Dr. Henghua Shen

Department of Digital and Intelligent Technology

Assistant Professor | Master's Supervisor

Biography

Dr. Henghua Shen is currently an Assistant Professor in the Department of Digital Technology and Intelligence at Macau Millennium College, also serving as the Director of the Library Administrative Center and the Director of the Teacher Development Center. He received his Ph.D. in Mechanical Engineering from Dalhousie University (Halifax, Canada). He previously conducted postdoctoral research at The Hong Kong Polytechnic University and Concordia University (Montreal, Canada). His research interests include control theory, robotics, artificial intelligence, human-robot interaction, and multi-agent systems. He has published numerous papers in top-tier journals/conferences such as *IEEE/ASME Transactions on Mechatronics*, *IEEE Transactions on Industrial Electronics*, the American Control Conference, and the IFAC World Congress. He serves as a member of the IEEE IES Young Professionals Committee and the Macau Academic Library Alliance.

Working Experience

- Assistant Professor, Macau Millennium College, 2025–present
- Director of Educational Development Center, Macau Millennium College, 2025–present

- Director of Library (Administrative Center), Macau Millennium College, 2025–present
- Postdoctoral Fellow, The Hong Kong Polytechnic University, 2024
- Postdoctoral Fellow, Concordia University (Canada), 2021–2023
- Research Assistant, Dalhousie University (Canada), 2020

Education Background

- Ph.D. in Mechanical Engineering, Dalhousie University (Canada), 2020
- M.Eng. in Mechatronic Engineering, Fuzhou University (China), 2015
- B.Eng. in Mechanical Design, Manufacturing and Automation, Fuzhou University (China), 2012

Research Interests

Control theory, robotics, artificial intelligence, human-robot interaction, multi-agent systems

Teaching Courses

- Ethics of Technology
- Visual Design
- Introduction to Artificial Intelligence
- Frontiers in Digital Technology
- Introduction to Digital Technology
- Applications of Artificial Intelligence

Honors & Awards

- Horizon Postdoctoral Fellowship, Concordia University (Canada), 2021–2023
- Nova Scotia Graduate Scholarship (Provincial), Canada, 2016–2020
- Department Dean Scholarship, Dalhousie University (Canada), 2016–2020
- Faculty of Engineering Excellence Award, Dalhousie University (Canada), 2017
- Bruce and Dorothy Rosetti Engineering Research Scholarship, Dalhousie University (Canada), 2017
- Best Presentation Award, IEEE ICPS 2021
- Distinguished Paper Award, IEEE/ACM ICSE 2025

Social Service

- Secretary, IEEE Canadian Atlantic Section Young Professionals Committee, 2017–2018
- Committee Member, IEEE IES Young Professionals, 2026
- Committee Member, Macau Academic Library Alliance, 2025–present

Research Outputs

Papers Under Review

1.W. Zhang, Q. Zhang, M. Xu, M. You, H. Shen, Z. He, K. Jin, D.F. Wong, T. Fang, "Agri-CPJ: A training-free explainable framework for agricultural pest diagnosis using caption-prompt-judge and LLM-as-a-judge", Expert Systems with Applications, Under Review (Paper ID: ESWA-D-26-15157), 2026.

2.H.H. Shen*, Z.H. Tan, "Safe Switching for AI Customer Service via Lyapunov-Certified Residual Emotion Dynamics", The IFAC World Congress, Under Review (Paper ID: 2384), 2026.

3.H.H. Shen*, Z.H. Tan, Y.J. Pan, "Lyapunov-Based Stability and Region-of-Attraction Analysis of a Multistable Neural Mass Model", The 2026 International Symposium on Industrial Electronics (ISIE), Under Review (Paper ID: 000186), June 2025.

4.H.H. Shen*, Z.H. Tan, "TA-GAN: A LiDAR-Based Trajectory Prediction Framework for Dynamic Obstacles in Indoor Robot Navigation", Robotics and Autonomous Systems, Under Review (Paper ID: ROBOT-D-26-00591), 2026.

5.H.H. Shen, W.F. Xie, "Path Planning for Robot Manipulator Using Adaptive Reinforcement Learning", Neurocomputing, Under Review (Paper ID: NEUCOM-D-23-07231), 2025.

Journal Publications

1.Z.H. Tan, H.H. Shen*, Y.Y. Wu, "RoboNavGuard: Lightweight Deformable Obstacle Segmentation and 3D Visual Grounding for Indoor Robot Navigation", Machine Vision and Applications, Accepted, 2026. (JCR Q2)

2.Z.H. Tan, H.H. Shen*, "Lyapunov-based emotion-aware switching in hybrid human artificial intelligence customer service systems", Information Sciences, Accepted, 2026. (JCR Q1, TOP)

3.R. Chen*, J. Xie, Y. Liu, H. Chen, S. Tang, J. Cheng, H.H. Shen, Z. Tan, "A novel complex network framework: Multi-span transition network with Riemann similarity measure", Engineering Applications of Artificial Intelligence, Accepted, 2025. (JCR Q1, TOP)

