ANDREW Y. CHEN

achen314@mit.edu ◇ (856) 581-1496 ◇ carbonheliumnitrogen.github.io

EDUCATION

Massachusetts Institute of Technology — S.M., Mechanical Engineering (anticipated: May 2024)

University of California, Berkeley — B.S., Mechanical Engineering (May 2022), 3.94/4.00

RESEARCH EXPERIENCE

Characterization of Build Parameter-Dependent Mechanical Behavior of Polymeric Materials Produced by Multi-Jet Fusion

3D and Digital Manufacturing Lab, HP Labs, HP Inc.

- Quantitatively evaluated mechanical properties of MJF-printed parts as a function of print geometry and nesting properties (location and orientation within the build volume) by conducting tensile, flexure, and impact tests following ASTM standards. The experimental design involved 1500+ test specimens printed in polyamide (PA)-11 and polyamide-12 spread across nine printing buckets
- Conducted data analysis in Python (primarily with `Pandas`) to isolate and visualize trends in strength, stiffness, energy absorption, and dimensional accuracy based on packing properties and material selection
- Designed a secondary study to quantify the effect of varying key parameters (beam size, aspect ratio r/L, and unit cell geometry) on the compressive strength and stiffness of PA-12 lattices printed using MJF; determined Gibson-Ashby scaling exponents to model and predict lattice behavior for topology-optimization routines

Comparison of Manufacturing Methods for Laminar Carbon-Fiber Reinforced Polymer Composites

Introduction to Composite Materials, ME 127

- Fabricated laminar carbon-fiber epoxy composite structures by hand using a wet layup process and seperately using a commercially-available FDM 3D printer; computed theoretical laminate properties using published models
- Tested specimens in tension and flexure pursuant to ASTM standards; analyzed data to identify stiffness, strength, and individual ply failure strains; performed image processing using digital image correlation (DIC) to compute strains and characterize the effect of fabrication methods on failure behavior

Development of an Electrically Conductive Composite Nanomaterial for Stereolithographic 3D Printing

Microelectromechanical Systems Laboratory, UC Berkeley

- Developed an SLA-printable, UV-sensitive composite resin for multi-material, multi-functional additive manufacturing with $\sigma \sim 150$ S/cm, allowing for rapid desktop fabrication of electronic parts with high resolution
- Measured the viscosity and conductivity of the resin as a function of solid loading; identified and characterized the effect of a chemical dispersant additive to improve printability

PROJECTS

Space Enterprise at Berkeley - UC Berkeley's Spaceshot Rocketry Team — **August 2018 – May 2022**

President — March 2020 – December 2021

- Oversaw the design, manufacturing, and static-fire testing of the propulsion system of *Eureka-1*, the team's first liquid-fuel (LOX/Propane) rocket. Created timelines for design, manufacturing, and system-level qualification and acceptance testing; led a CAD-forward design cycle using Onshape for collaboration; managed open design risks and cost-down drives during test-stand development. Successfully static-fired the engine in Fall 2021 using the test-stand, recording a peak thrust of 2.7kN and a total burn time of 20+ seconds.
- Led the from-scratch development of next-generation Low Altitude Demonstrator (LAD) vehicles, which include the world's first completely MJF 3D-printed supersonic-capable airframes. In 2022, *LAD-8* flew to 8025 ft AGL and was successfully recovered, immediately ready to fly again. This 120mm-diameter, 2.4m-tall vehicle was fully manufactured in a total of 24 hours, and is designed for rapid re-use in order to flight-test critical recovery and avionics infrastructure for *Eureka* flights.
- Oversaw $15,000 team budget, streamlined internal reimbursement process, and managed multiple financial accounts. Filed for and obtained 501(c)3 non-profit status; increased year-over-year donation revenue by over 500%

WORK EXPERIENCE

Formlabs **June 2022 – August 2022**
Intern, Mechanical Engineering - SLA Program Somerville, MA

- Used computational fluid dynamics (CFD) optimization to redesign fan ducts for optics cooling, increasing the convection transfer coefficient by 30% at the same fan input power with no perceptible noise increase. Validated design changes using empirical testing on the test bench and integrated the new duct design into existing full-scale system.
- Created high-fidelity "feels-like" and "looks-like" prototype mechanisms for a high user touchpoint system within a 3D-printer. Identified engineering requirements (location tolerances and force specifications) and integrated product design feedback to optimize for user experience. Implemented electromechanical control of the moving parts for an improved workflow.

