ANDREW Y. CHEN

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EDUCATION

Massachusetts Institute of Technology Ph.D., Mechanical Engineering (anticipated: 2027 $^{+1}_{-0}$), GPA 5.0/5.0
NSF Graduate Research Fellow S.M., Mechanical Engineering (September 2024), GPA 5.0/5.0

University of California, Berkeley B.S., Mechanical Engineering (May 2022), GPA 3.9/4.0

RESEARCH EXPERIENCE

Portela Research Group **August 2022 – present**
PI: Dr. Carlos Portela Cambridge, MA

Development of Scale-Rich Network-Inspired Metamaterials

- Designed a new class of metamaterials with heterogeneous length-scale distributions, expanding accessible property space by an order of magnitude in tunable anisotropy compared to conventional single-scale designs.
- Validated design approach through combined finite-element simulations and large-strain experiments using digital image correlation, demonstrating that length-scale heterogeneity enables deformation delocalization and enhanced energy absorption.

Synthesis and Characterization of Magnetically Responsive Microscale Nanocomposites

- Developed fabrication workflow combining two-photon lithography with *in situ* nanoparticle functionalization to create magnetically responsive microscale metamaterials.
- Achieved spatially programmable magnetic and mechanical properties by controlling polymer crosslink density. Performed micro-indentation, vibrating sample magnetometry (VSM), and energy-dispersive X-ray spectroscopy (EDS) measurements to measure stiffness, magnetization, and nanoparticle distribution.
- Demonstrated remote actuation capabilities through functional microdevices for gripping, sensing, and information encoding.

Fabrication and Modeling of Carbon– and Polymer–Based Interpenetrating Phase Composites

- Fabricated cm-scale carbon–polymer interpenetrating phase composites (IPCs) with specific energy absorption exceeding 20 J/g.
- Identified design criteria for stretching- versus bending-dominated behavior through combined experimental and finite-element analysis. Characterized damage mechanisms and toughening behavior using X-ray computed tomography.

Gu Research Group **September 2019 – May 2022**
PI: Dr. Grace Gu Berkeley, CA

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

- 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

- 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.

TEACHING AND MENTORING EXPERIENCE

2.002 Mechanics and Materials II **Spring 2025, Spring 2024, Spring 2023**
Teaching Assistant Professor Carlos Portela (2025), Professor Ken Kamrin (2024, 2023), MIT

- Held weekly office hours, wrote practice problems and designed problem sets, presented exam review sessions, and oversaw hands-on laboratory sessions for upper-division undergraduate solid mechanics course (enrollment 68 ± 17 students per semester).
- Received average overall rating of 6.86/7 ($N = 36$) in end-of-semester anonymous student surveys. Students praised clarity of instruction ("excellent at explaining concepts and understanding questions," "[published review notes] are so clear and concise in all the right places"), approachability and support ("always available to help," "super helpful in office hours," "I felt comfortable explaining problem areas"), and pedagogical impact ("piqued my interest in [mechanics of materials]," "encouraged curiosity beyond the scope of the course," "deeply cared about students learning the material").

MIT Safety, Health, Environment Discovery Lab ("*The SHED*") **August 2023 – present**
Makerspace Mentor Cambridge, MA

- The SHED is MIT's newest advanced prototyping space (open to the public Fall 2023), emphasizing cross-discipline collaboration through a combination of traditional wood-, metal-, and polymer-processing equipment together with laboratory space for biological, chemical, and radiation research.
- Gave prototyping space orientations and machine-specific trainings; oversaw use of equipment during open hours; enforced safe and proper use of tools.

Portela Research Group **August 2023 – present**
Undergraduate Research Mentor Cambridge, MA

- Mentored three undergraduate researchers in experimental and computational projects. Scoped and de-risked research directions prior to onboarding to demonstrate feasibility.
- Designed and led technical training sessions on laboratory protocols and computational workflows. Organized weekly project updates for accountability and productivity.
- Provided mentorship on academic and career planning, e.g. graduate school applications. Supported successful placement of two students into Ph.D. programs.

MIT MechE ENGAGE (*Empowering New Grads to Achieve Graduate Excellence*) **2024 – 2025**
Peer Mentor Cambridge, MA

- Led weekly small-group discussions with first-year graduate students to share advice, provide encouragement, and promote success in graduate school. Topics included managing the advisor-advisee relationship; classes and qualifying exams; research skills; and managing mental and physical health.
- Organized and hosted panel discussions with faculty members oriented towards first-year graduate students at large.

