Siyi Xu

CONTACT INFORMATION

John A. Paulson School of Engineering and Applied Sciences, Harvard University

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WORK EXPERIENCE

Postdoctoral Fellow September 2023-Present
Northwestern University

Postdoctoral Fellow June 2022-September 2023
Microrobotics Lab, Harvard University

EDUCATION

Ph.D. Engineering Science May 2022
Harvard University
Thesis Title: Sensing, actuation, and control of soft fluid-driven robots by liquid-elastomer composite sensors and dielectric elastomer actuators
Advisor: Robert Wood

S.M. Engineering Science 2018
Harvard University

B.S. Materials Science and Engineering, with High Honors 2016
University of Illinois at Urbana-Champaign

IES Abroad: Language and Culture Study 2013
Berlin, Germany

RESEARCH INTEREST

My research focuses on developing soft robots that are equipped with compliant, lightweight, and compact power and transducing systems. My work leverages multi-functional materials, different sensing mechanisms, and actuation technologies to create elastomer-based solutions for human-centered applications. My primary interests are in haptic interfaces, wearable assistive devices, and microfluidic devices for biomedical treatments and drug delivery.

RESEARCH APPOINTMENT

Postdoctoral Fellow June 2022-Present

Graduate Research Assistant, Harvard Microrobotics Laboratory 2016-May 2022
Harvard University
Topics: 1) Biocompatible wearable soft sensors and electronic skins for diagnostic and assistive purposes.
2) High power-density miniature soft electrically-driven dielectric elastomer actuators (DEAs).
3) DEA-based soft valves and peristaltic pumps power and control of soft fluidic robots.
4) Collision resilient and agile insect-scale aerial robots powered by soft artificial muscles.
Advisor: Robert Wood

Research Assistant, Frederick Seitz Materials Research Laboratory 2013-2016
University of Illinois at Champaign-Urbana
Topic: Collaborated on the project of Active Si Electronics for Chronic Biosensors, focusing on fabricating and optimizing the NMOS transistors to realize active sensing matrix for biosignals Investigated stretchable plasmonics, fabricating and studying optical and mechanical properties of metallic nanoparticles on flexible substrates.
Advisor: John A. Rogers

PUBLICATIONS

Google Scholar: https://scholar.google.com/citations?hl=enuser=tfVyLwMAAAAJ

Published

J9. **Xu, S.**, Nunez, C. M., Souri, M., Wood, R. J., An electrically-driven dynamic soft peristaltic pump for soft fluidic robots, *Science Robotics*, 8(79), 2023.

J8. Poccard-Saudart, J., **Xu, S.**, Teeple C. B., Hyun, N.P., Becker, K.P., and Wood, R. J., Controlling soft fluidic actuators using sot DEA-based valves, *Robotics and Automation Letters*, 7(4), pp.8837-8844, 2022.

J7. **Xu, S.**, Chen, Y., Hyun, N.P., Becker, K.P., A dynamic electrically-driven soft valve for control of fluidic soft actuators, *Proceedings of the National Academy of Sciences*, 118(34), 2021.

J6. Chen, Y., **Xu, S.**, Ren, Z., Chirarattananon, P. Collision Resilient Insect-Scale Soft-Actuated Aerial Robots With High Agility. *IEEE Transactions on Robotics*, 2021.

J5. **Xu, S.**, Vogt, D., Osborne, J., Walsh, T., Foster, J., Sullivan, S., Smith, V., Rousing, A., Goldfield, E., Wood, R. J., "Biocompatible Soft Fluidic Strain and Force Sensors for Wearable Devices", *Advanced Functional Materials*, 29(7), 2019.