4.H.H. Shen, W.F. Xie*, N.Y. Zhu, "Degeneracy-Aware Full-Pose Path Planning Strategy for Robot Manipulator", IEEE Transactions on Systems, Man and Cybernetics: Systems, Vol. 54, No. 8, pp. 4955-4965, 2024. (JCR Q1, TOP, IF: 8.6)

5.N.Y. Zhu, W.F. Xie*, H.H. Shen, "Trajectory planning of cooperative robotic system for automated fiber placement in a leader-follower formation", The International Journal of Advanced Manufacturing Technology, Vol. 130, No. 1-2, pp. 575-588, 2024. (JCR Q1, IF: 2.9)

6.H.H. Shen, W.F. Xie*, J.Y. Tang, T. Zhou, "Adaptive Manipulability-Based Path

Planning Strategy for Industrial Robot Manipulators", IEEE/ASME Transactions on Mechatronics, Vol. 28, No. 3, pp. 1742-1753, 2023. (JCR Q1, TOP, IF: 6.1)

7.H.H. Shen, Y.J. Pan*, "Nonlinear State Estimation and Online Neighbor Selection for Multi-Manipulator Systems", IEEE/ASME Transactions on Mechatronics, Vol. 27, No. 6, pp. 4373-4383, 2022. (JCR Q1, TOP, IF: 6.1)

8.L. Wan, Y.J. Pan*, H.H. Shen, "Improving Synchronization Performance of Multiple Euler-Lagrange Systems using Non-Singular Terminal Sliding Mode Control with Fuzzy Logic", IEEE/ASME Transactions on Mechatronics, Vol. 27, No. 4, pp. 2312-2321, 2022. (JCR Q1, TOP, IF: 6.1)

9.H.H. Shen, Y.J. Pan*, "Tracking Synchronization Improvement of Networked Manipulators Using Novel Adaptive Non-Singular Terminal Sliding Mode Control", IEEE Transactions on Industrial Electronics, Vol. 68, No. 5, pp. 4279-4287, 2021. (JCR Q1, TOP, IF: 7.5)

10.U. Ahmad, Y.J. Pan*, H.H. Shen, "Robust Control Design for Teleoperation of Multiple Mobile Manipulators under Time Delays", International Journal of Robust and Nonlinear Control, Vol. 30, No. 16, pp. 6454-6472, 2020. (JCR Q1, IF: 3.2)

11.H.H. Shen, Y.J. Pan*, U. Ahmad, B.W. He, "Pose Synchronization of Multiple Networked Manipulators using Non-singular Terminal Sliding Mode Control", IEEE Transactions on Systems, Man and Cybernetics: Systems, Vol. 51, No. 12, pp. 7497-7509, 2020. (JCR Q1, TOP, IF: 8.6)

12.H.H. Shen, Y.J. Pan*, "Improving Tracking Performance of Nonlinear Uncertain Bilateral Teleoperation Systems with Time-Varying Delays and Disturbances", IEEE/ASME Transactions on Mechatronics, Vol. 25, No. 3, pp. 1171-1181, 2020. (JCR Q1, TOP, IF: 6.1)

13.Y.Q. Liu, S.Y. Huang, B. He*, L.G. Yao, A. Lv, H.H. Shen, M.W. Chen, W.Y. Hong, "Preliminary Application of 3D Printing Technology in the Surgical Treatment of Falx Meningioma", Chinese General Practice, Vol. 19, No. 24, pp. 2953-2956, 2016. (JCR Q3, IF: 3.44)

14.H.H. Shen, B. He*, J. Zhang, S. Chen, "Obtaining four-dimensional vibration information for vibrating surfaces with a Kinect sensor", Measurement, Vol. 65, pp. 149-165, 2015. (JCR Q1, IF: 5.2)

15.L. Huang, C. Chen, H.H. Shen, B. He*, "Adaptive registration algorithm of color images based on SURF", Measurement, Vol. 66, pp. 118-124, 2015. (JCR Q1, IF: 5.2)

16.S.S. Dong, B. He*, C. Lin, Q. Zhao, H.H. Shen, "Calibration method for a structured light measurement system with two different focal length cameras", Measurement, Vol. 73, pp. 462-472, 2015. (JCR Q1, IF: 5.2)

17.X. Zhou*, H.H. Shen, B. He, "Birth Intensity Estimation Method for Multi-target Video Tracking", Journal of Computer Aided Design & Computer Graphics, Vol. 26, No. 12, pp. 2223-2231, 2014. (JCR Q4, IF: 0.89)

Conference Publications

1.S.Y. Zhang, H.Y. Song, Q.X. Wang*, H.H. Shen, Y. Pei, "A Test Oracle for Reinforcement Learning Software Based on Lyapunov Stability Control Theory", in *Proceedings of the IEEE/ACM 47th International Conference on Software Engineering (ICSE 2025)*, April 27-May 3, 2025, Ottawa, Canada, pp. 502-513. (Top conference in software engineering, Distinguished Paper Award)

2.N.Y. Zhu, W.F. Xie*, H.H. Shen, "A Leader-Follower Trajectory Planning Approach for Cooperative Robotic System in Automated Fiber Placement", in Proceedings of 2023 IEEE International Conference on Mechatronics and Automation (IEEE ICMA 2023), IEEE, 2023.