PROFESSIONAL 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 (the figure of merit) by 30% at the same fan input power with no perceptible noise increase. Empirically validated design changes and integrated the new duct design into full-scale system.
- Created high-fidelity "feels-like" and "looks-like" prototype mechanisms for a high user touchpoint system within the Form 4 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 3× 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.
- 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.

CERTIFICATIONS

MIT Grant Writing Training Certificate **expected Spring 2026**

- Completed certificate program oriented around grant writing and navigating the landscape of research funding. Major skills developed through the program include developing a new proposal from scratch, communicating with program officers, understanding the funding process, and formulating and delivering a persuasive scientific argument.

MIT Kaufman Teaching Certificate **December 2025**

- Completed practice-based certificate program designed around evidence-based teaching techniques: workshops focused on course design and syllabus construction based on the "backward design" framework (Wiggins and McTighe, 2005); lesson planning; assessing student work; providing feedback; and creating an inclusive classroom environment.
- Practiced designing and delivering a series of mock "microteaching" lessons, emphasizing activation of prior knowledge, scaffolding of concepts, and active learning.

Research Mentoring Certificate **August 2025**

- Completed mentor training based on the evidence-based Entering Mentoring curriculum which has been shown to positively impact mentorship skills and knowledge.
- The course was tailored toward the mentoring of undergraduate students in a research setting. Key concepts in mentoring pedagogy studied include maintaining effective communication, aligning expectations, assessing understanding, and addressing equity and inclusion.

PUBLICATIONS

Peer-Reviewed Journal Articles (†denotes equal contribution)

- Both, C.†, **Chen, A. Y.**†, Gao, T., Mooij, N., Charara, M., Portela, C.M., & Barabási, A.-L. (2025). *Scale-Rich network based metamaterials. Under review.* Preprint: `https://doi.org/10.48550/arXiv.2511.18108`
- Sun, R. M.†, **Chen, A. Y.**†, Ji, Y., Yee, D. W., & Portela, C. M. (2025). *Magnetically responsive microprintable soft nanocomposites with tunable nanoparticle loading. Under review.* Preprint: `https://doi.org/10.48550/arXiv.2510.07599`
- **Chen, A. Y.** & Portela, C. M. (2025). *Mechanics of micro-architected carbon- and polymer-based interpenetrating phase composites.* International Journal of Solids and Structures, 323, 113638. `https://doi.org/10.1016/j.ijsolstr.2025.113638`
- **Chen, A. Y.**, Chen, A., Fitzhugh, A., Hartman, A., Kaiser, P., Nwaogwugwu, I., Zeng, J., & Gu, G. X. (2023). *Multi Jet Fusion printed lattice materials: Characterization and prediction of mechanical performance.* Materials Advances, 4, 1030-1040. `https://doi.org/10.1039/D2MA00972B`
- **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`

Conference Presentations and Invited Talks

- **Chen, A. Y.**, Sun, R. M., Pignagnoli, C. & Portela, C. M. (2025). *Enhancing Strength in Carbon-Based Interpenetrating Phase Composites via Morphology and Disorder.* 2025 Society of Engineering Science Annual Technical Meeting, Atlanta, GA.

- **Chen, A. Y.** & Portela, C. M. (2025). *Micro-Architected Composite Materials Enabled by High-Throughput Two-Photon Polymerization.* 2025 Nano Expert Summit, Vienna, Austria. *Invited talk.*
- **Chen, A. Y.**, Pignagnoli, C. & Portela, C. M. (2024). *Three-Dimensional Architected Carbon Composites via Additive Manufacturing.* 2024 MRS Fall Meeting and Exhibit, Boston, MA.
- **Chen, A. Y.**, & Portela, C. M. (2024). *Three-Dimensional Micro-Architected Composite Materials.* Characterization.nano User Forum Series: Spotlight on X-Ray Computed Tomography, Cambridge, MA. *Invited talk.*
- **Chen, A. Y.**, & Portela, C. M. (2024). *Mechanics of 3D Micro-Architected Interpenetrating Phase Composites.* 2024 Engineering Mechanics Institute Conference, Chicago, IL.
- **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.