Mingsong Jiang

Ph.D. in Mechanical Engineering (Soft Robotics) Email: jason123jms@gmail.com
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Interests

Soft robotics, Reconfigurable Robotics, Smart materials & manufacturing

Education

University of California San Diego, La Jolla, CA, USA

Ph.D., Mechanical Engineering 4/2018–12/2021
Fields: Soft Robotics, Reconfigurable Robotics, 3D Printing
Advisor: Prof. Nick Gravish
Thesis: *Towards Reconfigurable and Adaptive Soft Robots via Hybrid Materials, Designs and Mechanisms*
Committee: Prof. Nick Gravish, Mike Tolley, Marc Meyers, Shengqiang Cai, and Ken Loh

M.S., Mechanical Engineering (GPA 3.7/4.0) 9/2016–3/2018
Fields: Robotics (Design & Fabrication)
Advisor: Prof. Nick Gravish
Thesis: *Sliding-layer laminates: a new robotic material enabling robust and adaptable undulatory locomotion*
Committee: Prof. Nick Gravish, Mike Tolley, and Mike Yip

Xi'an Jiaotong University, Xi'an, Shaanxi, China

B.Eng., Mechanical Engineering (Major GPA 90/100) 9/2012–6/2016
Thesis: *Design and fabrication of a 3D printed rehabilitative hand exoskeleton device*
(Best Graduate Thesis Nominee)

Publications

1. **Jiang, M.**; Wang, J.; and Gravish, N. A reconfigurable soft linkage robot via internal "virtual" joints. *Soft Robotics*. (under review).
2. **Jiang, M.**; and Gravish, N. Reconfigurable laminates enable multifunctional robotic building blocks. *Smart Materials and Structures*. 2021. 30 (3), 035005.
3. **Jiang, M.**; Yu, Q.; and Gravish, N. Vacuum induced tube pinching enables reconfigurable flexure joints with controllable bend axis and stiffness. *IEEE 4th International Conference on Soft Robotics (Robosoft)*. 2021. pp. 315–320.
4. Yu, Q.; **Jiang, M.**; and Gravish, N. Flexoskeleton Fingers: 3D Printed Reconfigurable Ridges Enabling Multi-functional and Low-cost Underactuated Grasping. *IEEE Robotics and Automation Letters*. 2021. pp. 3971-3978.
5. **Jiang, M.**; Zhou, Z.; and Gravish, N. Flexoskeleton printing enables versatile fabrication of hybrid soft and rigid robots. *Soft Robotics*. 2020. 7 (6), 770-778.
6. **Jiang, M.**; Song, R.; and Gravish, N. Knuckles that buckle: compliant underactuated limbs with joint hysteresis enable minimalist terrestrial robots. *IEEE/RSJ Int'l Conference on Intelligent Robots and Systems (IROS)*. 2020. pp. 3732-3738
7. **Jiang, M.**; and Gravish, N. Rapid prototyping of insect-exoskeleton inspired robots. *9th International Symposium on Adaptive Motion of Animals and Machines*. 2019.
8. **Jiang, M.**; and Gravish, N. Sliding-layer laminates: a robotic material enabling robust and adaptable undulatory locomotion *IEEE/RSJ Int'l Conference on Intelligent Robots and Systems (IROS)*. 2018. pp. 5944-5951.

Patent

Pinched tubes for reconfigurable robots. US Patent, No. US 2023/0127106 A1 4/2023
Inventors: Aukes D., Sharifzadeh M., Jiang Y., Gravish N., **Jiang M.**(lead inventor)

Awards

Co-author of Best Paper Award Nominee, *IEEE Robosoft 2021* 4/2021
Chinese National Student Fellowship *(8000 RMB)* 12/2015
Dancing Robot Competition, 3rd place, *Robocon China 2014* 5/2014

Postdoc Experience

Yale University, the Faboratory (PI: Rebecca Kramer-Bottiglio) 4/2023–present
Postdoctoral Associate

• Lead author in system design and testing of a flexible atmospheric diving suit sleeve via structured granular metamaterials .
• This suit is aimed for high pressure differential working conditions (e.g., 100 m water depth) while maintaining low shear modulus but high bulk modulus. (paper in progress)
• Lead author in building and testing the next generation amphibious turtle robot (ART).
• Main goals: robot waterproofing under deep pressure, autonomous robot reconfiguration and transitioning between land and water, as well as optimization of robot's cost of transport under different gaits and robot configurations

Ph.D. Research

Gravish Lab, UC San Diego, La Jolla, CA, USA 9/2016–12/2021
Graduate Research Assistant

Soft Curved Reconfigurable Anisotropic Mechanisms (SCRAMs) 9/2019–12/2021
• New reconfigurable soft robot paradigms with on-demand mechanical "virtual" joints based on curvature control and planar fabrications (sewing, lamination, and 3D printing).
• Funded by NSF Award: EFRI C3 SoRo, No. 1935324
• Multi-disciplinary team collaboration among four universities
PIs: Prof. Nick Gravish, Dan Aukes, Cindy Harnett and Ross Hatton.
• Collaborations and weekly discussions on: 3D soft robot printing, embroidered sensors and actuators, bio-inspired mechanisms and geometric methods for robot controls
• Mentored two students and published two papers.

