Zhenpeng Xu's Portfolio

-- Additive manufacturing process and its applications

Zhenpeng (Perry) Xu, Ph.D.

University of California, Los Angeles
(Now at UC Berkeley)

Education background

- University of California, Los Angeles, CA, USA — 09/2019 - 03/2023

  Transferred from Virginia Tech, Blacksburg, VA, USA

  Ph.D., Advisor: Xiaoyu (Rayne) Zheng, (GPA 4.00/4.00)

- University of Florida, Gainesville, FL, USA — 08/2016 - 06/2018

  M.Sc., Mechanical Engineering (GPA 3.83/4.00)

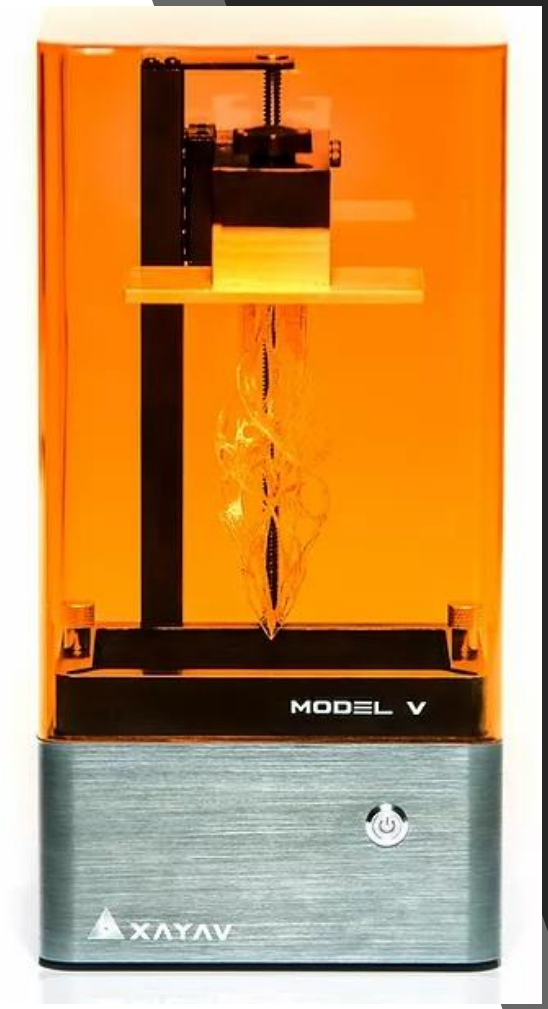
- Beijing University of Aeronautics and Astronautics, Beijing, China — 09/2012 - 07/2016

  B.Eng., Mechanical Engineering

Projects

1. **Desktop LCD 3D printer**
2. Large-scale high-resolution DLP 3D printer
3. Multi-material 3D printing
4. Ultra-lightweight antennas
5. Metamaterials
6. Other projects

Desktop LCD 3D printer



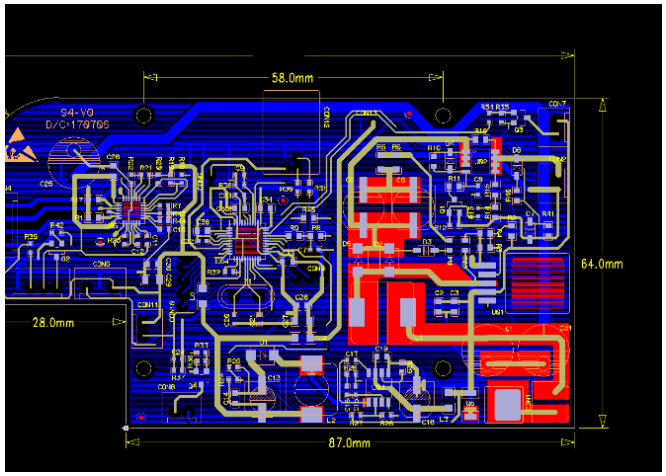
Co-Founded XAYAV Inc.: Focus on Desktop LCD 3D printer

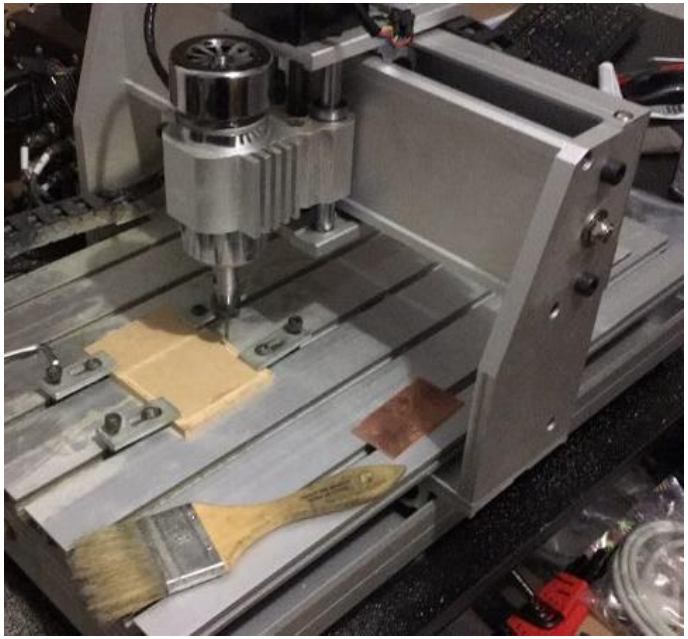
XAYAV Inc. (www.xayav.com), Gainesville, FL, USA

Aug. 2016 - May. 2018

XAYAV, founded in Shenzhen in 2017, specializes in developing and applying desktop-level light-curing 3D printing technology. With our sales headquarters in Florida, USA, we have successfully marketed our products. As a co-founder, my responsibilities encompass machine design, R&D, and supply chain management.

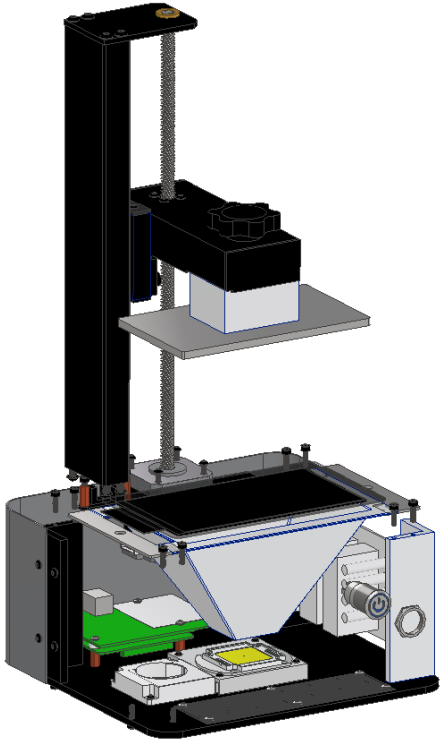
- Designed and prototyped a desktop LCD 3D printer by milling, lathe, CNC, hand tools, etc.
- Finalized the manufacturing processes of the printer, including metal machining, sheet metal forming, die casting, acrylic molding, PCB manufacturing, silk screen printing, etc.
- Investigated and visited suppliers (Shenzhen, China) for production; managed the supply chain to balance inventories and distribution.
- Successfully sold hundreds of printers with the team.

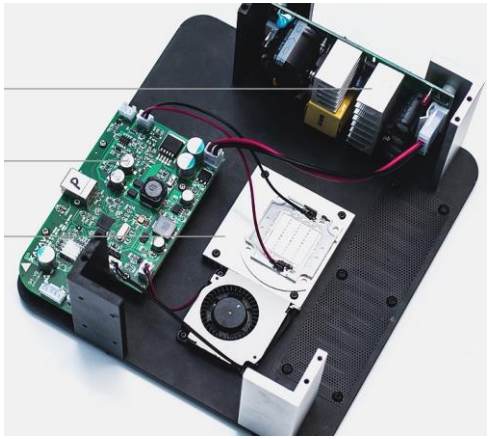


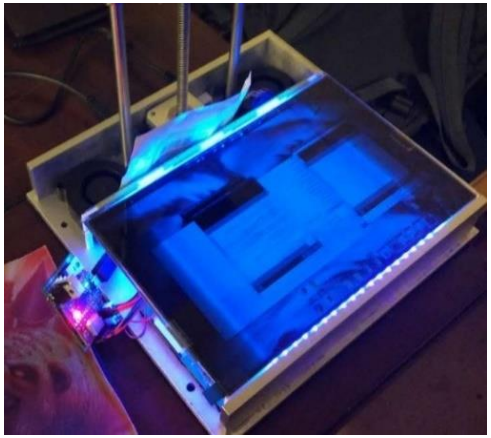


Most of the prototype components were machined by ourselves

I led the team and developed three generations of prototypes, ultimately finalizing the manufacturing processes.



