DEVIN J. ROACH, PH.D.

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Assistant Professor

Mechanical, Industrial, and Manufacturing Engineering
Oregon State University

Focused on AI-driven design, materials synthesis, and additive manufacturing of functional composites which can find real-world applications in fields such as aerospace, renewable energy, biomedicine, and soft robotics.

EDUCATION

Doctor of Philosophy in Mechanical Engineering **08/2016 – 05/2021**
Dissertation: Developing Intelligent Structures and Functional Devices Using Novel Smart Materials and Multi-Material Multi-Method (m^4) 3D Printing
Georgia Institute of Technology, Atlanta, GA

Masters of Science in Mechanical Engineering **08/2016 – 05/2018**
Georgia Institute of Technology, Atlanta, GA

Bachelor of Science in Mechanical Engineering **08/2011 – 05/2016**
Concentration: Mechanics of Materials
Georgia Institute of Technology, Atlanta, GA

PROFESSIONAL & RESEARCH EXPERIENCE

Senior Member of Technical Staff **08/2022 – 12/2023**
Advanced Materials Lab, Sandia National Laboratories, Albuquerque, NM

- Leading PI of research focused on AI-driven process monitoring and control of Additive Manufacturing (AM) and novel multi-functional materials. Led to publications [1,2,3] and Patents [32,33].
- Coordinating research efforts related to the AM of functional composites for use in mission critical Department of Energy applications. Led to publication [4,12] and Copyright [30].

Postdoctoral Fellow **06/2021 – 07/2022**
Advanced Materials Lab, Sandia National Laboratories, Albuquerque, NM
Advisor: Adam Cook, Principal Member of Technical Staff

- Utilizing computer vision and artificial intelligence (AI) techniques for real-time analysis and optimization of 3D printed components. Led to publication [5] and Patent [34].
- Designing energy absorbent structures using additive manufacturing for use in the nation's stockpile.

Graduate Research Assistant **08/2016 – 05/2021**
Active Materials & Additive Manufacturing Lab, Georgia Institute of Technology, Atlanta, GA
Advisor: Dr. H Jerry Qi, Woodruff Fellow

- Designed and built multi-material multi-method 3D printing platforms to print functional structures such as electronics, energy generators, sensors, and soft robotics. Led to publications [7-10,13,15].
- Developed novel soft-active materials using organic synthesis techniques to generate smart wearable systems, smart robots, and reconfigurable/adaptive radio frequency devices. Led to publications [11,14].

INDUSTRY EXPERIENCE

Airbus Germany **05/2016 – 08/2016**
Testia, GMBH, Non-destructive Inspection Group, Airbus Headquarters, Bremen, Germany

- Determined new ultrasonic inspection technique's capability within the Airbus fleet
- Collaborated with Senior Engineers to write industry-wide inspection methods for a newly developed nondestructive inspection technique, eventually to be approved by three major aircraft manufactures.

Delta Air Lines **01/2012 – 08/2015**

Enabling Technologies (R&D) Department, Delta Air Lines Maintenance Headquarters, Atlanta, GA

- Characterized aircraft structural integrity and airworthiness using FEM structural analysis techniques
- Researched current theoretical structural mechanics techniques used to predict fatigue life of numerous aircraft joint configurations within Delta's fleet
- Designed experiments proving aircraft lap-splice joint strength to the Federal Aviation Administration for an initial, inspection-driven Damage Tolerance Analysis
- Implemented Nasgrow, a NASA-developed crack growth simulation technique, and its relevant equations to aid in the design of an automated crack propagation simulator

PEER-REVIEWED PUBLICATIONS

(*CORRESPONDING AUTHOR) (†UNDERGRADUATE STUDENT)

Google Scholar: Cumulative citation count of 1920; i10-index of 18; and an h-index of 17.

- JOURNAL ARTICLES

[1] J Herman, R Telles, E Fu, CC Cook, SC Leguizamon, JA Lewis, BJ Kaehr, T White, **DJ Roach***, **(2024)**, "Digital Light Process 3D Printing of Magnetically Aligned Liquid Crystalline Elastomer Free–forms", *Advanced Materials*, 36 (52), 2414209.

