

Xinghao Huang

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EDUCATION

University of Southern California (USC)

Sept 2021 – Present

Ph.D. Candidate, Mechanical Engineering

Advisor: Professor Hangbo Zhao

M.S., Mechanical Engineering (cumulative GPA: 3.95)

Sept 2021 – June 2023

University of California, Santa Barbara (UCSB)

Sept 2017 – June 2021

B.S., Mechanical Engineering (cumulative GPA: 3.89)

Relevant Coursework: Mechatronics, NEMS/MEMS, Biomedical Measurement and Instrumentation, Structure Instability, Elasticity, Continuum Mechanics, Machine Learning, Wearable Technologies, Robot Dynamics and Planning, Stress/Thermal Analysis, Fluid Mechanics.

RESEARCH INTERESTS

Stretchable piezoresistive and capacitive sensors, implantable sensors, electromagnetic micro-actuators, soft robots, neuromodulation, solid mechanics.

RESEARCH EXPERIENCE

Graduate Research Assistant

Sept 2021 – Present

Zhao Research Group, Department of Aerospace and Mechanical Engineering, USC

- Developed and microfabricated capacitive strain sensors using 3D origami architectures to realize strain sensing of soft, deformable bodies with large strain (200%) and low hysteresis (1.2%).
- Designed and fabricated capacitive strain sensors / rosettes based on interdigitated electrodes made of carbon nanotubes (CNTs), which can measure large, multi-directional strain with stable performance.
- Developed automated Abaqus simulation scripts in to model soft robot deformations, generating training datasets for a neural network to predict soft robot displacements from surface strain data.
- Developed stretchable encapsulation materials using wrinkled parylene films for soft, implantable sensors (strain > 60%, modulus < 300 kPa). Conducted thermally accelerated aging tests to verify the sensor performance and analyzed the pinhole development on parylene and silicone by using SEM.
- Investigated polymer-like mechanical properties of inorganic double helical Van Der Waals semiconductor materials through analytical modeling and FEA, verified by experiments (in collaboration with Han Wang group at USC).
- Studied the mechanics of 3D buckling of SiC mesostructures by FEA and provided design parameters for experimental collaborators at University of New South Wales.

Summer Research Intern

June 2018 – Sept 2018

RE Touch Lab, Media Art and Technology, UCSB

- Developed a heavy-duty, pump-bladder system for the mega-size fluid fabric muscle sheet and realized its actuation to generate large strains (>100%) and lifted heavy loads (15 kg).
- Developed and tuned a PID control loop for the pump-bladder system that could inject >3L of liquid into the mega-size soft robot at >60 PSI pressure and stabilize the pressure within +/-0.5 PSI.

PUBLICATIONS

- **X. Huang**, L. Liu, Y.H. Lin, R. Feng, Y. Shen, Y. Chang, H. Zhao. High-stretchability and low-hysteresis strain sensors using origami-inspired 3D mesostructures, *Sci. Adv.* 9, eadh9799 (2023).
- PCT/US2024/025551 - High-stretchability and low-hysteresis strain sensing 3d mesostructures, WO2024220907A2 (2024)
- Truong, T.-A., Nguyen, T.-K., **Huang, X.**, Ashok, A., et al., Engineering Route for Stretchable, 3D Microarchitectures of Wide Bandgap Semiconductors for Biomedical Applications. *Adv. Funct. Mater.* 2023, 2211781.

- J. Wu, N. Wang, Y.-R. Xie, H. Liu, **X. Huang**, X. Cong, H.-Y. Chen, J. Ma, F. Liu, H. Zhao, J. Zhang, P.-H. Tan, H. Wang. Polymer-like Inorganic Double Helical Van Der Waals Semiconductor. *Nano Letters* 2022 22 (22), 9054-9061. DOI: 10.1021/acs.nanolett.2c03394
- X. Li, E. Rytkin, Q. Zhao, P. Bhat, L. Yin, **X Huang**, L. Yang, B. Yang, I. Efimov, H. Zhao. High resolution stretchable electronics enabled by self-assembly and transfer printing of liquid metal particles, *Nat. Mater.* Under Review.
- X. Li, **X. Huang**, L. Yang, S. Jung, J Wang, H Zhao. Implantable physical sensors for in vivo organ monitoring, *Med-X*. Accepted.
- Truong, T.-A., **Huang, X.**, Barton, M. J., Ashok, A., et al., A flexible electrode array based on a wide bandgap semiconductor for chronic implantable multiplexed sensing and heart pacemakers, *ACS Nano*. Accepted.
- **X. Huang**, H. Xu, M. Wu, R. Jacobsen, H. Zhao. Wrinkled Parylene Coating for Implantable Strain Sensor Encapsulation, in preparation.
- L. Liu, **X. Huang**, B. Zhang, H. Xu, V. Trivedi, K. Liu, Z. Shaikh, S. Liang, X. Zhang, and H. Zhao. Model-based 3D shape reconstruction of soft robots via distributed strain sensing, submitted.

WORK EXPERIENCE

Optomechanical R&D Intern – Alcon, Lake Forest, CA June 2021 – Aug 2021

- Investigated and developed a contactless method to diagnose ocular diseases by measuring the biomechanical properties of cornea using optical coherence elastography.
- Designed, built, and calibrated an air-puff excitation platform using a fast-response solenoid to exert 20±0.2 kPa pressure pulse within 20 ms on the eye surface.
- Calibrated the air-puff system using data acquisition cards, motor eval-boards, and pressure sensors.

Mechanical Engineering Intern – Lumentum, Milpitas, CA Jun 2020 – Sept 2020

- Developed a cooling solution that limited the maximum temperature within 65C° on the new optical transceiver package, verified by thermal-flow simulations in SolidWorks and COMSOL.
- Tested thermal interfacial materials and heat spreaders on the prototype using thermalcouples.
- Improved the failure modes on PCBAs, flex cables, and fixture frames used in the optical transceivers.

Mechanical Engineering Intern – Bruker Nano Surfaces, Goleta, CA June 2019 – Sept 2019

- Designed and built an optical cage system to study the light interference created by the laser source and backscattered light from the substrate in atomic force microscopes (AFM).
- Recorded the interference level using different AFM probes, laser wavelengths, and substrate materials, which helped reduce the noise level in the company's next generation AFM.
- Used Ansys to model the stress, nonlinear contact, and vibration of MEMS strain gauge and flexure.

HONORS AND AWARDS

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| • USC Viterbi School of Engineering Graduate School Fellowship | 2021 |
| • UC Santa Barbara Dean's Scholarship | 2018, 2019, 2020, 2021 |
| • UC Santa Barbara Engineering Honors Scholar | 2021 |

SKILLS

Programming	Python, C/C++, MATLAB, LabVIEW.
Software	SolidWorks, Ansys, COMSOL Multiphysics, Abaqus, Multisim, ImageJ, Arduino, PTC Creo, AutoCAD, Fusion 360, KiCAD, Fritzing.
Experimental skills	Microfabrication (photolithography, physical vapor deposition, etching), SLA/FDM 3D printing, Desktop SEM, Dektak profilometer, Raspberry Pi, Jetson Nano, NI-DAQ Boards, PowerLab.