Prof. Qingsong XU 徐青松

PhD, FASME
Department of Electromechanical Engineering
Faculty of Science and Technology
University of Macau
Avenida da Universidade, Taipa, Macau, China
Office: E11-4072
Tel: (853) 8822 4278
Fax: (853) 8822 2426
Email: qsxu@um.edu.mo

Papers

Education

- Ph.D. in Electromechanical Engineering, University of Macau, Macao, China (2008)
- M.Sc. in Electromechanical Engineering, University of Macau, Macao, China (2004)
- B.Sc. in Mechatronics Engineering, Beijing Institute of Technology, Beijing, China (2002)

Professional Experience

- 08/2019–present: Full Professor, University of Macau, China
- 08/2015–08/2019: Associate Professor, University of Macau, China
- 08/2010–08/2015: Assistant Professor, University of Macau, China
- 11/2016–12/2016: Visiting Scholar, University of California, Los Angeles, USA
- 09/2016–10/2016: Visiting Scholar, RMIT University, Melbourne, Australia
- 07/2012: Visiting Scholar, National University of Singapore, Singapore
- 06/2011–07/2011: Visiting Scholar, Swiss Federal Institute of Technology Zurich, Switzerland

Awards and Honors

- **Best Guangdong-Hong Kong-Macao Greater Bay Area Award**, The 9th Macao International Innovation and Invention Expo, 2021
- **Gold Medal Award**, The 9th Macao International Innovation and Invention Expo, 2021

- **Best Paper Award**, IEEE International Conference on Real-time Computing and Robotics (RCAR), 2021
- **Most Cited Article Award**, 2018 to 2019, International Journal of Precision Engineering and Manufacturing, Springer, 2020
- **Awardee of 2019/2020 Incentive Award Scheme for Outstanding Academic Staff**, University of Macau, 2020
- **Awardee of Incentive Award Scheme for Outstanding Academic Staff 2018/2019**, University of Macau, 2019
- **Technological Invention Award** (2nd Prize), Macao Science and Technology Awards, Macao SAR, 2018
- **Awardee of Incentive Award Scheme for Outstanding Academic Staff 2017/2018**, University of Macau, 2018
- **Best Presentation Paper Award**, IEEE International Conference on Mechatronics, Robotics and Automation (ICMRA), 2018
- **2017 Award for Outstanding Contribution in Peer Review**, Mechanism and Machine Theory, Elsevier, Netherlands, 2018
- **FST Research Excellence Award 2016/2017**, Faculty of Science and Technology, University of Macau, 2017
- **Technological Invention Award** (3rd Prize), Macao Science and Technology Awards, Macao SAR, 2016
- **Best Paper Award in Mechatronics**, IEEE International Conference on Advanced Robotics and Mechatronics (ARM), 2016
- **Gold Medal Award**, The 5th Macao International Innovation and Invention Expo, 2016
- **Natural Science Award** (2nd Prize), Macao Science and Technology Awards, Macao SAR, 2014

Laboratory in Charge

- Smart and Micro/Nano Systems Laboratory

Teaching

B.Sc. Courses

1. Mechatronics (EMEN2007, EMEB223)
2. Control Engineering (EMEN3002, EMEB312)
3. Sensors and Actuators (EMEN3042, EMEB385)
4. Design Project (EMEN4000, EMEB410)
5. Measurement Technique & Data Processing (MECH483)
6. Control and Automation (MECH451)
7. Control Techniques (MECH404)
8. Computational Methods (MECH471)
9. Quality Assurance and Control (MECH407)

M.Sc. Courses

1. Intelligent Theory and Engineering Applications (EMEN7032, ELME732)
2. Micromechatronics and Applications (EMEN7031, ELME731)
3. Advanced Robotics and Control (EMEN7011)
4. Introduction to Research (EMEN7001, ELME701)
5. Intelligent Theory and Manufacturing (IMEM016)
6. Academic Thesis (EMEN7999)

Ph.D. Courses

1. Advanced Topics in Electromechanical Engineering (EMEN8001)
2. Doctoral Thesis (EMEN8999)

Research

Research Interests

- MEMS/NEMS, Micro/Nano Mechatronics, Micro/Nano Systems
- Compliant Mechanisms, Soft Robots, Force and Tactile Sensing
- Robotics and Automation, Intelligent Control, Artificial Intelligence
- Sensors and Actuators, Smart Materials and Structures, Energy Harvesting