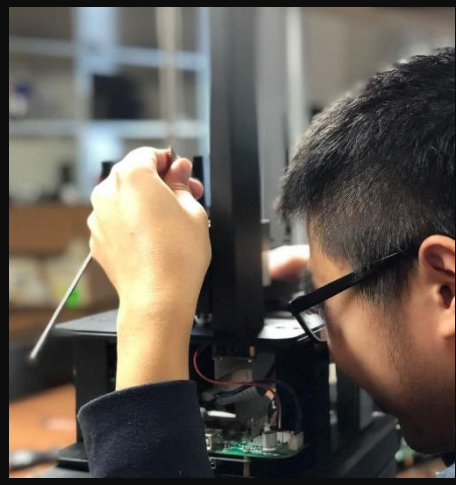


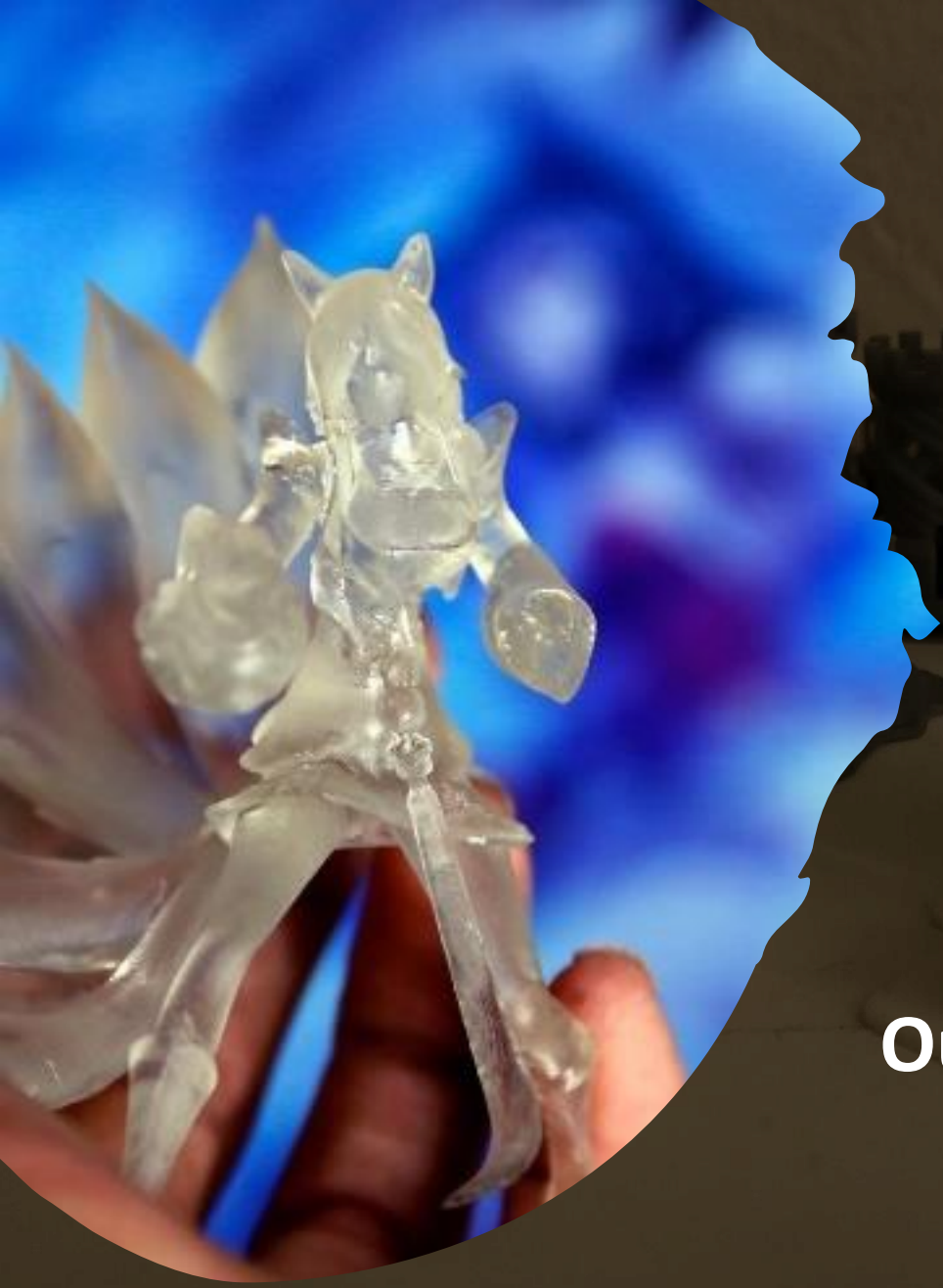


Manufactured in Shenzhen

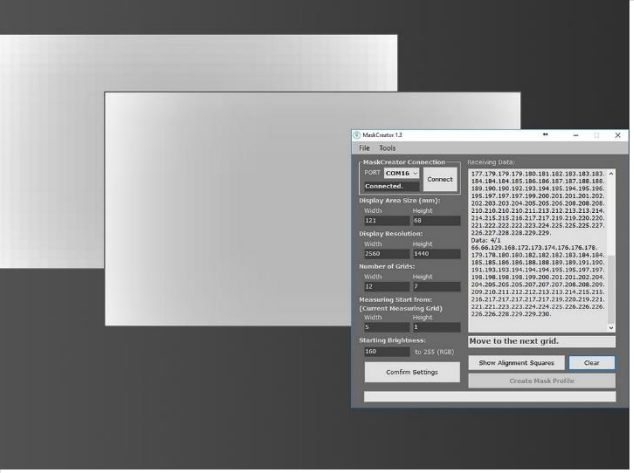
Assembled in the US

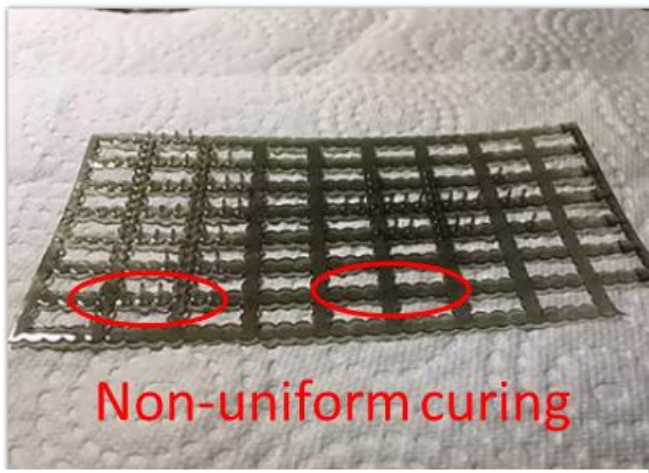
Successfully sold hundreds of printers

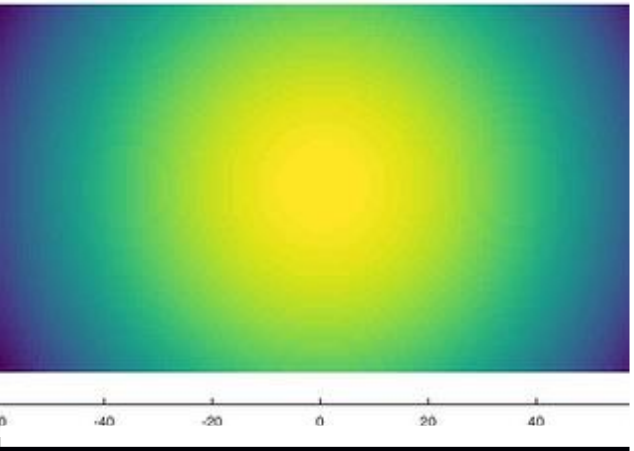


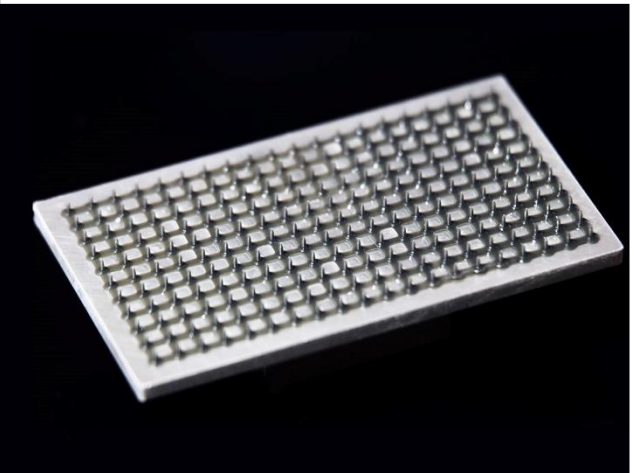


Our printer produces parts with excellent accuracy









MaskCreator – correction of light non-uniformity

Projects

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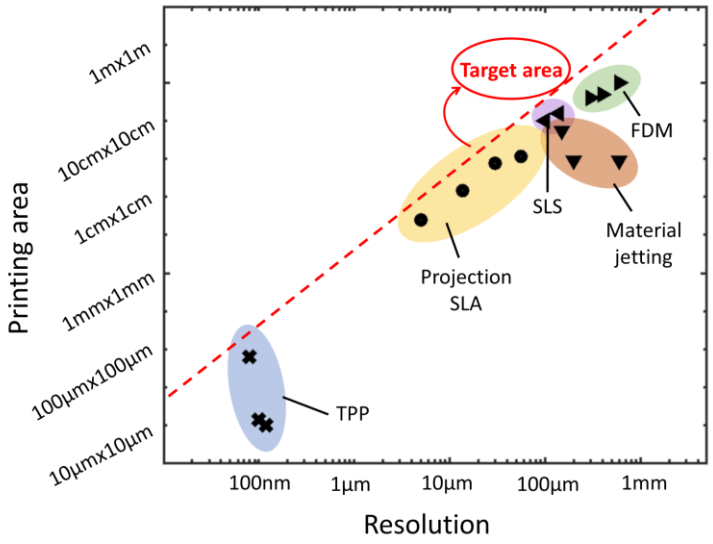
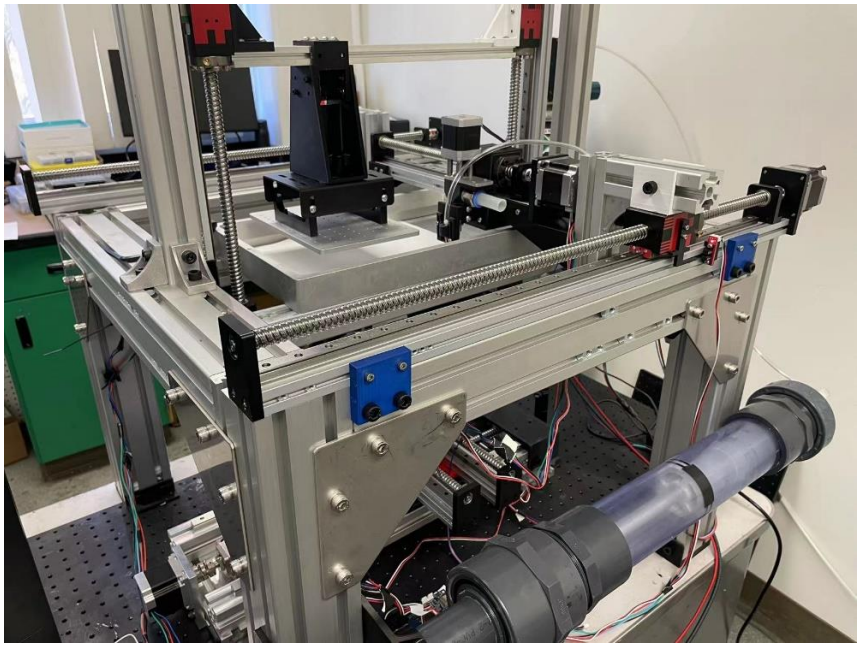


Large-scale high-resolution DLP 3D printer



Large-scale high-resolution DLP 3D printer

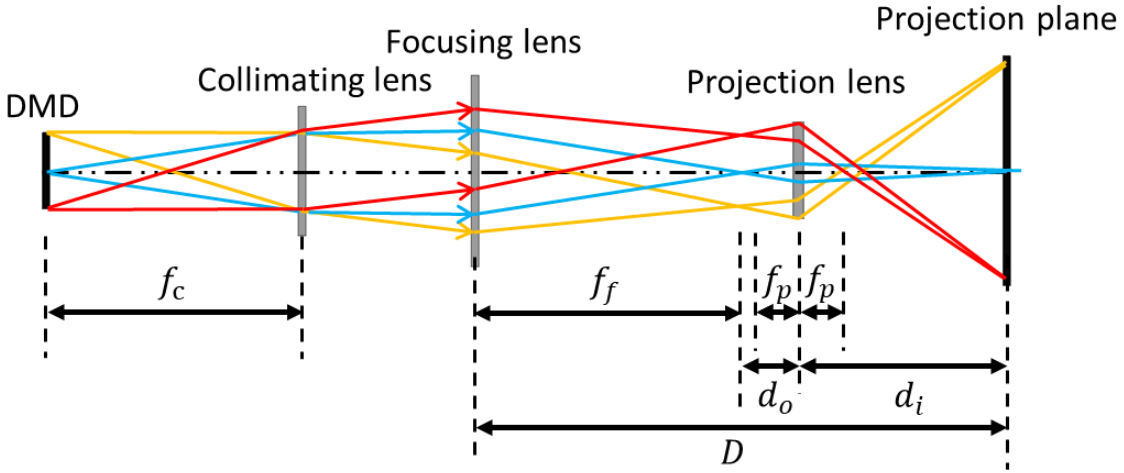
AMML, University of California, Los Angeles, CA, USA