⋆ **Cover Article**

J4. Fang, H.†, Yu, K.J.†, Gloschat, C., Yang, Z., Song, E., Chiang, C.H., Zhao, J., Won, S.M., **Xu, S.**, Trumpis, M. and Zhong, Y., "Capacitively coupled arrays of multiplexed flexible silicon transistors for long-term cardiac electrophysiology", *Nature biomedical engineering*, 1(3), pp.1-12, 2017. (†authors contributed equally to this work)

J3. Feng, Di†, Zhang, H.†, **Xu, S.**, Tian, Li., and Song N., "Stretchable array of metal nanodisks on a 3D sinusoidal wavy elastomeric substrate for frequency tunable plasmonics", *Nanotechnology*, 28(11), 2017. (†authors contributed equally to this work)

J2. Feng, D., Zhang, H., **Xu, S.**, Tian, L., and Song, N. Fabrication of plasmonic nanoparticles on a wave shape PDMS substrate. *Plasmonics*, 12(5), 1627-1631, 2017.

J1. Gao, L., Zhang, Y., Zhang, H., Doshay, S., Xie, X., Luo, H., Shah, D., Shi, Y., **Xu S.**, Fang, H. and Fan, J.A., Optics and nonlinear buckling mechanics in large-area, highly stretchable arrays of plasmonic nanostructures. Acs Nano, 9(6), 5968-5975, 2015.

Conference Papers and Abstracts

C4. Poccard-Saudart, J., **Xu, S.**, Teeple C. B., Hyun, N.P., Becker, K.P., and Wood, R. J., Controlling soft fluidic actuators using sot DEA-based valves, *IEEE International Conference on Intelligent Robots and Systems (IROS)*, 2022. (Paper)

C3. **Xu, S.**, Chen, Y., Hyun, N.P., Becker, K.P., Dynamic Electrically-driven Soft Valve and Pump for Powering and Control Hydraulic Robots, *Gordon Research Conference*, 2022. (Abstract)

C2. **Xu, S.**, Chen, Y., Hyun, N.P., Becker, K.P., A Dynamic Electrically-driven Soft Valve for Control of Hydraulic Robots, *IEEE International Conference on Robotics and Automation (ICRA)*, 2022. (Abstract)

C1. **Xu, S.**, Chen, Y., Hyun, N.P., Becker, K.P., A Dynamic Electrically-driven Soft Valve for the Control of Mesoscale Fluidic Flows, *Materials Research Society*, Fall 2020. (Abstract)

In Preparation and Submitted

C5. Vogt, D.†, **Xu, S.**†, Hsu, W.†, Osborne, J., Foster J., Sullivan S., Goldfield E., Wood R. J., "Human grasping studies with biocompatible wearable soft sensors", *In Prep.* (†authors contributed equally to this work)

C6. Vogt, D., **Xu, S.**, Hsu, W., Rousing, A., Foster, J., Sullivan, S., Walsh, T., Lansberry, G.B., Martin, T.V., Goldfield, E., Wood, R. J., An Ultra-Soft Biocompatible Multi-Sensor Glove for Human-Machine Interfaces and Medical Diagnostics, *In Prep.*

PRESENTATIONS AND INVITED TALKS

Therapeutic Technology Design and Develop Lab, MIT. 2022
Topic: Electrical Sensing, Actuation, and Control of Soft Fluidic Robots

Gordon Research Conference and Seminar, Ventura, CA. 2022

Topic: Electrically-driven Soft Valve and Pump for Powering and Control Hydraulic Robots
IEEE International Conference on Robotics and Automation, Philadelphia, PA. 2022
Topic: A Dynamic Electrically-driven Soft Valve for Control of Hydraulic Robots
Materials Research Society Fall Meeting, Boston, MA. 2021
Meet the New Faculty Candidates Event
Topic: Electrical Sensing, Actuation, and Control of Soft Fluid-driven Robots
Materials Discovery and Applications Group, Harvard University 2021
Topic: A Dynamic Electrically-driven Soft Valve for Control of Soft Hydraulic Actuators.
Materials Research Society Fall Meeting, Boston, MA. 2020
Topic: A Dynamic Electrically-driven Soft Valve for the Control of Mesoscale Fluidic Flows
Smart and Connected Health (SCH) Principal Investigator Meeting, Alexandria, VA. 2020
Topic: Flexible Electronics for Assessment of Planning by Children born prematurely.
SEAS Nexus: Connect, Create, Converge, Cambridge, MA. 2019
Topic: Biocompatible fluidic soft sensors: functions and future applications.
Poster presentation, 11th Annual Retreat of Wyss Institute, Boston, MA. 2019
Topic: Fleximitts: A wearable soft sensing glove for medical diagnostic.
Poster Presentation, 9th Annual Retreat of Wyss Institute, Boston, MA. 2017
Topic:Fleximitts: A soft wearable sensing glove capable of medical diagnostic for children born prematurely.

