Automation Congress (CAC), Chongqing, China, 2023, pp. 980-985.
- [25]. Kefei Wu, Xuming He, **Yang Wang**, Xiaopei Liu*, Multi-Level Progressive Reinforcement Learning for Control Policy in Physical Simulations, 2024 IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, 2024, pp. 9502-9508.
- Xiaozhu Lin, Song Liu*, and Yang Wang*, Dynamic Modeling of Robotic Fish considering Background Flow using Koopman Operators, 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Abu Dhabi, United Arab Emirates, 2024, pp. 11843-11848.
- [27]. Binglin He, Heng Zhang, Song Liu*, and Yang Wang*. B. He, H. Zhang, B. Lai, S. Liu and Y. Wang, "Data-

- Driven Modeling of Ground Effect For UAV Landing on a Vertical Oscillating Platform," 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Abu Dhabi, United Arab Emirates, 2024, pp. 8169-8174,
- Yizhou Gong, Gilberto Pin, Yanjun Zhang, **Yang Wang***, A Novel Parameter-dependent Input Normalization-based Direct MRAC with Unknown Control Direction, Accepted by CDC2024.
- [29]. Gilberto Pin, Yizhou Gong, **Yang Wang*** and Andrea Serrani, Parameter Identification in Linear Error Equations: Guaranteeing Output Error Boundedness, Accepted by CDC2024.
- Yizhou Gong, Chengyang Ji, **Yang Wang***, A Model-Free Active Noise Control for Periodic Disturbances: with Guaranteed Stability and Robustness, ACC2025 Accepted.
- Hongru Dai, Xiaozhu Lin, **Yang Wang***, Ambient Flow Perception of Freely Swimming Robotic Fish using an Artificial Lateral Line System, ICRA 2025 Accepted.
- [32]. Kaitian Chao, Xiaozhu Lin, Xiaopei Liu, **Yang Wang***, Learning Flow-Adaptive Dynamic Model for Robotic Fish Swimming in Unknown Background Flow, Accepted by IROS2025.
- Yuyu Jia, Yizhou Gong, Mingyue Wang, Zhenhuan Sun, Yalin Shi, **Yang Wang***, Song LIU*, Oscillation Suppression of Acoustic Trapping: A Disturbance Observer-based Approach, Accepted by IROS2025.
- Pavel Kharitenko, Xiaopei Liu, **Yang Wang***, A Spatiotemporal Downwash Modeling for Agile Close-Proximity Multirotor Flight, Accepted by IROS2025
- Chenyang Ji, Yizhou Gong, **Yang Wang***, A Novel Hybrid Active Noise Control System for Composite Disturbance Signal, EUSIPCO 2025, Accepted.

ACADEMIC ACTIVITIES

Conference Session Chair & Talk Host

- Co-Chair of the session on Robust Adaptive Control, 59th IEEE Conference on Decision and Control, Jeju Island, Republic of Korea, December 14th-18th 2020.
- Chair of Regular Session on the Reinforcement Learning, 22nd IFAC World Congress, July 9-14, 2023, Yokohama, Japan.
- Chair of Regular Session on the Disturbance Rejection, 22nd IFAC World Congress, July 9-14, 2023, Yokohama, Japan.
- Host of talk on "Learning and Predicting Human Intentions and Actions for Autonomy", Prof. Fumin Zhang (IJRR AE), 2023 Shanghai Symposium on Information Science and Technology (ASSIST 2023).
- Host of talk on "Multigrid Methods for Computing Low-Rank Solutions to Parameter-Dependent Partial Differential Equations", Prof. Howard Elman(SIAM Fellow), Distinguished Lecture Series, ShanghaiTech, 2022.

Reviewer of

- Automatica
- IEEE Transaction on Control System Technology
- IEEE Transaction on Control of Network System
- IEEE Control Systems Letters
- · European Journal of Control
- IEEE Transactions on Mechatronics
- Optimal Control Application and Methods
- IEEE Conference on Decision and Control (CDC)
- IEEE American Control Conference (ACC)
- IFAC World Congress
- IEEE International Conference on Robotics and Automation (ICRA)

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

Committee Assignment

- Admissions Committee 2020, 2021, 2022, 2023
- Reward and punishment committee, 2023
- · Academic degree committee, 2023

AWARDS

- ShanghaiTech University Outstanding Teacher, 2022
- ShanghaiTech University Excellent Researcher, 2022
- · YangFan Talent Program Award from Shanghai Municipal People's Government, 2021
- Leading Talent Program Award from Shanghai Municipal People's Government, 2021
- Nomination of Eryl Cadwallader Davies Prize of Imperial College London, 2019
- Imperial College London Scholarship (Top 1%), 2015
- National Scholarship (Top1%), 2013
- The First Prize Scholarship of Tongji University (Top 3%), 2011

STUDENTS MENTORSHIP

Ph.D students

- Zhang Heng, whose research interests include the model reference adaptive control, iterative learning control, neural network-based regulator, flight control of UAV. He is expected to graduated in 2025.
- Xiaozhu Lin, whose research interests include bionic robotics, active flow control, trajectory tracking and attitude control, data-driven modelling, adaptive learning control, reinforcement learning. He is expected to graduate in 2026.
- Yizhou Gong, whose research interests includes output regulation, nonlinear system, geometry control, unknown input observer. He is expected to graduate in 2027.

Master students:

- Yuqi Pan, whose research interests include formation control, multi-agent system, UAV flight control. He
 has graduated in 2023 with the thesis entitled 'Decentralized Formation Control and Application on
 Ouadrotor Platform'.
- Jiangkun Xu, whose research interests includes output regulation, discrete-time control systems, active noise control. He has graduated in 2024.
- Yangyang Zhao, whose research interests includes control with output constraints, iteration learning control, adaptive control for uncertain system, UAV flight control. He has graduated in 2024.
- Binglin He, whose research interests includes UAV flight control, data-driven modelling. He is expected to graduate in 2025.
- Xinlong Li, whose research interests includes visual-servo control, trajectory tracking, multi-agent system. He is expected to graduate in 2025.
- Qinxiao Ma, whose research interests includes data-driven modelling, sim2real, robotic system with aerodynamic system. He is expected to graduate in 2026.
- Yuhang Zhao, whose research interests includes data-driven modelling, sim2real, robotic system with hydrodynamic interaction. He is expected to graduate in 2026.
- Hongru Dai, whose research interests

Distinguished Undergraduate Students:

- Guanqi He, whose bachelor thesis is entitled 'Switching-based Adaptive Output Regulation for Uncertain Systems Affected by a Periodic Disturbance'. He went to Carnegie Mellon University (CMU) for graduate study in 2023. He was awarded the honorary title of Shanghai Outstanding Undergraduate Student.
- · Qinxiao Ma, whose bachelor thesis is entitled 'constructing a control platform for a flapping-wing aircraft'.

He continue his graduate study in my Lab since 2023. He was awarded the honorary title of Shanghai Outstanding Undergraduate Student.