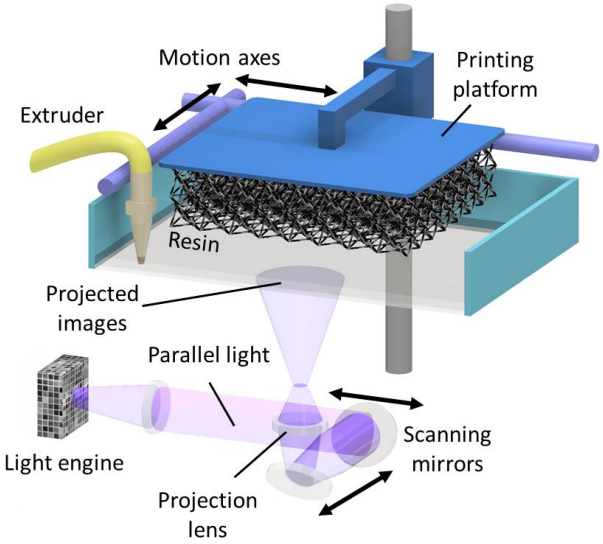
Sep. 2019 - Present

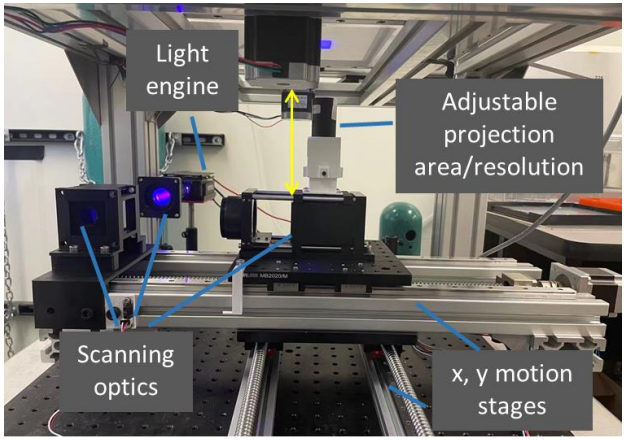
As a project leader, I am currently working with Oak Ridge National Laboratory, funded by the U.S. Department of Energy, to develop a high-precision 3D printer capable of large-area manufacturing of high-strength carbon fiber composites.

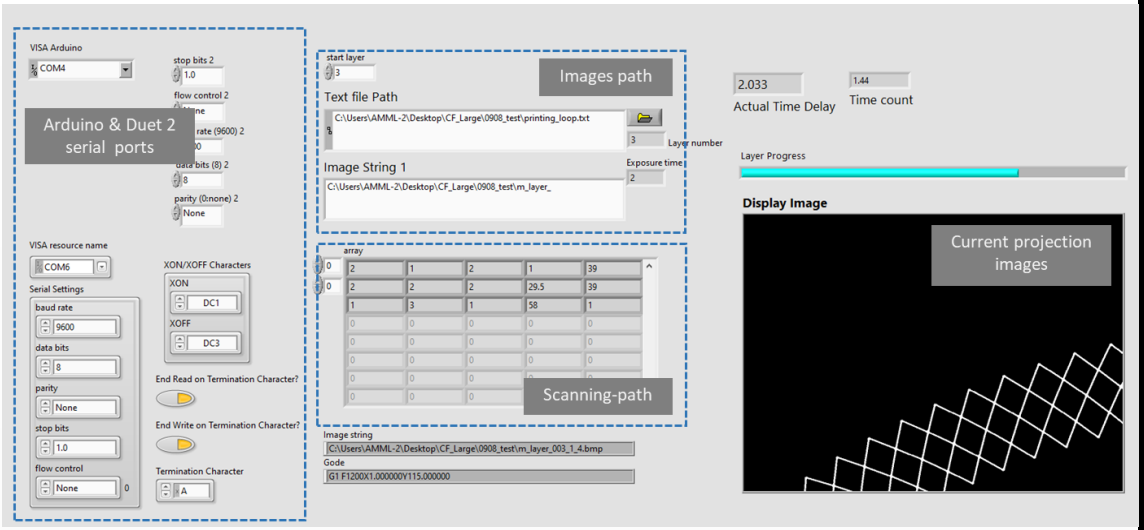
- Developed a high-precision 3D printer using light-curing technology for fast, large-area printing.
- Integrated optics and multi-material extrusion for versatile 3D printing.
- Printed large, precise parts for energy-absorbing components with carbon fiber composites.
- Created multi-functional metamaterials with self-sensing materials and 3D printing.