Research Projects

- **Principal Investigator**, “Design and Control of Micromanipulation Robotic System for High-Throughput Microinjection of Zebrafish”, funded by National Natural Science Foundation of China (NSFC) (國家自然科學基金面上項目), 2022–2025.
- **Principal Investigator**, “Development of Robotic Intelligent Operation System Based on 3D Vision Sensing and Compliant Force Control”, funded by Macao Science and Technology Development Fund (FDCT), Macao Funding Scheme for Key R&D Projects (澳門重點研發專項資助計劃), 2020–2023.
- **Principal Investigator**, “Development of a New Robotic System for Automated Microinjection of Zebrafish Larvae”, funded by Macao Science and Technology Development Fund (FDCT), 2020–2023.
- **Principal Investigator**, “Development of Intelligent Robot for Anti-Epidemic Medical Healthcare (Anti-NCP epidemic)”, funded by Macao Science and Technology Development Fund (FDCT) (澳門抗疫科研專項資助), 2020.
- **Principal Investigator**, “Design and Fabrication of Novel Flexure-Guided Multiple Degree-of-Freedom Energy Harvester”, funded by Research Committee of University of Macau, 2020–2021.
- **Principal Investigator**, “Development of Novel Haptic Feedback-Based Robotic Micromanipulation System for Biological Cell Manipulation”, funded by Macao Science and Technology Development Fund (FDCT), 2018–2021.

- **Principal Investigator**, “Design and Development of New Adjustable Zero-Stiffness Compliant Micropositioning System”, funded by Research Committee of University of Macau, 2018–2021.
- **Principal Investigator**, “Design and Development of a Novel Piezoelectric Energy Harvester”, funded by Macao Science and Technology Development Fund (FDCT), 2017–2018.
- **Principal Investigator**, “Design and Fabrication of Constant-Force Microgripper for Micromanipulation”, funded by Macao Science and Technology Development Fund (FDCT), 2016–2018.
- **Principal Investigator**, “Design and Control of Fully Compliant 3-DOF Constant-Force Micropositioning Stage for Cell Microinjection with Minimal Damage”, funded by National Natural Science Foundation of China (NSFC) (國家自然科學基金面上項目), 2016–2019.
- **Principal Investigator**, “Microforce Sensing and Control System and Its Application in Automated Bio-Micromanipulation”, funded by Macao Science and Technology Development Fund (FDCT), 2015–2017.
- **Principal Investigator**, “Design and Development of Novel Rotary Precision Micropositioning Systems”, funded by Research Committee of University of Macau, 2013–2016.
- **Principal Investigator**, “Design and Development of Large-Range Microgripper for Microassembly”, funded by Macao Science and Technology Development Fund (FDCT), 2013–2015.
- **Principal Investigator**, “Development of Novel MEMS-Based Microgrippers for Micromanipulation”, funded by Research Committee of University of Macau, 2012–2015.
- **Principal Investigator**, “Novel Design and Control of a Micro/Nano-Positioning System with Large Motion Range”, funded by Macao Science and Technology Development Fund (FDCT), 2011–2012.
- **Principal Investigator**, “Precise Motion Control of a Micro/Nano-Positioning Stage

with Piezoelectric Actuation", funded by Research Committee of University of Macau, 2011.

Selected Publications

Books

1. **Q. Xu** and L. M. Tam, "*Mechanical Design of Piezoelectric Energy Harvesters*," Elsevier, 2021, (273 pages).
2. **Q. Xu**, "*Micromachines for Biological Micromanipulation*," Springer, 2018, ISBN: 978-3-319-74621-0, (226 pages).
3. **Q. Xu**, "*Design and Implementation of Large-Range Compliant Micropositioning Systems*," John Wiley & Sons, 2016, ISBN: 978-1-119-13143-4, (273 pages).
4. **Q. Xu** and K. K. Tan, "*Advanced Control of Piezoelectric Micro-/Nano-Positioning Systems*," Springer, 2015, ISBN: 978-3-319-21622-5, (257 pages).

Journal Papers

1. J. Wang, L. Chen, and **Q. Xu**, "Disturbance Estimation-Based Robust Model Predictive Position Tracking Control for Magnetic Levitation System," ***IEEE/ASME Transactions on Mechatronics***, vol. 27, no. 1, pp. 81-92, 2022, (SCI/EI).
2. Y. Wei and **Q. Xu**, "Design and Testing of a New Force-Sensing Cell Microinjector Based on Small-Stiffness Compliant Mechanism," ***IEEE/ASME Transactions on Mechatronics***, vol. 26, no. 2, pp. 818-829, 2021, (SCI/EI).
3. **Q. Xu**, "Adaptive Integral Terminal Third-Order Finite-Time Sliding-Mode Strategy for Robust Nanopositioning Control," ***IEEE Transactions on Industrial Electronics***, vol. 68, no. 7, pp. 6161-6170, 2021, (SCI/EI).
4. Z.H. Wu and **Q. Xu**, "Design and Development of a Novel Two-Directional Energy Harvester With Single Piezoelectric Stack," ***IEEE Transactions on Industrial Electronics***, vol. 68, no. 2, pp. 1290-1298, 2021, (SCI/EI).
5. C. Zhi, **Q. Xu**, and L.M. Zhu, "A Review of Recent Advances in Robotic Cell Microinjection," ***IEEE Access***, vol. 8, pp. 8520-8532, 2020, (SCI/EI).