Tesla **June 2021 – August 2021**
Intern, Mechanical Design Engineering Palo Alto, CA

- Developed a mechanical datuming and fastening strategy for the placement and mounting of PCBAs without risk of damage to electronic components or battery cell parts; oversaw a cross-functional team, including the selected contract manufacturer (CM), in the design and mechanical simulation-based validation of fasteners
- Spearheaded a testing campaign to identify the root cause of delamination failure in an adhesive bond; recommended an appropriate surface treatment to provide a 3X increase in adhesive strength; validated design changes using a series of lap-shear tests; communicated new functional requirements and initiated cost-down measures with CM for this part
- Designed a fluid-sealing foam surface to protect battery components from structural adhesive dispensed during module integration; characterized the compression behavior of the foam and quantified resulting loads and deflections on cell array parts; demonstrated the sealing functionality of the part using a fully 3D-printed prototype

Formlabs **September 2020 – December 2020**
Intern, Mechanical Engineering - SLA Program Somerville, MA

- Designed and built a closed-loop, temperature-controlled testbed for the development of a filtration system for volatile organic compounds (VOCs) generated from heated resin; demonstrated autonomous control of resin temperature to within 0.5°C and removal of 45% of generated VOCs using an activated charcoal filter
- Redesigned components in the linear drive system for an automated wash solution to increase stiffness by a factor of six and address lifetime reliability concerns; built in-house prototypes and validated changes
- Optimized solvent agitation parameters to improve automated wash performance in SLA post-processing; designed a screening experiment to isolate and tune key wash parameters; created and applied quantitative metric to empirically characterize and compare part cleanliness as a function of wash parameters

PUBLICATIONS

Journal Articles

Chen, A. Y., Chen, A., Wright, J., Fitzhugh, A., Hartman, A., Zeng, J., & Gu, G. X. (2021). *Effect of build parameters on the mechanical behavior of polymeric materials produced by multi-jet fusion.* Advanced Engineering Materials, 2100974. https://doi.org/10.1002/adem.202100974

Chen, A. Y., Pegg, E., Chen, A., Jin, Z., & Gu, G. X. (2021). *4D-printing of electro-active materials.* Advanced Intelligent Systems, 2100019. https://doi.org/10.1002/aisy.202100019

Chen, A. Y., Baehr, S., Turner, A., Zhang, Z., & Gu, G. X. (2021). *Carbon-fiber reinforced polymer composites: A comparison of manufacturing methods on mechanical properties.* International Journal of Lightweight Materials and Manufacture, 4(4), 468–479. https://doi.org/10.1016/j.ijlmm.2021.04.001

Guardincerri, E., Bacon, J. D., Barros, N., Blasi, C., Bonechi, L., **Chen, A. Y.**, D'Alessandro, R., Durham, J. M., Fine, M., Mauger, C., Mayers, G., Morris, C., Newcomer, F. M., Okasinski, J., Pizzico, T., Plaud-Ramos, K., Poulson, D. C., Reilly, M. B., Roberts, A., Saeid, T., Vaccaro, V. & Van Berg, R. (2018). *Imaging the dome of Santa Maria del Fiore using cosmic rays.* Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 377(2137), 20180136. https://doi.org/10.1098/rsta.2018.0136

Conference Presentations

Chen, A. Y., Chen, A., Wright, J., Fitzhugh, A., Hartman, A., Zeng, J., & Gu, G. X. (2022). *Multi-jet fusion printed lattice materials: characterization and prediction of mechanical performance.* 2022 MRS Spring Meeting and Exhibit, Honolulu, HI.
Winner, Best Poster Award (Gold) for the Symposium on "Advanced Manufactured Materials — Innovative Experiments, Computational Modeling and Applications"

Chen, A. Y., Chen, A., Wright, J., Fitzhugh, A., Hartman, A., Zeng, J., & Gu, G. X. (2021). *Effect of build parameters on the material properties of printed parts produced by multi-jet fusion.* 2021 Solid Freeform Fabrication Symposium, Austin, TX.
Selected as the recipient of a National Science Foundation (NSF) Student Award grant.