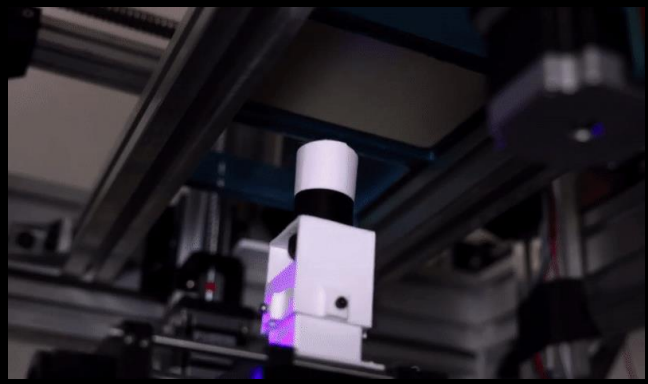
Optical design

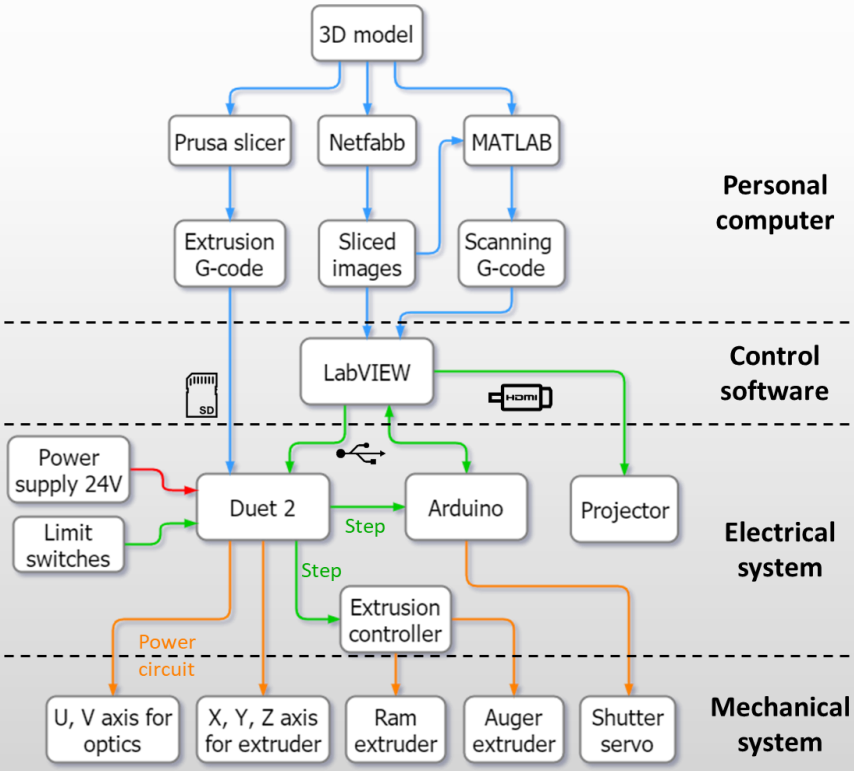






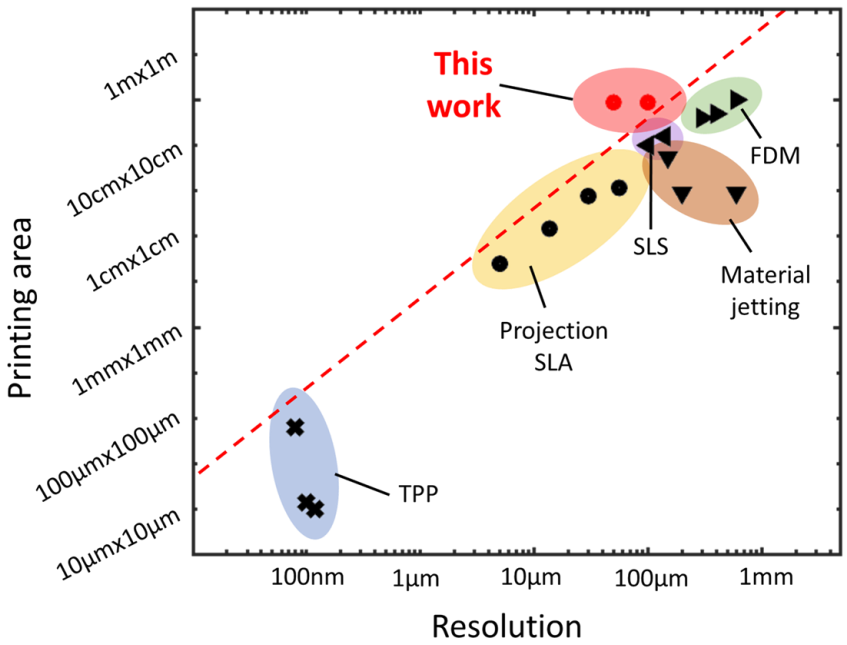


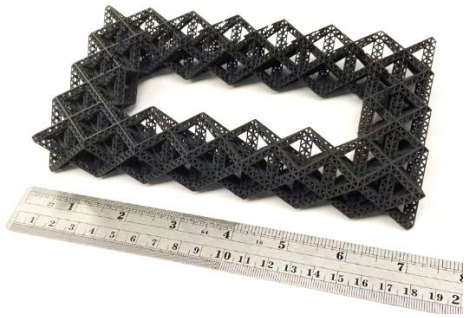


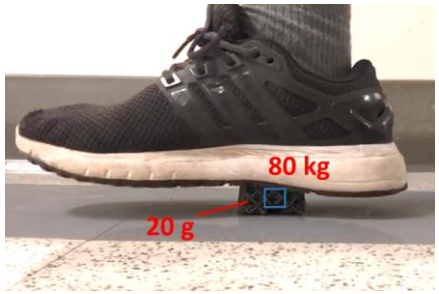


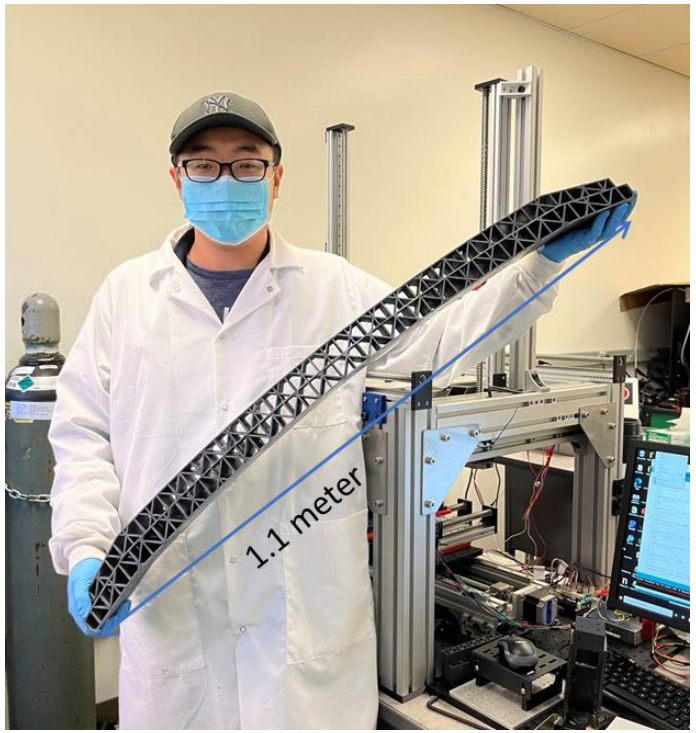
Software & Mechatronics diagram

Fabricated samples









- The developed system fabricated multi-scale architectures from micrometers to meters.