3.N.Y. Zhu, W.F. Xie*, H.H. Shen, "Adaptive Sliding Mode Control with RBF Neural Network-Based Tuning Method for Parallel Robot", in Proceedings of the 48th Annual Conference of the IEEE Industrial Electronics Society (IECON 2022), IEEE, 2022.

4.R. Adderson, Y.J. Pan*, H.H. Shen, "Application of Sliding Mode Control for the Formation of Heterogeneous Multi-Agent Systems", in Proceedings of the 5th IEEE Conference on Control Technology and Applications (CCTA), August 9-11, 2021, San Diego, USA, pp. 777-782. (Top conference in control)

5.H.H. Shen, Y.J. Pan*, L. Wan, "Teleoperated Single-Master-Multiple-Slave System for Cooperative Manipulations in Task Space", in *Proceedings of the IEEE International Conference on Industrial Cyber-Physical Systems (ICPS 2021)*, May

2021, Victoria, BC, Canada, pp. 864-869. (Best Presentation Award)

6.H.H. Shen, Y.J. Pan*, G. Bauer, "Online Noise-Estimation-based Neighbor Selection for Multi-Manipulator Systems", in *Proceedings of the 21st IFAC World Congress (IFAC-WC)*, July 2020, Berlin, Germany, Vol. 53, No. 2, pp. 9802-9807. (Top conference in control)

7.G. Bauer, Y.J. Pan, H.H. Shen, "Adaptive Impedance Control in Bilateral Telerehabilitation with Robotic Exoskeletons", in Proceedings of the 2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC 2020), October 2020, Toronto, Canada, pp. 719-725.

8.H.H. Shen, Y.J. Pan*, "Adaptive Robust Control of Networked Multi-Manipulators with Time-Varying Delays", in Proceedings of the 2019 IEEE American Control Conference (ACC), July 2019, Philadelphia, USA, pp. 3670-3675. (Top conference in control)

9.H.H. Shen, Y.J. Pan*, U. Ahmad, S. Liu, M. Wu, Y. He, "Tracking Performance Evaluations on the Robust Teleoperative Control of Multiple Manipulators", in *Proceedings of the 28th IEEE International Symposium on Industrial Electronics (IEEE-ISIE 2019)*, June 2019, Vancouver, Canada, pp. 1268-1273.

10.H.H. Shen, Y.J. Pan*, G. Bauer, "Manipulability-based Load Application and Kinematic Decoupling in Cooperative Manipulations", in *Proceedings of the 28th IEEE International Symposium on Industrial Electronics (IEEE-ISIE 2019)*, June 2019, Vancouver, Canada, pp. 1168-1173.

11.U. Ahmad, Y.J. Pan*, H.H. Shen, S. Liu, "Cooperative Control of Mobile Manipulators Transporting an Object based on an Adaptive Backstepping Approach", in Proceedings of the 14th IEEE International Conference on Control and Automation (ICCA), June 2018, Anchorage, Alaska, USA, pp. 198-203.

12.H.H. Shen, Y.J. Pan*, B. He, "Teleoperation of Multiple Cooperative Slave Manipulators Using Graph-based Non-singular Terminal Sliding-Mode Control", in Proceedings of the IEEE International Conference on Robotics and Biomimetics (ROBIO), December 2017, Macau, China, pp. 1430-1435. (Top conference in robotics)

13.H.H. Shen, A.T. Lei, B. He*, "Fusing Salient Region Features and Depth Data for

Real-time Multi-target Searching and Humanoid Navigation", in *Proceedings of the 1st IEEE International Conference on Real-time Computing and Robotics (RCAR 2015)*, June 2015, Changsha, China.

Funded Research Projects

Feasible Strategies and Regulatory Framework for Cross-Border Low-Altitude UAV Operations in Macau-Zhuhai-Hengqin, Funded by Fundação Macau, 2026–2027, Principal Investigator.

Autonomous Recognition and Localization System for Non-Standard Residential Address Plates in Macau, Funded by Associação de Educação Millennium, 2026–2027, Principal Investigator.

Neural-Guided, Multimodal Fusion-Based Self-Evolving Empathetic Interaction System, Funded by Associação de Educação Millennium, 2026–2027, Co-Principal Investigator.

Patents

Measurement method for acquiring four-dimensional vibration information in real time (CN103971409B, 2014)

A Method for Foot Three-Dimensional Measurement and Reconstruction with an RGB-D Sensor (CN103971409B, 2017)

A Measuring Method for Three-Dimensional Foot Surface Information with Multiple RGB-D Sensors (CN104126989B, 2016)