[2] A Bischoff, M Sorkin, J Yazzie, C Krikorian, S Leguizamon, A Cook, **DJ Roach***, **(2024)**, "Nematic Liquid Crystal Elastomer Foams for Dynamic Energy Dissipation", *Advanced Engineering Materials*, 27 (2).

[3] E Meija, D Darby, E Linde, L McDougall, A Commisso, A Greenlee, L Appelhans, A Cook, J Moore, N Sottos, SC Leguizamon, **DJ Roach***, **(2024)**, "Real-time Automated Control of Extrusion 3D Printing of a Frontally Polymerizing Gel" in review with *Advanced Science*.

[4] L McDougall†, J Herman, E Huntley, TJ White, B Kaehr, **DJ Roach***, **(2023)**, "Freeform Liquid Crystal Elastomers via Embedded 4D Printing" *ACS Applied Materials & Interfaces*. 15, 50, 58897–58904.

[5] A Rohskopf, L Appelhans, J Cardenas, A Cook, **DJ Roach***, **(2023)**, "Invertible Neural Networks for Real-Time Control of Extrusion Additive Manufacturing" *Additive Manufacturing*. 103742.

[6] **DJ Roach***, X Sun, X Peng, F Demoly, K Zhou, HJ Qi*, **(2022)**, "4D Printed Multifunctional Composites with Cooling-Rate Mediated Tunable Shape Morphing" *Advanced Functional Materials*, 32 (36), 2203236.

[7] **DJ Roach**, A Rohskopf, WD Reinholtz, R Bernstein, HJ Qi, A Cook, **(2021)**, "Utilizing computer vision and artificial intelligence algorithms to predict and design the mechanical compression response of direct ink write 3D printed foam replacement structures" *Additive Manufacturing*, 41,101950.

[8] **DJ Roach**, C Roberts, J Wong, X Kuang, J Kovitz, Q Zhang, TG Spence, HJ Qi, **(2020)**, "Surface Modification of Fused Filament Fabrication (FFF) 3D Printed Substrates by Inkjet Printing Polyimide for Printed Electronics" *Additive Manufacturing*, 36, 101544.

[9] **DJ Roach**$^{+}$, S Zhang^{+}, S Xu, P Wang, W Zhang, HJ Qi, ZL Wang, **(2020)**, "Electromagnetic Pulse Powered by a Triboelectric Nanogenerator with Applications in Accurate Self-Powered Sensing and Security" *Advanced Materials Technologies*, 2000368. [$^{+}$ Equal first authorship]

[10] **DJ Roach**, C Yuan, M Romero, I Hamel, C Dunn, K Yu, HJ Qi, **(2019)**, "Long Liquid Crystal Elastomer Fibers for Smart Textiles and Soft Robotics Applications", *ACS Applied Materials & Interfaces*, 11(21), 19514-19521.

[11] **DJ Roach**, C Hamel, C Dunn, X Kuang, HJ Qi, **(2019)**, "The m^4 3D Printer: A multi-material multi-method additive manufacturing platform for future 3D printed structures" *Additive Manufacturing*, 29, 100819.

[12] **DJ Roach**, X Kuang, C Yuan, C Dunn, H Jerry Qi, **(2018)**, "Novel Ink for Ambient Condition Printing of Liquid Crystal Elastomers for 4D Printing". *Smart Materials and Structures*, 27 (12), 125011.

[13] **DJ Roach**, C Hamel, J Wu, X Kuang, M Dunn, H Jerry Qi, **(2017)**, "4-D Printing: Potential Applications of 3-D Printed Active Composite Materials" *HDIAC Journal*, 4, 4.

[14] E. Linde, **DJ Roach**, L. Appelhans, A. Cook, **(2022)**, "In Situ Characterization and Monitoring of Material Extrusion Printing by Near-Infrared Spectroscopy". *Additive Manufacturing*, 63, 103420.

[15] X Kuang, **DJ Roach**, C Hamel, K Yu, HJ Qi, **(2020)**, "Materials, Design and Fabrication of Shape Programmable Polymers". *Multifunctional Materials*, 3 (3), 032002.

[16] C Hamel, **DJ Roach**, K Long, HJ Qi, **(2019)**, "Machine-learning based design of active composite structures for 4D printing", *Smart Materials and Structures*, 28 (6), 065005.