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Multi-material 3D printing

Development of multi-material 3D printing

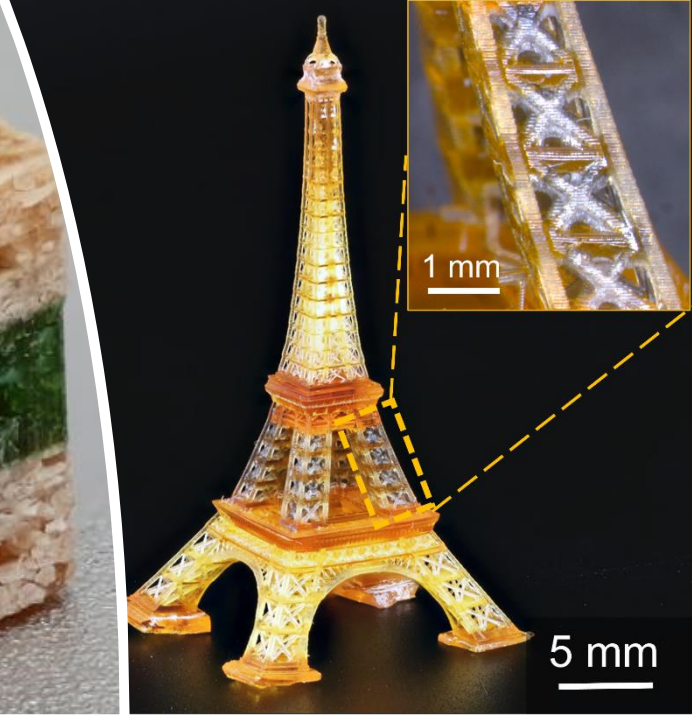
AMML, UCLA, CA, USA

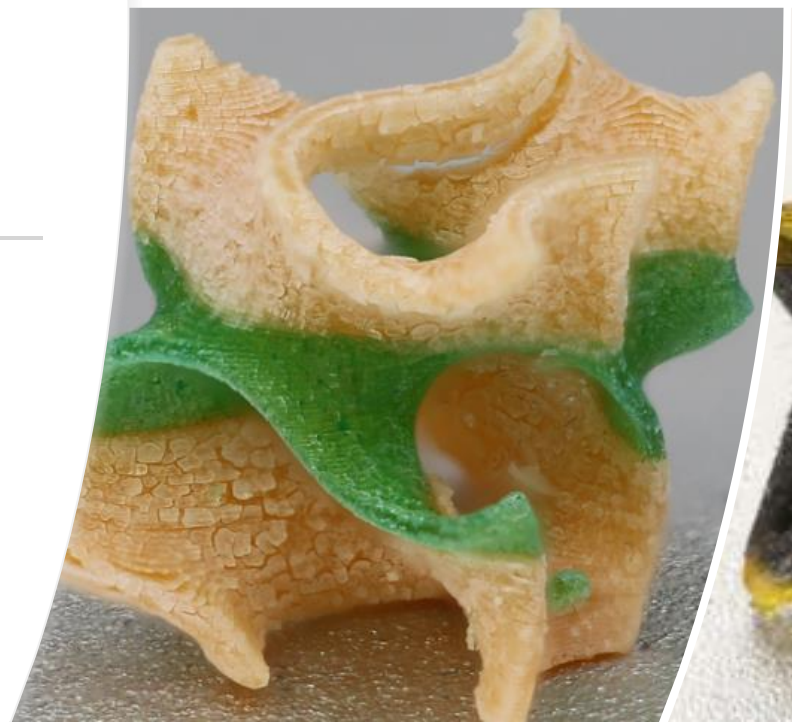
July. 2018 - Present

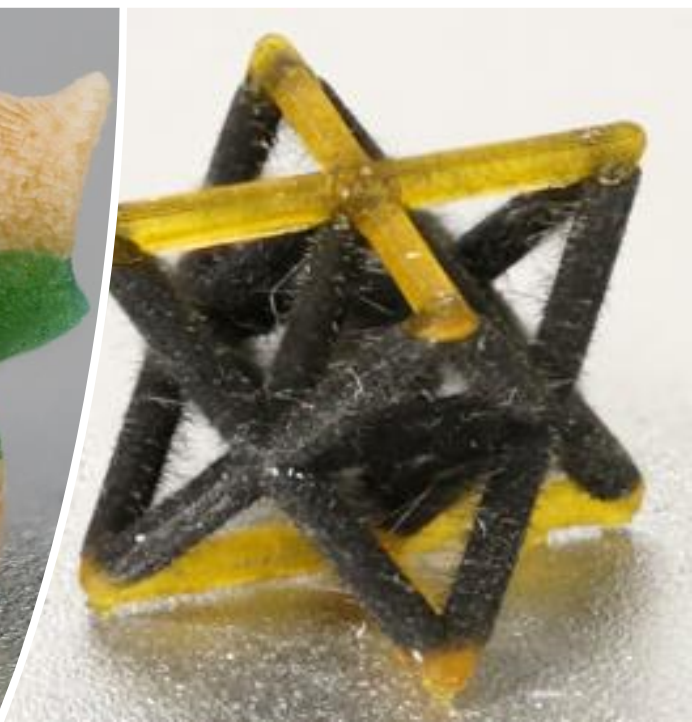
I developed a technique using light-curing for selective deposition of single and multiple active materials, including ceramics, semiconductors, magnetic, and colloidal materials. This allows for location-specific 3D topologies in multi-material 3D printing.

- Developed a multi-material printing system for printing various resins.
- Authored papers and presented at major conferences.
- Communicated with sponsors and prepared reports.

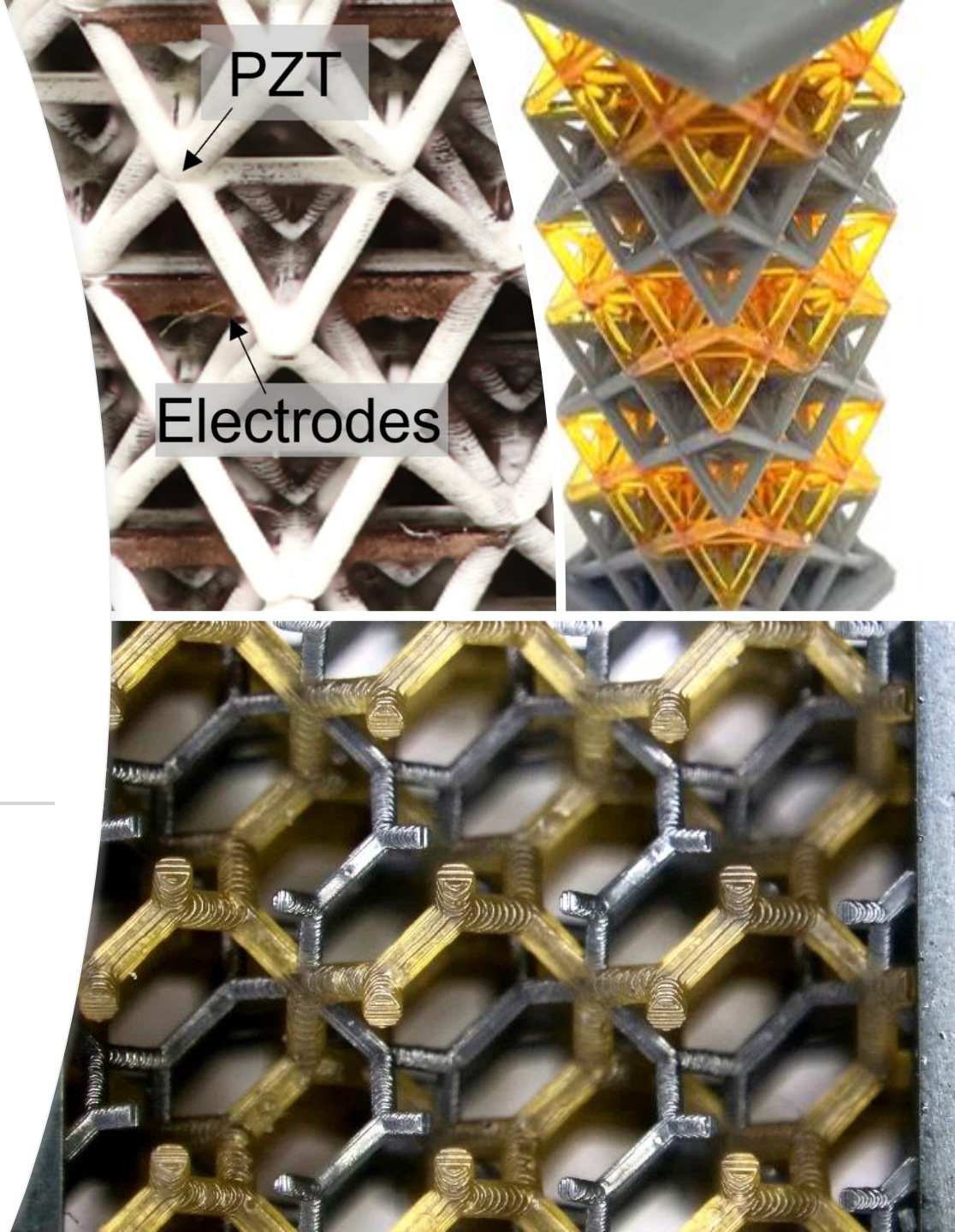
Sample gallery







Sample gallery



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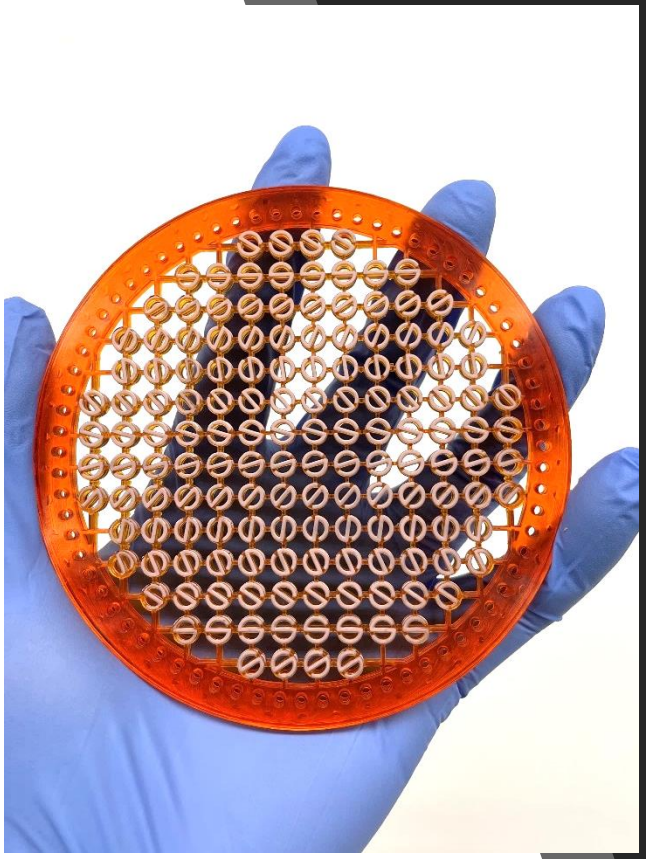
Ultra-lightweight antenna



Development of a group of ultra-lightweight antennas

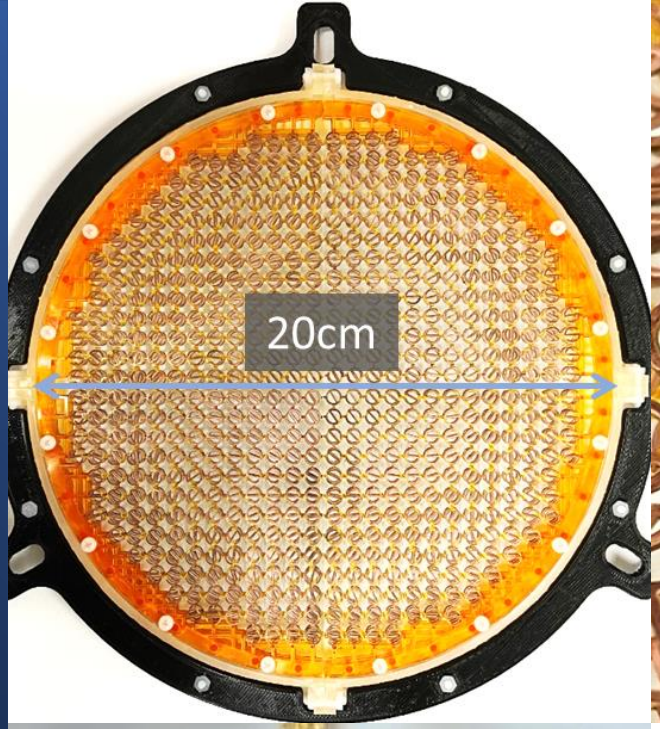
AMML, University of California, Los Angeles, CA, USA

