

# Mingsong Jiang

Ph.D. in Mechanical Engineering

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## 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

Thesis: *Towards Reconfigurable and Adaptive Soft Robots via Hybrid Materials, Designs and Mechanisms*

Advisor: Prof. Nick Gravish (his 1<sup>st</sup> PhD to graduate)

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: Soft Robotics (Design & Fabrication)

Thesis: *Sliding-layer laminates: a new robotic material enabling robust and adaptable undulatory locomotion*

Advisor: Prof. Nick Gravish

Committee: Prof. Nick Gravish, Mike Tolley, and Mike Yip

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

B.S., Mechanical Engineering (Major GPA 90/100) 9/2012–6/2016

Thesis: *Design and fabrication of a 3D printed rehabilitative hand exoskeleton device*  
(Best student thesis nominee)

## PUBLICATIONS

1. **Jiang, M.**; Wang, J. and Gravish, N. Internal actuation of inflatable beams to achieve “soft” linkage robots with reconfigurable “rigid” kinematics. 2022 (In preparation).
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.

<b>RESEARCH EXPERIENCE</b>	<b>Gravish Lab, UC San Diego, La Jolla, CA, USA</b>	9/2016–12/2021
	<i>Graduate Research Assistant</i>	
	<b>Soft Curved Reconfigurable Anisotropic Mechanisms (SCRAMs)</b>	9/2019–12/2021
	<ul style="list-style-type: none"> <li>• New reconfigurable soft robot paradigms with on-demand mechanical "virtual" joints based on curvature control and planar fabrications (sewing, lamination, and 3D printing).</li> <li>• Funded by NSF Award: <b>EFRI C3 SoRo, No. 1935324, 2M\$</b></li> <li>• Multi-disciplinary team collaboration among four universities</li> </ul> PIs: Prof. Nick Gravish, Dan Aukes, Cindy Harnett and Ross Hatton. <ul style="list-style-type: none"> <li>• Established a truly reconfigurable soft robotic manipulator with on-demand joint formation and actuation (plus two "virtual" joint mechanisms)</li> <li>• Bi-weekly group discussions on: 3D soft robot printing, embroidered sensors and actuators, bio-inspired mechanisms and geometric methods for robot controls</li> <li>• Mentored two students and published two papers.</li> <li>• One top-tier journal paper in preparation.</li> </ul>	
	<b>Flexoskeleton Printing Enables Hybrid Functional Robots</b>	12/2018–4/2020
	<ul style="list-style-type: none"> <li>• Low-cost rapid prototyping of multi-material robots based on commercial 3D printers.</li> <li>• Embedded compliance, rigid chassis, actuators and sensors via simple fabrication steps</li> <li>• Demonstrated a series of underactuated robots as multi-legged walking robots, multi-fingered grippers, and tailed and limbed swimmers.</li> <li>• Mentored two students and published three papers.</li> <li>• Press highlights on multiple major tech-sites.</li> </ul>	
<b>WORK EXPERIENCE</b>	<b>Reconfigurable Laminates as Multifunctional Robotic Materials</b>	5/2017–1/2020
	<ul style="list-style-type: none"> <li>• Geometric reconfiguration of hybrid material compositions to achieve tunable properties</li> <li>• Laser cutting and manual lamination of various robotic fabrics and prototypes.</li> <li>• Research outreach to high school students in laminate robot fabrication.</li> <li>• Mentored several undergrads and published two papers.</li> </ul>	
	<b>Other Lab Duties</b>	
	<ul style="list-style-type: none"> <li>• Early stage lab establishment: building experimental stages and lab arrangements, self-built DPSS laser micro-fabrication stage with Prof. Gravish.</li> <li>• As a safety coordinator, in charge of lab daily operation and training new students.</li> </ul>	
	<b>XPeng Robotics, affiliate of XPeng Inc., Shenzhen, China</b>	3/2022–6/2022
<b>TEACHING EXPERIENCE</b>	<i>System Design Expert</i>	
	<ul style="list-style-type: none"> <li>• Worked in a startup team (300 people) to build next-generation quadruped robots for urban transportation and in-house entertainment.</li> <li>• Directly reported to CEO and board committee on product definition, concerning key technical parameters of robot actuation, transmission and power systems.</li> <li>• System-level optimization of design parameters, e.g., robot form factors (weights, sizes), length distribution associated by robot vision, passability, safety and user experience.</li> <li>• Drawing technical solutions for robot riding safety (target users: young kids).</li> </ul>	
	<b>UC San Diego, La Jolla, CA, USA</b>	9/2017–12/2019
	<i>Graduate Teaching Assistant</i>	
	<b>MAE156A, Mechanical Engineering Senior Design, Fall 2017– Fall 2019</b>	
<b>TEACHING EXPERIENCE</b>	<ul style="list-style-type: none"> <li>• Held lab courses on design, electronics, and control of motorized robotic systems via microcontrollers (Arduinos) and robot manufacturing via 3D printing and laser cutting.</li> <li>• Held office hours on basic robot kinematics and dynamics.</li> <li>• Designed and graded homework and midterms.</li> </ul> Course by: Prof. Nate Delson and Nick Gravish.	

## **MAE207, Bioinspired Robotics, Spring 2018 & Spring 2019**

- A bioinspired robotics class focusing on the theories of dynamic robot locomotion and hands-on building of direct drive quadruped robots.
- Held lab courses on control of BLDC motors via 3-phase motor controllers (ODrive) and robot coding using Python.
- Designed and graded homework and midterms.

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

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.
- Successfully admitted to MIT Ph.D. program (Mechanical Engineering).

Jiangsong Wang, Undergrad student, Aerospace Engineering, UCSD 9/2020–12/2021

- Contributing author to SCRAMs team research: *Internal actuation of inflatable beams to achieve soft linkage robots with reconfigurable rigid kinematics*
- Successfully admitted to CMU M.S. program (Robotics).

Shuhang Zhang, MS student, Mechanical Engineering, UCSD 6/2020–6/2021

- Lead author in original research of flexoskeleton printing combined with pouch actuation
- Successfully admitted to EPFL Ph.D. program (Robotics).

## **PRESENTATIONS**

<b>(SELECTED)</b>	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**

<b>(SELECTED)</b>	<i><b>Flexoskeleton Printing</b></i>
	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: <i>Breaking the Mold: Challenging Current Paradigms in Soft Robotics</i>	4/2021
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## **AWARDS**

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

## **GITHUB**

Original Project Website: <https://github.com/gravish-lab/Flexoskeleton-printing>

## **REFERENCES**

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## **PERSONAL**

Enjoy running, hiking, swimming, tennis, basketball, frisbee, and many other team sports.