[17] X Kuang, **DJ Roach**, J Wu, C Hamel, D Zhen, T Wang, M Dunn, HJ Qi, **(2017)**, "Advances in 4D Printing: Materials and Applications". *Advanced Functional Materials*, 29 (2), 1805290.

[18] C Yuan, **DJ Roach**, C Dunn, Q Mu, X Kuang, C Yakacki, TJ Wang, K Yu, H Jerry Qi, **(2017)**, "3D printed reversible shape changing soft actuators assisted by liquid crystal elastomers", *Soft Matter*, 13 (33), 5558-5568.

[19] Q Zhang, **DJ Roach**, L Geng, H Chen, H Qi, and D Fang, **(2018)**, "Highly stretchable and conductive fibers enabled by liquid metal coating" *Smart Materials and Structures*, 27 (3), 035019.

[20] O Davydovich, A Greenlee, H Root, A Jansen, S Gallegos, M Warner, **DJ Roach**, B Jones, S Leguizamon, **(2023)**, "Encapsulated Transition Metal Catalysts Enable Long-term Stability in Frontal Polymerization Resins", *Macromolecules*, 56, 18.

[21] J Cardenas, J Bullivent, I Kolesnichenko, **DJ Roach**, M Gallegos, A Cook, **(2022)**, "3D Printing of Ridged FeS_2 Cathodes for Improved Rate Capability and Custom-Form Lithium Batteries", *ACS AMI*.

[22] C Armstrong, L Yue, X Kuang, **DJ Roach**, HJ Qi, **(2022)**, "A hybrid additive manufacturing process for production of functional fiber-reinforced polymer composite structures" *Journal of Composite Materials*, 10, 1177.

[23] X Peng, X Kuang, **DJ Roach**, Y Wang, CM Hamel, C Lu, HJ Qi, **(2021)**, "Integrating digital light processing with direct ink writing for hybrid 3D printing of functional structures and devices" *Additive Manufacturing*, 40, 101911.

[24] Q Zhang, X Kuang, S Weng, L Yue, **DJ Roach**, D Fang, HJ Qi, **(2021)**, "Shape-Memory Balloon Structures by Pneumatic Multi-material 4D Printing", *Advanced Functional Materials*, 2010872.

[25] S Weng, X Kuang, Q Zhang, CM Hamel, **DJ Roach**, N Hu, HJ Qi, **(2020)**, "4D Printing of Glass Fiber-Regulated Shape Shifting Structures with High Stiffness", *ACS Applied Materials & Interfaces*, 13 (11), 12797-12804.

[26] X Kuang, Q Mu, **DJ Roach**, HJ Qi, **(2020)**, "Shape-programmable and healable materials and devices using thermo-and photo-responsive vitrimer", *Multifunctional Materials*, October **2020**.

[27] V Li, X Kuang, C Hamel, **DJ Roach**, HJ Qi, **(2019)**, "Cellulose nanocrystals support material for 3D printing complexly shaped structures via multi-materials-multi-methods printing" *Additive Manufacturing*, 28, 14-22.

[28] Q Mu, M Lei., **DJ Roach**, C Dunn, X Kuang, C Yuan, T Wang, Qi, HJ Qi, **(2018)**, "Intense pulsed light sintering of thick conductive wires on elastomeric dark substrate for hybrid 3D printing applications" *Smart Materials and Structures*, 27 (11), 115007.

- PATENTS & COPYRIGHTS

[29] **"Tunable Magnetic Field Strength Stereolithography Printing for Voxelated Hierarchical Structures"** Patent under internal review. **(2024)**.

[30] **"Machine Learning for Real-Time Control of Additive Manufacturing"** Patent Applied for. Application Serial No. SD 16367.1. **(2023)**.

[31] **"Real-time process monitoring for direct ink write additive manufacturing"** Patent Applied for. Application Serial No. 17/967,083. SD15860.1. **(2022)**.

[32] **"Slice-Write"** Commercial Software Copyright Assertion SCR 2753. **(2022)**.

[33] **"Design and Analysis of 3D Printed Structures using Machine Learning"** Patent Granted. Serial No. 17/548,746. **(2022)**.

[34] **"System of Foldable Box Kites to Harness High Altitude Wind Energy for Electricity Generation"** Provisional Serial No: 62/844,822. **(2019)**.

[35] **"Fabrication of Long Liquid Crystal Elastomer Fibers for Smart Textile and Smart Fiber Applications"** Patent under internal Georgia Tech review.