6. S. Wen, Z.H. Wu, and **Q. Xu**, “Design of a Novel Two-Directional Piezoelectric Energy Harvester with Permanent Magnets and Multi-Stage Force Amplifier,” ***IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control***, vol. 67, no. 4, pp. 840-849, 2020, (SCI/EI).
7. Z. H. Wu and **Q. Xu**, “Design, Fabrication, and Testing of a Novel 3-DOF Energy Harvester With Single Piezoelectric Stack,” ***Journal of Mechanical Design, Transactions of the ASME***, vol. 142, no. 6. pp. 063303, 2020, (SCI/EI).
8. Z. Li, **Q. Xu**, and L. M. Tam, “Design of a New Piezoelectric Energy Harvesting Handrail With Vibration and Force Excitations,” ***IEEE Access***, vol. 7, pp. 151449-151458, 2019, (SCI/EI).
9. Y. Wei and **Q. Xu**, “Design and Testing of a New Force-Sensing Cell Microinjector Based on Soft Flexure Mechanism,” ***IEEE Sensors Journal***, vo. 19, no. 15, pp. 6012-6019, 2019, (SCI/EI).
10. Z. Nan, **Q. Xu**, Y. Zhang, and W. Ge, “Force-Sensing Robotic Microinjection System for Automated Multi-Cell Injection with Consistent Quality,” ***IEEE Access***, vol. 7, pp. 55543-55553, 2019, (SCI/EI).
11. S. Wen and **Q. Xu**, “Design of a Novel Piezoelectric Energy Harvester Based on Integrated Multi-Stage Force Amplification Frame,” ***IEEE/ASME Transactions on Mechatronics***, vol. 24, no. 3, pp. 1228-1237, 2019, (SCI/EI).
12. Y. Wei and **Q. Xu**, “A Survey of Force-Assisted Robotic Cell Microinjection Technologies,” ***IEEE Transactions on Automation Science and Engineering***, vol. 16, no. 2, pp. 931-945, 2019, (SCI/EI).
13. Z.Y. Wu and **Q. Xu**, “Design, Fabrication and Testing of a New Compact Piezo-Driven Flexure Stage for Vertical Micro/Nano-Positioning,” ***IEEE Transactions on Automation Science and Engineering***, vol. 16, no. 2, pp. 908-918, 2019, (SCI/EI).
14. J. P. Mishra, **Q. Xu**, X. Yu, and M. Jalili, “Precision Position Tracking for Piezoelectric-Driven Motion System using Continuous Third-Order Sliding Mode Control,” ***IEEE/ASME Transactions on Mechatronics***, vol. 23, no. 4, pp. 1521-1531, 2018, (SCI/EI).

15. P. Wang and **Q. Xu**, “Design and Testing of a Flexure-Based Constant-Force Stage for Biological Cell Micromanipulation,” ***IEEE Transactions on Automation Science and Engineering***, vol. 15, no. 3, pp. 1114-1126, 2018, (SCI/EI).
16. S. Wen, **Q. Xu**, and B. Zi, “Design of a New Piezoelectric Energy Harvester Based on Compound Two-Stage Force Amplification Frame,” ***IEEE Sensors Journal***, vol. 18, no. 10, pp. 3989-4000, 2018, (SCI/EI).
17. S. Yang, **Q. Xu**, and Z. Nan, “Design and Development of a Dual-axis Force Sensing MEMS Microgripper,” ***Journal of Mechanisms and Robotics, Transactions of the ASME***, vol. 9, no. 6. pp. 061011, 2017, (SCI/EI).
18. **Q. Xu**, “Continuous Integral Terminal Third-Order Sliding Mode Motion Control for Piezoelectric Nanopositioning System,” ***IEEE/ASME Transactions on Mechatronics***, vol. 22, no. 4, pp. 1828-1838, 2017, (SCI/EI).
19. Y. Wei and **Q. Xu**, “Design of a PVDF-MFC Force Sensor for Robot-Assisted Single Cell Injection,” ***IEEE Sensors Journal***, vol. 17, no. 13, pp. 3975-3982, 2017, (SCI/EI).
20. G. Wang and **Q. Xu**, “Design and Precision Position/Force Control of a Piezo-Driven Microinjection System,” ***IEEE/ASME Transactions on Mechatronics***, vol. 22, no. 4, pp. 1744-1754, 2017, (SCI/EI).
21. **Q. Xu**, “Precision Motion Control of Piezoelectric Nanopositioning Stage With Chattering-Free Adaptive Sliding Mode Control,” ***IEEE Transactions on Automation Science and Engineering***, vol. 14, no. 1, pp. 238-248, 2017, (SCI/EI).
22. Y. Liu, Y. Zhang, and **Q. Xu**, “Design and Control of a Novel Compliant Constant-Force Gripper Based on Buckled Fixed-Guided Beams,” ***IEEE/ASME Transactions on Mechatronics***, vol. 22, no. 1, pp. 476-486, 2017, (SCI/EI).
23. Y. Zhang and **Q. Xu**, “Adaptive Sliding Mode Control With Parameter Estimation and Kalman Filter for Precision Motion Control of a Piezo-Driven Microgripper,” ***IEEE Transactions on Control Systems Technology***, vol. 25, no. 2, pp. 728-735, 2017, (SCI/EI).
24. **Q. Xu**, “Design and Development of a Novel Compliant Gripper With Integrated