TEACHING AND MENTORING EXPERIENCE

Teaching Assistantships
Teaching Fellow, Harvard University 2017
ES176: Introduction to MicroElectroMechanical System
Teaching Assistant, University of Illinois at Champaign-Urbana 2016
ENG 198: Illinois Engineering First Year Experience (IEFX) Research
Engineering Learning Assistant, University of Illinois at Champaign-Urbana 2015
ENG 100: Engineering Orientation

Mentorship
Johan Poccard-saudart 2021
Visiting master student, École polytechnique fédérale de Lausanne (EPFL), Switzerland.
Undergraduate Mentoring Workshop 2021
Harvard University
Tobias V. Martin (Mentored with Daniel Vogt) 2019
Undergraduate, Cornell Univerisity
Research Topic: Non-Sensing Sensor Geometry Development for Integration with Fleximitts
Alisha Mah (Mentored with Daniel Vogt) 2018
Undergraduate, Harvard College
Research Topic: Upper Limb Biomechanics Measurements using Soft Sensors
Tutor, Center for Academic Resources in Engineering (CARE) 2014-2015
Undergraduate students, University of Illinois at Urbana-Champaign

AWARDS AND HONORS

IEEE Transactions on Robotics King-Sun Fu Memorial Best Paper Award 2022
Rising Stars in Mechanical Engineering 2021
Wiston Chen Graduate Fellowship Fund 2016
Fellowship Support for incoming Ph.D. Students
Eckel Scholarship 2015
Awared for outstanding academic performances
Wert Scholarship 2014
Awared for outstanding academic performances
Dean's List 2012-2015
Awared for outstanding academic performances

PROFESSIONAL SERVICE

Program Committee Member, Gordon Research Seminar 2021-2022

	Reviewer, Advanced Materials Technology	2020
	Reviewer, Robotics and Automation Letters	2020 - present
	Reviewer, IEEE Conferences (RoboSoft, ICRA, IROS, BioRob)	2018 - present
	Member, Institute of Electrical and Electronics Engineers	2018-present
	Outreach	
	Harvard SEAS Engineering Open House Organizer	2017-2020
	First Lego League Championship Judge	2017-2018
	MIT Girl's Day 'THE SECRET LIVES OF ROBOTS' Presenter	2017
LEADERSHIP AND ACTIVITIES	Harvard Microrobotics Lab	
	Outreach Diversity Chair	2020-Present
	Harvard SEAS Graduate Council (SEAS-GC)	
	Co-President	2019-2020
	Harvard Chinese Students and Scholars Association	
	Vice President	2019-2020
	Society of Women Engineers (SWE)	
	Membership and Enrichment Committee Creativity Chair	2012-2013
SELECTED PRESS	Harvard SEAS, Pump powers soft robots, makes cocktails	2023
	Harvard SEAS, Soft components for the next generation of soft robotics	2021
	Electronics Weekly: Pliable electro-mechanical actuator suits soft robots	2021
	MIT News, Researchers introduce a new generation of tiny, agile drones	2021
	Tech Briefs, Harvard's Siyi Xu Designs All-New Strain and Force Sensors	2019
	DesignNews, Safe, Biocompatible Sensor for Child Diagnostics and Virtual-Reality Applications	2019
	Harvard SEAS, A safe, wearable soft sensor	2018