Ziyang Zhou

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EDUCATION

Virginia Polytechnic Institute and State University (Virginia Tech) Blacksburg, VA
Ph.D. Mechanical Engineering *Aug.2022 - Expected May.2027*
Clemson University Clemson, SC
Bachelor of Mechanical Engineering *Aug.2018 - May.2022*
Minor in Mathematics Science

TECHNICAL SKILLS

Robotics & Control: Soft robotic actuation, locomotion & manipulation, motion planning, kinematics
Mechanical Design: SolidWorks, Fusion 360, AutoCAD, 3D printing, rapid prototyping
Simulation: Solid mechanics, FEA (Abaqus), dynamics, motion analysis
Programming Languages: Python, MATLAB, Arduino-based embedded systems

RESEARCH EXPERIENCE

Entangling Origami Tentacles for Universal Robotic Gripping Jun.2025 – Present
Research Assistant, Supervisor: Dr. Suyi Li & [Co-advisor]

- Designed and fabricated a **16-tentacle** tendon-driven origami gripper from **0.1 mm Mylar (PET)**, using a parametric planar cut pattern (**49 holes;** R_T, R_S, α, β) to program contraction, bending, and 3D coiling.
- Developed a mechanics-based **Python** folding solver and validated design effects on **4 prototypes**; introduced an **8-hour conditioning** step to improve force–fold repeatability.
- Modeled multi-tentacle entanglement using **Cosserat-rod dynamics (PyElastica)** and **Gauss-linking** metrics (self/mutual/object link) to identify high-performing looping and braiding regimes.
- Demonstrated "universal" grasping: lifted up to **1.02 kg** with a ∼**32 g** array (∼**31**× payload-to-gripper mass), captured **20 cm** balloons, achieved underwater rod capture to **80%** reach, and built a **1U CubeSat-sized** stow-and-release deployment for flyby-style satellite capture.

Spider-Web-Inspired Fiber Network Reservoir Computer Jan.2025 – Present
Research Assistant, Supervisor: Dr. Suyi Li & Noel M Naughton

- Designed compliant fiber networks as **physical reservoir computers**, where the structure's own mechanics perform nonlinear, memory-rich computation under deformation.
- Simulated and fabricated 2×2–10×10 networks, showing that appropriately tuned stiffness and topology boost **nonlinear capacity (**≈ 0.88**)** and short-term memory for temporal tasks.
- Built low-cost fishing-line/elastic prototypes that process actuator inputs directly in the body, demonstrating a mechano-intelligent layer for distributed sensing and control in soft robots.

Hyper-Yoshimura Deployable Robotic Boom & Space Crane Manipulator Jan.2024 – Present
Research Assistant, Supervisor: Dr. Suyi Li & Dr. Ian Walker

- Engineered hyper- and Golden-Ratio Yoshimura origami trunks as multi-stable robotic backbones with up to $\mathbf{9^m}$ **distinct configurations**, enabling programmable workspaces and task-specific robot postures.
- Derived **forward/inverse kinematics** and a simple actuation scheme (one tendon set + one pneumatic line) to steer end-effectors along complex 3D paths for **obstacles-avoiding** manipulation.
- Built a **meter-scale** pop-up phone-charging station and a space crane-manipulator prototype that **manipulated three objects at different heights** and supported a 5.7 kg payload with a 0.2 kg boom **(28.5 load-to-weight ratio)**, surpassing typical 3D-printed deployable trunks in strength and adaptability.

Electronics-Free SMA Soft Crawler Aug.2022 – Dec.2023
Research Assistant, Supervisor: Dr. Suyi Li

- Designed modular SMA curved-beam actuators with snap-through stroke amplification for soft locomotion.
- Developed a **fully mechanical control circuit** that autonomously gates a constant 3.5 V, 2.5 A DC input to generate self-sustained rhythmic deformation **without the use of electronics or a microcontroller**.
- Demonstrated single- and dual-module crawlers that each travel 50 mm; coordination cuts the required cycles from 12 to 5 ($\approx 2.4\times$ longer stride per cycle) while still using **a single DC power source**.

PUBLICATIONS

Journal Publications

[1] **Z. Zhou** and S. Li. *Self-Sustained and Coordinated Rhythmic Deformations with SMA for Controller-Free Locomotion.* ***Advanced Intelligent Systems***, 2024.

[2] V. D., Y. P., **Z. Zhou***, I. Walker, and S. Li. *"Golden Ratio Yoshimura" for Meta-Stable and Massively Reconfigurable Deployment.* ***Philosophical Transactions of the Royal Society A***, 2024.(*corresponding author)

[3] **Z. Zhou***, Y. P*., V. D., I. Walker, and S. Li. *Hyper-Yoshimura: How a Slight Tweak on a Classical Folding Pattern Unleashes Meta-Stability for Deployable Robots.* ***Advanced Science***, *in preparation*, 2026. (*equal contribution)

[4] J. W*, **Z. Zhou***, A. K.* and S. Li. *Embodying Physical Computing into Soft Robots.* ***Nature Communications***, 2026. (*equal contribution)

[5] A. K., Y. P., J. W., **Z. Zhou**, J. R., B. J., S. Li, and N. N. *Spider web-inspired sensing and computation with fiber network physical reservoirs.* ***Journal of Intelligent Material Systems and Structures***, 2026.

[6] A. B*, B. Z.*, **Z. Zhou***, N. N. and S. Li. *Stochastic Entanglement of Deterministic Origami Tentacles For Robust Robotic Grasping.* ***Advanced Science***, 2026. (*equal contribution)

Conference Publications

[7] **Z. Zhou** and S. Li. *Self-Sustained Mechanical Oscillator with SMA Coil for Controller-Free Locomotion. Active and Passive Smart Structures and Integrated Systems XVIII,* , 2024.

[8] A. K., Y. P., J. W., **Z. Zhou**, J. R., B. J., S. Li, and N. N. *Physical Reservoir Computing with Compliant Fiber Networks.* ***ASME SMASIS***, 2025.

[9] N. H., **Z. Zhou**, S. Li, and I. Walker. *Plant-Inspired Robot for Adaptive Monitoring across Multiple Time Scales in Congested and Evolving Outdoor Environments.* ***IEEE IROS***, 2026.