Position and Grasping/Interaction Force Sensing," ***IEEE Transactions on Automation Science and Engineering***, vol. 14, no. 3, pp. 1415-1428, 2017, (SCI/EI). (**ESI Highly Cited Paper**)

25. **Q. Xu**, "Design of a Large-Stroke Bistable Mechanism for the Application in Constant-Force Micropositioning Stage," ***Journal of Mechanisms and Robotics, Transactions of the ASME***, vol. 9, no. 1, pp. 011006-1-011006-7, 2017, (SCI/EI).
26. **Q. Xu**, "Digital Integral Terminal Sliding Mode Predictive Control of Piezoelectric-Driven Motion System," ***IEEE Transactions on Industrial Electronics***, vol. 63, no. 6, pp. 3976-3984, 2016, (SCI/EI).
27. **Q. Xu**, "Design, Fabrication and Testing of an MEMS Microgripper With Dual-Axis Force Sensor," ***IEEE Sensors Journal***, vol. 15, no. 10, pp. 6017-6026, 2015, (SCI/EI).
28. **Q. Xu**, "Piezoelectric Nanopositioning Control Using Second-Order Discrete-Time Terminal Sliding Mode Strategy," ***IEEE Transactions on Industrial Electronics***, vol. 62, no. 12, pp. 7738-7748, 2015, (SCI/EI).
29. **Q. Xu**, "Design of a Large-Range Compliant Rotary Micropositioning Stage With Angle and Torque Sensing," ***IEEE Sensors Journal***, vol. 15, no. 4, pp. 2419-2430, 2015, (SCI/EI).
30. **Q. Xu**, "Robust Impedance Control of a Compliant Microgripper for High-Speed Position/Force Regulation," ***IEEE Transactions on Industrial Electronics***, vol. 62, no. 2, pp. 1201-1209, 2015, (SCI/EI).

Professional Activities

Full publications list

Professional Membership

- Fellow of ASME
- Senior Member of IEEE
- Member of MIIA
- Member of MAPST

Journal and Conference Services

- Associate Editor, IEEE Transactions on Robotics, 2021–
- Technical Editor, IEEE/ASME Transactions on Mechatronics, 2016–
- Associate Editor, IEEE Transactions on Automation Science and Engineering, 2019–
- Associate Editor, IEEE Robotics and Automation Letters, 2017–
- Associate Editor, International Journal of Advanced Robotic Systems, 2015–
- Co-Editor, Recent Patents on Mechanical Engineering, 2020–
- Associate Editor, IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM 2017–2021)
- Editorial Board Member, TMech/AIM 2020 Concurrent Submission
- Associate Editor, IEEE International Conference on Robotics and Automation (ICRA 2019–2022)
- Associate Editor, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2021–2022)
- Associate Editor, IEEE Conference on Automation Science and Engineering (CASE 2017–2022)
- Regional Program Chair, The 7th Annual IEEE Int. Conf. on CYBER Technology in Automation, Control, and Intelligent Systems (IEEE-CYBER 2017), July-August 2017, Hawaii, USA
- Symposium Co-Chair, Cross-Strait Symposium on Dynamical Systems and Vibration (SDSV 2017), December, 2017, Hong Kong and Macau, China
- Local Arrangement Chair, The 19th IEEE Conference on Nanotechnology (IEEE-NANO 2019), July 2019, Macau, China
- Local Arrangement Co-Chair, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2019), November 2019, Macau, China
- International Program Committee Co-Chair, The 2nd Modeling, Estimation and Control Conference (MECC 2022), October 2-5, 2022, Jersey City, NJ, USA

Openings

Open Positions of PhD Students, Master Students, and Postdoc Fellows are Available in 2022/2023.

- **Qualification for applicants**: Possess relevant degree in mechanical engineering, control engineering, robotics, mechatronics, or related fields
    - **PhD admission**
    - **Master admission**
    - **Postdoc and Visiting scholar**