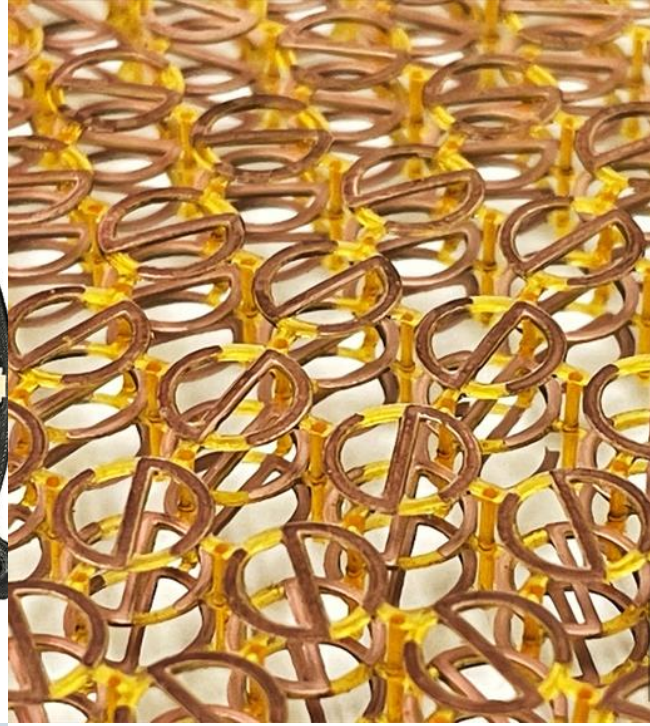
Apr. 2020 - Present

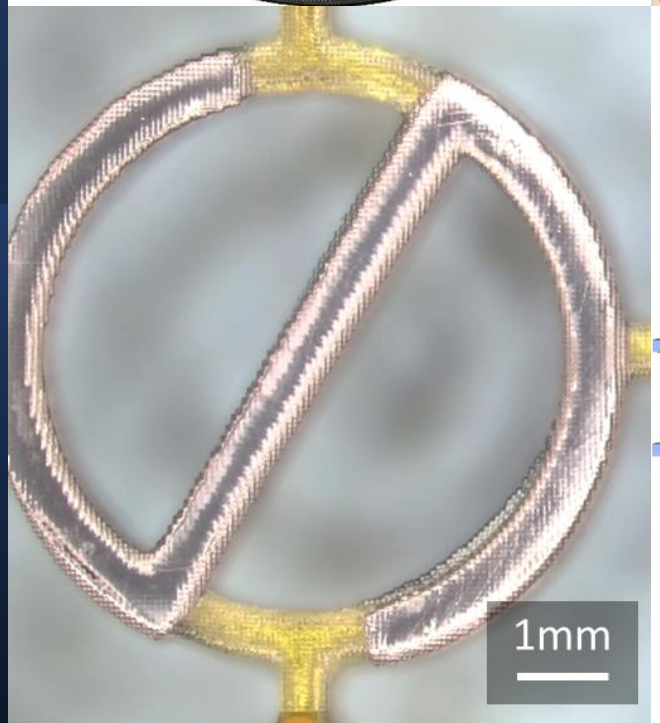
In collaboration with Prof. Rahmat-Samii's group at UCLA, I used multi-material additive manufacturing and selective deposition via controlled surface charge polarity to create ultra-lightweight antennas that were previously impossible to manufacture. The resulting antennas demonstrated an order-of-magnitude reduction in weight through lattice incorporation and minimized dielectric supporting material. Furthermore, the fabrication process was faster (days to weeks) and 1/10th the cost (<$100/antenna) compared to traditional PCB/CNC manufacturing.

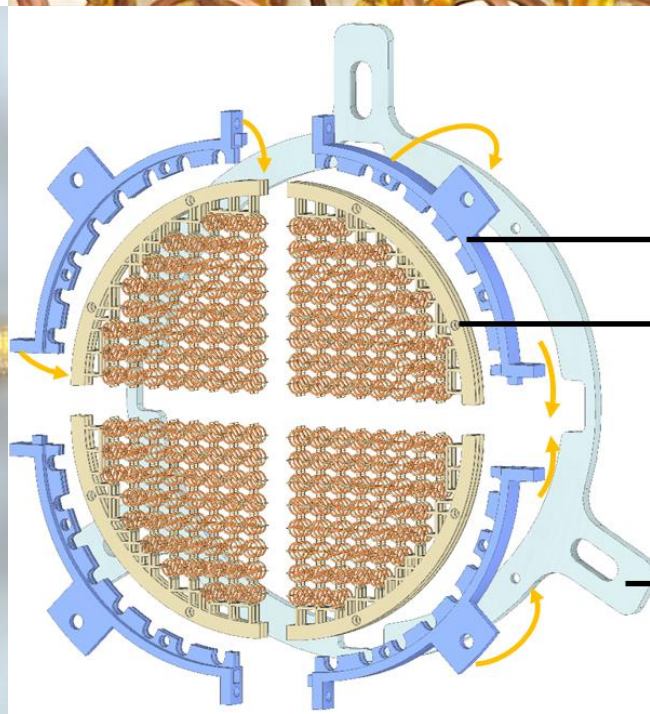
- Designed and printed large-scale multi-material antennas.
- Developed a tiled antenna fabrication method to remove restrictions in printer build area and enable larger antenna diameters (12-20 cm).
- Demonstrated excellent performance of the fabricated transmitarray prototype, measured in the spherical near-field range at UCLA.