- BOOK CHAPTERS & EDITORIALS

[36] Z Wang, J Boothby, **DJ Roach***, Q He*, **(2022)**, "Editorial: Soft robotics based on liquid crystal elastomers (LCE), *Frontiers in Robotics and AI*, 9, 1018819.

[37] **DJ Roach**, X Kuang, HJ Qi. "4D Printing Based on Multi-Material Design" Edited Volume on Additive Manufacturing for Multifunctional Materials and Structures, Manufacturing in the Era of 4th Industrial Revolution, **(2020)**.

INVITED PRESENTATIONS & SEMINARS

TMS Annual Meeting **Las Vegas, NV, 2025**

[38] **DJ Roach**. "Unveiling the Potential of Hybrid Additive Manufacturing for Next-Generation Functionality in Printed Electronics"

TMS 2nd World Congress on Artificial Intelligence in Materials and Manufacturing **Cleveland, OH, 2024**

[39] **DJ Roach,** A Cook, A Rohskopf. "Neural Networks as Surrogate Models for Real-time Optimization of Additive Manufacturing"

European Project STORM-BOTS: LCE-based Soft Robotics Workshop **University of Zaragoza, Spain, 2024**

[40] **DJ Roach,** A Bischoff, T White, B Kaehr. "Omnidirectional Printing and Control Strategies for Liquid Crystal Elastomers Towards Freeform Soft Robotics"

International Liquid Crystal Elastomer Conference **The University of Colorado, Boulder, 2023**

[41] **DJ Roach,** J Herman, L McDougall, B Kaehr. "Multi-material Design of Liquid Crystal Elastomer Actuators for Functional Composite Devices"

Oregon Bioengineering Symposium **The University of Oregon, 2023**

[42] **DJ Roach,** L McDougall, B Kaehr. "Bioengineering via Direct Ink Write 3D Printing".

International Workshop on Structural Health Monitoring **Stanford University, 2019**

[43] **DJ Roach**, X Kuang, HJ Qi. "Developing Smart Structures and Devices using Novel Materials and Hybrid 3D Printing".

Homeland Defense & Security Information Analysis Center (HDIAC) Tech Talk **Virtual, 2018**

[44] **DJ Roach**, C Hamel, X Kuang, HJ Qi. "4D Printing: Concept, Review, and Perspective".

AWARDS AND RECOGNITIONS

Best Presentation Award, 4D Materials Design and Additive Manufacturing Conference, 2023.

Early Career Leadership Award, New Mexico NSF Established Program to Stimulate Competitive Research (EPSCoR), 2022.

Sandia National Laboratory Directed Research Directive Exploratory Express Award, Digital Light Processing of Liquid Crystal Elastomers, 2022.

Invited Editor for Frontiers in Robotics and AI, Special Topic on Liquid Crystal Elastomers for Soft Robots, 2021.

2019 The Homeland Defense & Security Information Analysis Center (HDIAC) Subject Matter Expert (SME) for 4D Printing, 2019.

NSF Innovation Corps Grant Award, 2017.

Grand Award in Mechanical Engineering, ISEF International Science and Engineering Fair, 2010.

TEACHING ACTIVITIES

Oregon State University

MFGE 4/538 – Composite Manufacturing **01/2024 – Present**

- Senior/Graduate course focused on the processing techniques for manufacture, design, and characterization of advanced composite structures.

The University of New Mexico

ME 459 – Mechanical Engineering Design IV **08/2022 – 12/2023**

- Terminal design course based on Budynas & Nisbett's "Shigley's Mechanical Engineering Design".
- Utilized weekly "flipped classrooms" for improved student engagement and problem solving.

Georgia Institute of Technology

ME 3001 – Mechanics of Deformable Bodies (Teaching Fellow) **01/2019 – 05/2019**

- Prepared and delivered lectures on all topics, especially focusing on exam review sessions.
- Prepared, administered, and graded exams.

ME 3180 – Machine Design (Collegiate Education Researcher) **01/2018 – 08/2021**

- Collaborated with researchers investigating the "Impact of Active Learning Interventions on Student Outcomes in Core Mechanical Engineering Topics" and results presented at pedagogy conferences.

