

Exponent®
Engineering & Scientific Consulting

Hayden Furcolo, Ph.D.

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Professional Profile

Hayden Furcolo, Ph.D., specializes in failure analysis, experimental mechanics, and design assessment for fatigue-critical applications. His experience includes the structural use of metals, advanced mechanical testing, fractographic analysis, and the development of novel experimental methods to investigate complex engineering problems.

Dr. Furcolo applies first-principles mechanics, materials characterization, fracture mechanics, laboratory testing, and data/statistical analysis to evaluate how components and structures respond to manufacturing variation, cyclic loading, and service conditions. Drawing on his background in materials science and engineering, he relates macroscopic loading conditions to the microscopic phenomena governing the onset of failure. His work spans defect-sensitive fatigue, root-cause investigation, crack initiation and propagation, structural deviations, and design for manufacturing. Additionally, Dr. Furcolo has experience assisting in complex litigation involving material and mechanical claims.

Dr. Furcolo's doctoral research evaluated the validity and limitations of accelerated ultrasonic fatigue testing for cast aluminum alloys. He developed controlled experimental methods integrated with digital image correlation, strain and displacement measurement, computed tomography, scanning electron microscopy, and fracture-mechanics-based modeling. This work clarified how defect populations, environmental exposure, crack initiation, and early crack development influence the frequency-dependent fatigue behavior and the interpretation of accelerated fatigue data.

Academic Credentials & Professional Honors

Ph.D., Materials Science and Engineering, Worcester Polytechnic Institute, 2026

B.S., Mechanical Engineering, Worcester Polytechnic Institute, 2020

Prior Experience

Research Assistant, Worcester Polytechnic Institute, Worcester, MA, 2021-2026

Teaching Assistant, Worcester Polytechnic Institute, Worcester, MA, 2021-2023

Structural Engineer, General Dynamics Electric Boat, Groton, CT, 2020-2021

Professional Affiliations

American Society of Mechanical Engineers (ASME) – Member

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Publications

Presentations

Furcolo HG, Spangenberger AG, Wang Q, Lados DA. Ultrasonic fatigue investigations for high and very-high cycle fatigue applications of A356 cast aluminum alloys. Oral Presentation, TMS, San Diego, CA, 2023.

Project Experience

- Investigated fatigue failures in aluminum alloys using optical microscopy, SEM, quantitative fractography, and fracture mechanics; identified how the location and morphology of manufacturing defects influenced crack initiation and life variability.
- Evaluated tensile and compressive response across six orders of magnitude in strain rate using servo-hydraulic and split-Hopkinson systems to quantify the flow stress response with increasing strain rate.
- Implemented in-situ digital image correlation and synchronized strain/displacement measurements to validate cyclic strain amplitude, map full-field strain distributions, and detect unintended vibration modes during high-frequency testing.
- Developed workflows for data-acquisition and post-processing using LabVIEW, MATLAB, and Python to extract waveform frequency, displacement, strain amplitude, and high-rate mechanical response.
- Combined optical microscopy, SEM, EDS, EBSD, and X-ray computed tomography to characterize microstructure and three-dimensional defect populations and connect with fatigue resistance.
- Applied CAD, CNC machining, and additive 3D printing methods to design and fabricate specialized test specimens and experimental fixtures.
- Designed and prototyped an automated assembly process for packaging sterilization filters, applying mechanical design and design for manufacturing principles to a commercial production challenge.