Transmitarray antenna

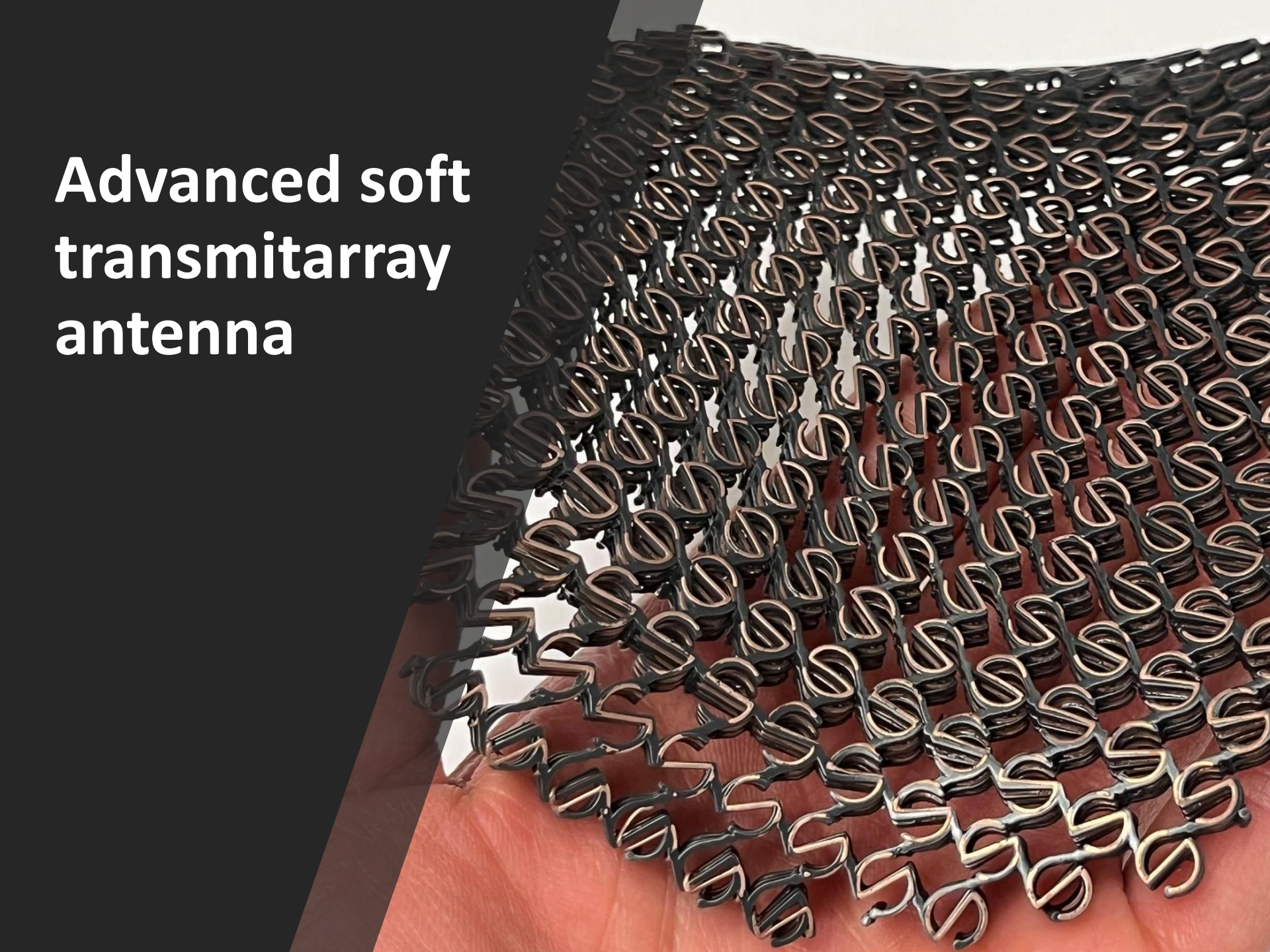








Advanced soft transmitarray antenna



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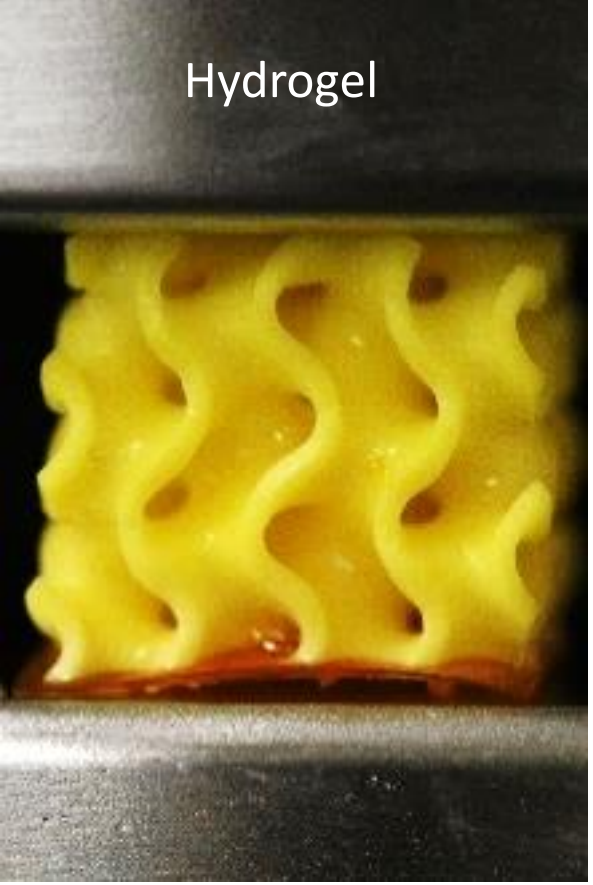
Metamaterials

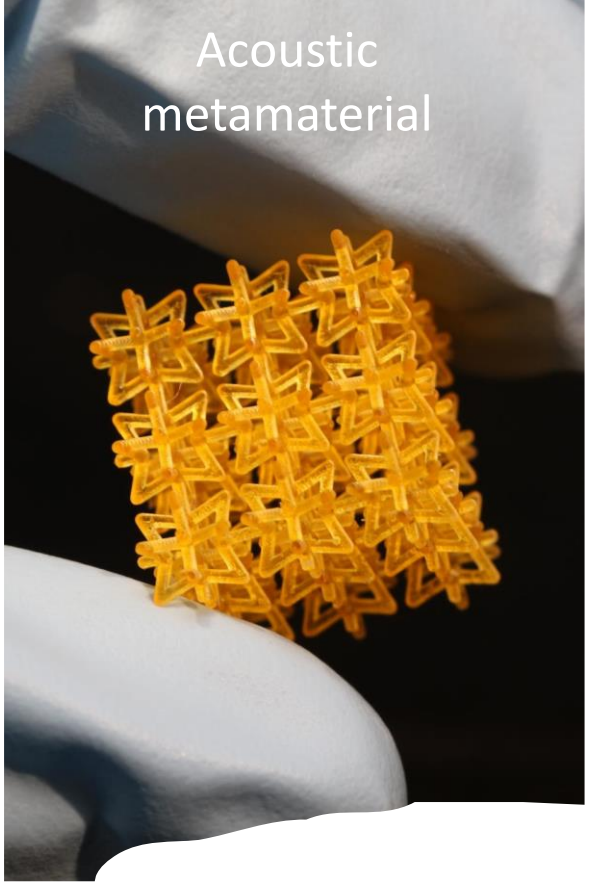
Development of metamaterials

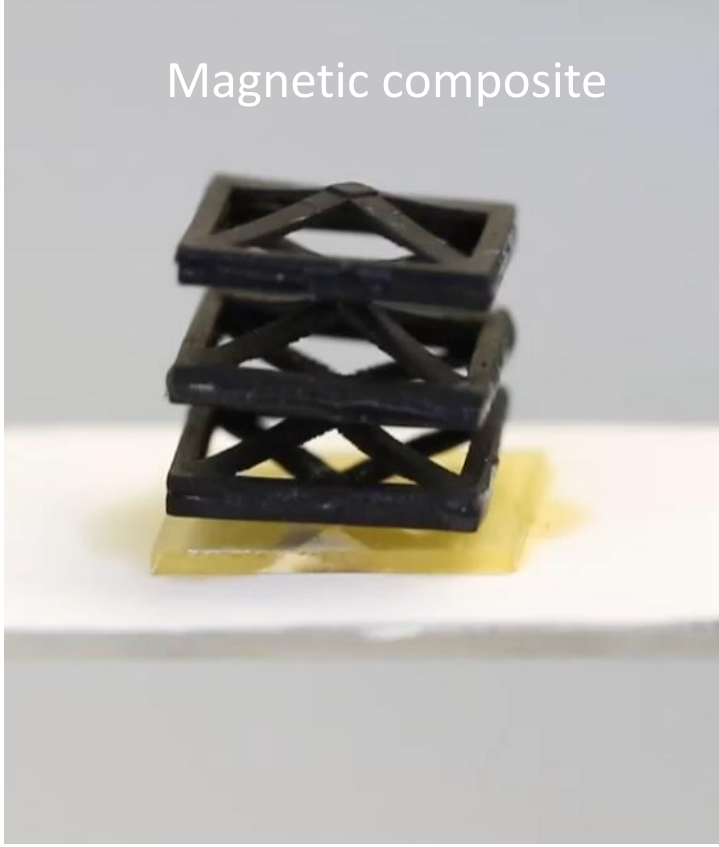
AMML, UCLA, CA, USA

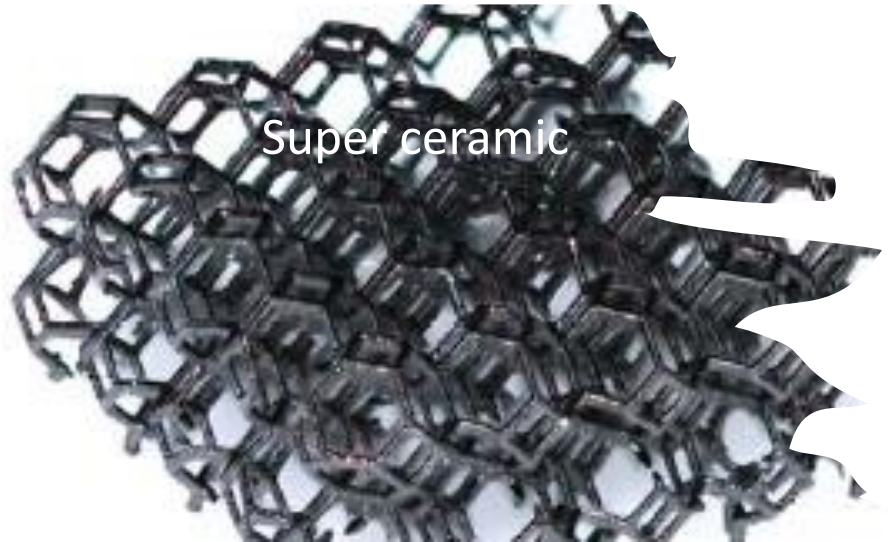
July. 2018 - Present

- Throughout my Ph.D. studies, I collaborated with various partners to apply additive manufacturing techniques to multiple areas. I developed numerous metamaterials for use in materials science, acoustics, magnetics, and antennas.





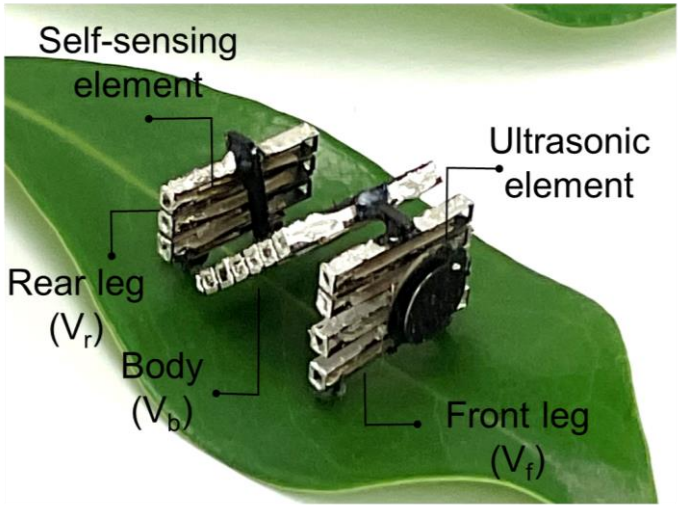


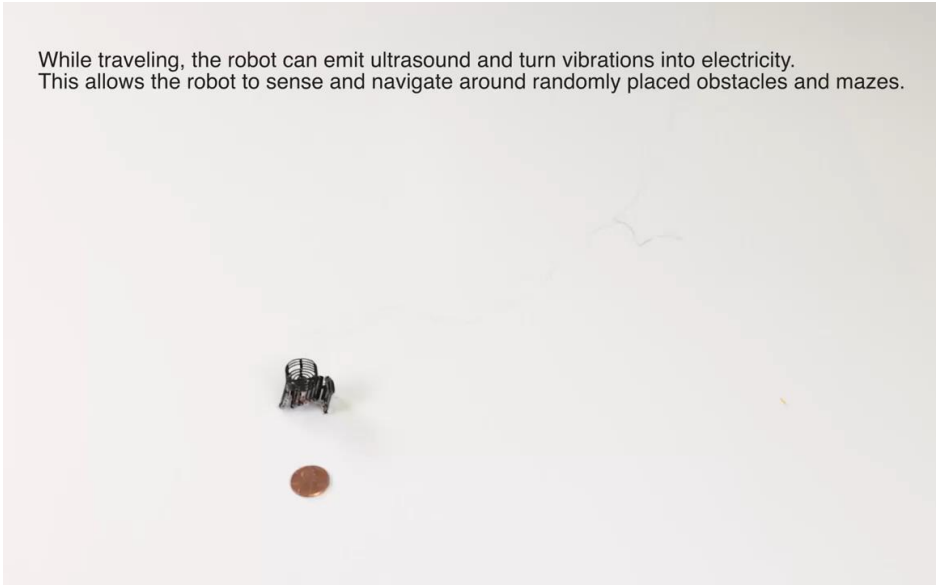


Metamaterials

- Wang, C., Ping, W., Bai, Q., Cui, H., Hensleigh, R., Wang, R., Brozena, A.H., **Xu, Z.**, Dai, J., Pei, Y. and Zheng, C., 2020. A general method to synthesize and sinter bulk ceramics in seconds. ***Science, 368(6490), pp.521-526.***