Flexoskeleton Printing Enables Hybrid Functional Robots 12/2018–4/2020
• Low-cost rapid prototyping of multi-material robots based on commercial 3D printers.
• Embedded compliance, rigid chassis, actuators and sensors via simple fabrication steps
• Demonstrated a series of underactuated robots as multi-legged walking robots, multi-fingered grippers, and tailed and limbed swimmers.
• Mentored two students and published three papers.
• Press highlights on multiple major tech-sites.

Reconfigurable Laminates as Multifunctional Robotic Materials 5/2017–1/2020
• Geometric reconfiguration of hybrid material compositions to achieve tunable properties
• Laser cutting and manual lamination of various robotic fabrics and prototypes.
• Research outreach to high school students in laminate robot fabrication.
• Mentored several undergrads and published two papers.

Other Lab Duties
• Early stage lab establishment and a DPSS laser stage for micro-scale robot fabrication
• Lab Safety Coordinator: responsible for lab daily operation and new lab members training.

Teaching

UC San Diego, La Jolla, CA, USA 9/2017–12/2019
Graduate Teaching Assistant

MAE156A, Fundamental Principles of Mechanical Design I, Fall 2017– Fall 2019
• Undergrad class on engineering science to the design and analysis of mechanical components.
• Held lab courses on design and control of motorized robotic systems via self-built electronics and microcontrollers. Also taught robot fabrication based on 3D printing and laser cutting.
• Held office hours and contributed to the design and grading of homework and midterms.
Course by: Prof. Nate Delson and Nick Gravish.

MAE207, Bioinspired Mobile Robotics, Spring 2018 & Spring 2019
• Graduate-level bioinspired robotics class focusing on the theories and experimentation of dynamic robot locomotion and interesting biological mechanisms
• Held lab-based courses on control of legged robot locomotion via direct drive motors, on board sensors and controllers (ODrive motor controllers), coded by Python.
• As the lead TA, held office hours and contributed to designing and grading of homework.
Course by: Prof. Nick Gravish.

Robot Inventors (Cluster 10), COSMOS summer high school, Summer 2019
• UCSD STEM program for high school students interested in engineering and robotics
• Lectures on introduction of robotics, operation of motors, computer vision and basic programming using Python.
Course by: Prof. Nick Gravish and Curt Schurgers.

Mentorship (selected)

Gravish Lab, UC San Diego (3 Undergrads & 5 MS students)

Qifan Yu, Undergrad student, Mechanical Engineering, UCSD 10/2020-10/2021
• First author IEEE RAL paper: *Flexoskeleton Fingers: 3D Printed Reconfigurable Ridges Enabling Multi-Functional and Low-Cost Underactuated Grasping*
• Received best paper nominee in Robosoft 2021.
• Day-to-day research mentorship and instructions on scientific writing.
• Admission to MIT Ph.D. program (Mechanical Engineering).

Jiangsong Wang, Undergrad student, Aerospace Engineering, UCSD 9/2020–12/2021
• Admission to CMU M.S. program (Robotics).

Shuhang Zhang, MS student, Mechanical Engineering, UCSD 6/2020–6/2021
• Admission to EPFL Ph.D. program (Robotics).

Presentations (selected)

IEEE Robosoft 2021 Poster Session, virtual	4/2021
IROS 2020 Poster Session, virtual	10/2020
Jacobs School of Engineering Research Expo, UCSD	4/2019 & 4/2018
Invited talk on robotic laminates, Contextual Robotics Institute, UCSD	11/2017

Press (selected)

Flexoskeleton Printing

TechXplore – Flexoskeleton printing: Fabricating flexible exoskeletons for insect-inspired robots

EEPOWER – 3D Printed Insect-Inspired 'Flexoskeleton' Robots are Fast and Inexpensive

Hackster.io – 3D-Printed Flexoskeleton Soft Robots Developed Using Insect Inspiration

Engadget – Scientists can 3D print insect-like robots in minutes

Workshop Robosoft2021 Workshop Organization: *Breaking the Mold: Challenging Current Paradigms in Soft Robotics* 4/2021

Github Original Project Website: https://github.com/gravish-lab/Flexoskeleton-printing
Personal Website: https://mingsongj.github.io

References

Nicholas G. Gravish
Dept. of Mechanical & Aerospace Engineering
University of California San Diego
Email:ngravish@eng.ucsd.edu

Rebecca Kramer-Bottiglio
Mechanical Engineering & Materials Science
Yale University
Email:rebecca.kramer@yale.edu

Michael T. Tolley
Dept. of Mechanical & Aerospace Engineering
University of California San Diego
Email:tolley@ucsd.edu

Cindy K. Harnett
J.B. Speed School of Engineering
University of Louisville
Email:cindy.harnett@louisville.edu

Daniel M. Aukes
Ira A. Fulton Schools of Engineering
Arizona State University
Email:danaukes@asu.edu