ME 7201 – Computational Mechanics of Materials (Guest Lecturer) **08/2018 – 12/2018**

ME 3322 – Thermodynamics, ME 3340 – Fluid Mechanics (Tutor) **01/2016 – 08/2017**

Georgia Tech Athletic Association, Georgia Institute of Technology, Atlanta, GA

MENTORSHIP

Postdoctoral Students

Daniel Darby, PhD	Sandia National Labs, 03/2022 – Present
Jorge Cardenas, PhD	Sandia National Labs, 08/2021 – Present

PhD Students

Adam Bischoff	Oregon State University, 01/2024 – Present, PhD Student
Bukola Adebisi	Oregon State University, 01/2024 – Present, PhD Student
Seth O'Brien	Oregon State University, 01/2024 – Present, PhD Student co-advised with Prof. John Parmigiani
Jeremy Herman	The University of Colorado, Boulder, 06/2022 – Present, PhD Student co-advised with Prof. Timothy White

Masters Students

Saegis Abbott	Oregon State University, 01/2024 – Present, MS Student
Georgia Kaufman	Sandia National Labs, completed MS, 2023, Member of the Technical Staff at Sandia National Labs

Undergraduate Researchers

Cade Sickafoose	Sandia National Labs, BS, est. 2025
Luke McDougall	Sandia National Labs, completed BS, 2024, Target Software Engineering Team
Annika Jansen	Sandia National Labs, completed BS, 2023, Intel
Madison Hochrein	Sandia National Labs, completed BS, 2023, Medical Student

Senior Design Mentor (The University of Texas, El Paso) **08/2021 – 1/2022**

- Mentored 5 students working on a senior design project focused on artificial intelligence (AI) and computer vision – based approaches for process monitoring.

Undergraduate Mentorship Programs Leader (Georgia Institute of Technology) **01/2016 – 08/2020**

- Mentored five undergraduate students in research projects, three of whom eventually became co-authors on publications. Students went on to work at Tesla, Boeing, Schlumberger, & Northrop Grumman.
- Led undergraduate research program by providing all liaison and recruiting for undergraduate students within our laboratory and assigned them graduate students based on targeted skills/career path.

- Led onboarding and training of new Graduate students within our group with items such as how to write papers, facilitate collaboration, and write fellowship applications.

ENGAGES STEM Mentorship Program(Georgia Institute of Technology) 05/2019 – 08/2020

- Mentored historically under-represented Atlanta-area high school students in a research project.
- Mentee's project was selected as one of only three students from the state of Georgia to present his work at the 2020 International Science & Engineering Fair.

ACADEMIC SERVICE & PROFESSIONAL ACTIVITIES

Thesis Committee Service

- Karl Haapala's student, *Sustainably Incorporating Hemp Biobased Economy Into Western US Regional Rural and Tribal Lands*, Oregon State University, est. defense in 2025.
- Jeremy Herman, *Investigation of Liquid Crystal Elastomer Formulation Strategies for End-Use Applications*, The University of Colorado, Boulder, est. defense in 2024.
- Stephanie Garcia, *Computer Vision Design and Additive Manufacturing of Composites*, The University of Texas, El Paso, successful defense in 2023.

Local Scientific Community Involvement

- New Mexico Regional Science and Engineering Fair Materials Judge & Topic Chair, 01/2022 – Present
- Georgia Tech ENGAGES STEM Mentorship Program, 05/2019 – 08/2020

Journal Editor

- *Frontiers in Robotics and AI – Special Topic on Liquid Crystal Elastomers*

Journal Referee and Reviewer

- *Advanced Functional Materials*
- *Additive Manufacturing*
- *Multifunctional Materials*
- *Science Advances*
- Full list on Publons

APPLICABLE SKILLS AND INTERESTS

Programming Languages:	Python, LabView, Matlab, Visual Basic, C++, Java
Certifications/Trainings	CETL Education, Cleanroom, Machine Shop, SEM, FTIR, DMA, DSC
Software:	Abaqus, Ansys, and NASTRAN finite element modeling solvers, Visual Studio, Microsoft Office, AutoCAD, SolidWorks, Adobe Suite
Languages:	English (Native), Spanish (Fluent), German (Conversational)
Things I do for fun:	Ride (and fix) my dirt bike, hike/run with my wife, play my guitar, watch Breaking Bad, watch Oregon State & Georgia Tech football