- Cui, H., Yao, D., Hensleigh, R., Lu, H., Calderon, A., **Xu, Z.**, Davaria, S., Wang, Z., Mercier, P., Tarazaga, P. and Zheng, X., 2022. Design and printing of proprioceptive three-dimensional architected robotic metamaterials. ***Science, 376(6599), pp.1287-1293.***





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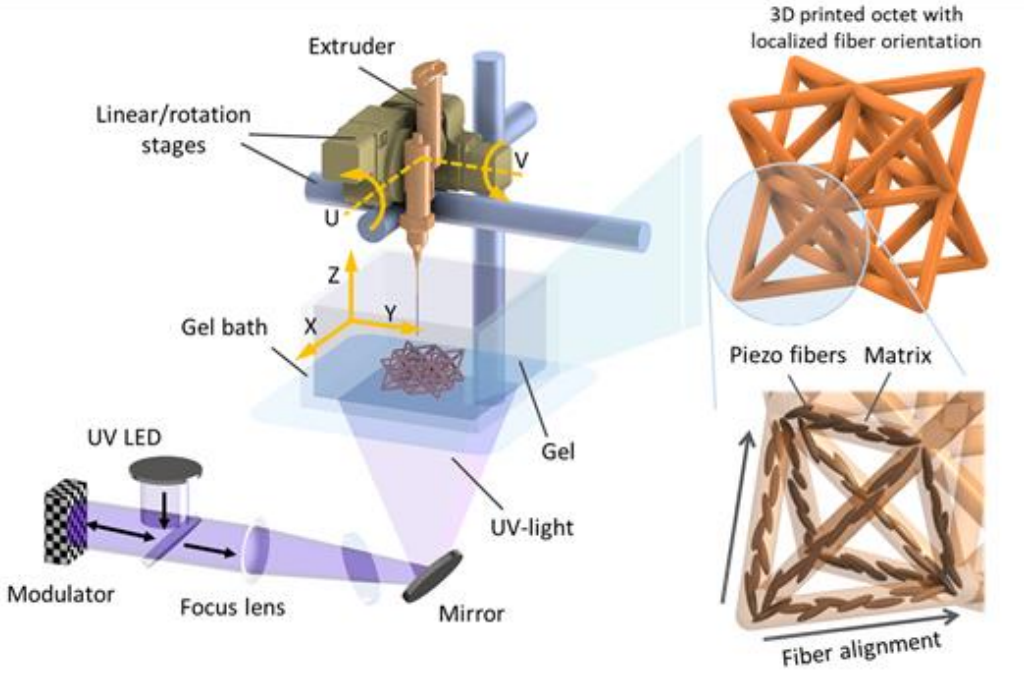
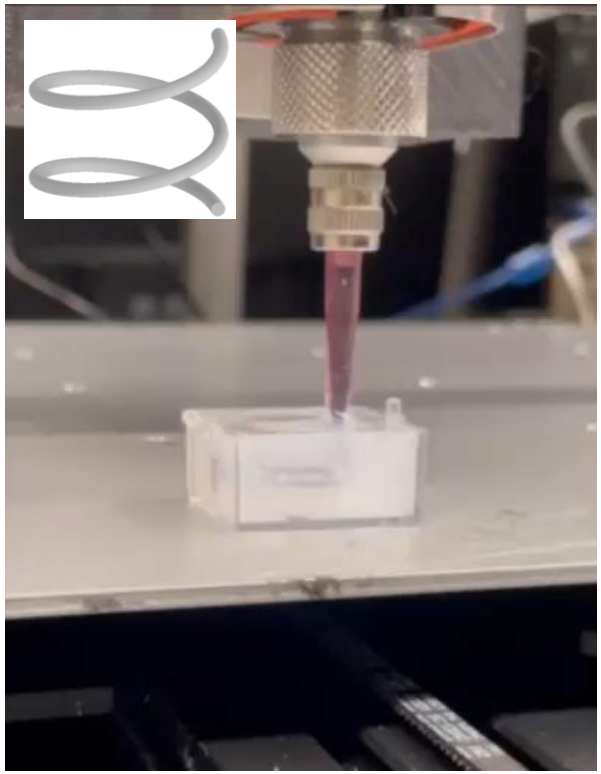
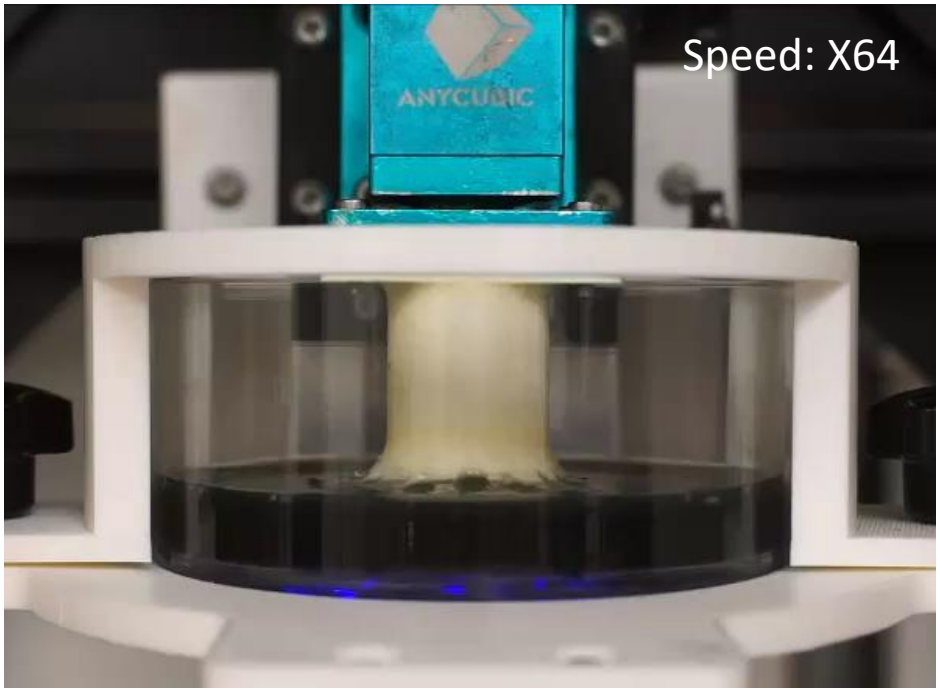
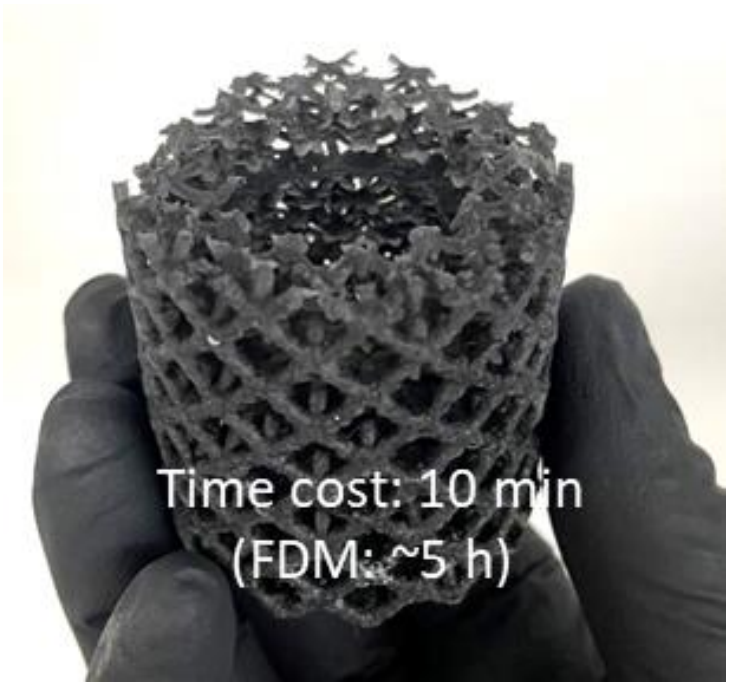




Embedded direct ink writing for 3D fiber alignment

- Designed and prototyped a 5-axis direct ink writing platform for fiber alignment
- Optimized toolpath and manufactured lattices with localized 3D alignment





High throughput printing using a liquid interface

- Developed a continuous 3D printing system using oil as interface
- Implemented system to rapidly (30× faster than FDM) print carbon fiber concentrated composites

Acknowledgements and license

I commit that I took the lead or participated in the production of all the samples mentioned above. The work conducted during my Ph.D. was sponsored by Prof. Xiaoyu (Rayne) Zheng's funding resources from various projects.