Craig M. Weeks

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EDUCATION

Carnegie Mellon University — Pittsburgh, PA
Doctor of Philosophy in Mechanical Engineering | GPA: 4.0/4.0 — May 2026
Master of Science in Mechanical Engineering — May 2025

Oregon State University — Corvallis, OR
Bachelor of Science in Mechanical Engineering | GPA: 3.92/4.0 — September 2022
Minors in Aerospace Engineering and Computer Science

SKILLS

Software: MATLAB, Python, ANSYS, OpenFOAM, FLOW3D, SolidWorks, OnShape
Hardware: Metal additive manufacturing, FDM 3D printing, Mechanical assembly, Machining
Analysis: Heat transfer, Computational fluid dynamics, Thermal imaging, Applied machine learning

PhD RESEARCH

Carnegie Mellon University — Pittsburgh, PA

Spectral Observation and Simulation of Metal Vapor Plumes — May 2025 - Present

- Analyzed multimodal spectral data on metallic vapor plumes to ascertain vapor interaction with high power laser irradiation and develop a physically based model of laser-based evaporation of metals
- Identified spectral signatures of ionizing titanium vapor atoms and vapor condensate regions with upwards of 20% light attenuation
- Created a multiphysics CFD model of vapor plume evaporation with a custom nucleation submodel and laser-vapor interaction for use in quantification of laser beam attenuation and additive manufacturing process planning development **(In Progress)**

Hybrid Ratiometric and Illuminated Process Monitoring — October 2024 - Present

- Co-developed a hybrid illuminated and ratiometric process monitoring technique to determine cooling rates in additive manufacturing processes by combining thermal gradients and morphological data obtained via laser reflections
- Developed a machine learning UNet model with >85% F1 Score to efficiently segment illuminated image video frames
- Reported temporally and spatially varying solidification cooling rates in 316L stainless steel melt pools between 170,000 and 3,000,000 K/s that demonstrate process phenomena and provide a foundation for process monitoring correlations

Simulated Imaging of L-PBF Melt Pools — July 2024 – March 2025

- Created an algorithm to simulate ratiometric thermal imaging on reflecting concave surfaces using radiation heat transfer physics and imported CFD data for understanding high temperature thermal distributions in liquid metals
- Reproduced temperature distributions to within 4-6% of experimental values and provided imaging recommendations for experimentalists to use when imaging

Multiphysics CFD Melt Pool Simulation — September 2022 – November 2024

- Developed and validated multiphysics CFD models of laser powder bed fusion (L-PBF) additive manufacturing in OpenFOAM® and FLOW3D® to study melt pool dynamics and evaporation
- Simulated L-PBF vapor plumes and found vapor velocities on the order of 100x greater than melt pool flow velocities

PUBLICATIONS

Weeks, C. M., Myers, A. J., Malen, J. A., & Singh, S. (2025). Validation of OpenFOAM modeling of additive manufacturing melt pool dynamics against geometric and thermal experiments. *Journal of Manufacturing Processes*, *152*, 237–249.

Quirarte, G., Myers, A. J., Gourley, A., **Weeks, C. M.**, Reeja-Jayan, B., Beuth, J., & Malen, J. A. (2025). High speed thermal imaging and modeling of laser powder bed fusion manufactured WC–Ni cemented carbides. *Additive Manufacturing*, *110*, 104913.

Weeks, C. M., Malen, J. A., & Singh, S. (2025). Resolving Experimental Artifacts in Thermal Imaging of Laser Powder Bed Fusion Melt Pools. (in review)

CONFERENCES/PRESENTATIONS

Weeks, Craig. "Simulation and Validation of Melt Pool Physics in the L-PBF Additive Manufacturing Process." Materials Science and Technology Technical Meeting and Exhibition, Pittsburgh, PA, 8 October 2024, *Conference Presentation*

Weeks, Craig. "Numerical Simulation of Melt Pool Physics in Metal Additive Manufacturing Processes." Solid Freeform Fabrication Symposium, Austin, TX, 13 August 2024, *Conference Presentation*

Weeks, Craig. "Numerical Simulation of Melt Pool Physics in Metal Additive Manufacturing Processes." ASTFE Thermal and Fluids Engineering Conference, Corvallis, OR, 22 April 2024, *Conference Presentation*

Weeks, Craig. "Numerical Simulation of Melt Pool Physics in Metal Additive Manufacturing Processes." Materials Science and Technology Technical Meeting and Exhibition, Columbus, OH, 2 October 2023, *Conference Presentation*

Weeks, Craig. "Hardware Design for an Efficient Inverter used in Electric Aircraft Power Systems." Oregon Space Grant Consortium Student Symposium, Corvallis, OR, 13 November 2020, *Conference Presentation*

TEACHING ASSISTANT EXPERIENCE

Carnegie Mellon University — Pittsburgh, PA

Lead Teaching Assistant / 24-321 Thermal Fluids Experimentation — January 2024 – May 2025

- Graded student homework and laboratory assignments
- Facilitated online office hours and assisted students outside of classroom hours
- Led undergraduate lab sessions and acted autonomously to respond to student questions and requests

AWARDS AND HONORS

National Defense Science and Engineering Graduate Fellow — April 2023

Oregon State University George and Evelyn Lundstrom Scholarship — September 2021

National Merit Scholar — March 2018

VOLUNTEER EXPERIENCE

Volunteer Instructor, CMU Gelfand Outreach Center – Pittsburgh, PA — July 2023 – July 2025

Internship Peer Mentor, NASA Glenn Research Center – Cleveland, OH — June 2020 – August 2021

RELEVANT COURSEWORK

Graduate: 24-718 Computational Fluid Dynamics, 24-623 Molecular Simulation of Materials, 24-789 Intermediate Deep Learning for Engineers, 24-730 Advanced Heat Transfer

Undergraduate: ME312 Thermodynamics, ME332 Heat Transfer, ME461 Gas Dynamics, ME430 Systems Dynamics and Control, CS325 Analysis of Algorithms