SETH T. STRAYER

Cell: (412) 944-0226 Benedum Hall #636
e-Mail: sts106@pitt.edu 3700 O'Hara Street, Pittsburgh, PA 15261
LinkedIn: https://www.linkedin.com/in/sethstrayer e-Portfolio: http://www.pitt.edu/~sts106/

EDUCATION & CERTIFICATION

University of Pittsburgh, Pittsburgh, PA

- **Doctor of Philosophy in Mechanical Engineering *(Ph.D.),* GPA 3.96** Graduation date: August 2024
  - **Advisor:** Prof. Albert To
  - **Fellowship:** NASA Space Technology Graduate Research Opportunity (NSTGRO)
- **Bachelor of Science in Mechanical Engineering (*BSME*), GPA: 3.78** Date Conferred: 08/10/2019
  - **Minor:** Mathematics
  - **Total Completed Credits:** 145 (over 18 credits/semester)
  - **Honors:** The National Society of Collegiate Scholars; University Honors College
- **Certified in Robo-Met Materials Characterization,** by UES, Inc. Date Conferred: 05/10/2022
- **Certified in Additive Manufacturing**, by The Barnes Group Advisors (TBGA) Date Conferred: 02/13/2020

COMPUTATIONAL SKILLS

Focuses on artificial intelligence, data analysis, extraction, and preparation, and numerical scientific computation

- ***Programming:*** Python; C/C++; GitHub; HTML/CSS; Java; PHP; SQL; Visual Basic
  - ***Python Packages:*** NumPy; PyTorch; TensorFlow; Keras; Pandas; scikit-learn; SciPy; matplotlib
- ***Deep Learning Algorithms:*** Autoencoder; convolutional neural networks; generative adversarial networks; graph neural networks; recurrent neural networks; reinforcement learning; physics-informed neural networks
- ***Machine Learning Algorithms:*** Clustering; decision trees; gaussian mixture model; regression; support vector machine
- ***Computer Vision Algorithms:*** Image filtering and feature extraction; classification and object recognition using convolutional neural networks; vision; language processing and reasoning; self-supervised and embodied learning
- ***Engineering Software:*** ANSYS; FLOW-3D; Mathcad; MATLAB; ParaView; SolidWorks; SpaceClaim
- ***Typesetting & Operating Systems:*** LaTeX; Microsoft Office; Unix/Linux; Windows

RESEARCH EXPERIENCE

University of Pittsburgh Mechanical Engineering Department, Pittsburgh, PA August 2019 – Present

NASA Space Technology Graduate Research Fellow | Ph.D. Candidate

- **Research Task:** Use data-driven algorithms to develop novel methods promoting efficient, high-fidelity thermal process simulation of laser powder bed fusion (L-PBF) additive manufacturing
- Assisted the development of PAMSIM, an in-house, GPU-accelerated, matrix-free, and object-oriented finite element (FE) code written using C/C++ and CUDA; validated the code through extensive unit test cases with ANSYS
- Developed the computational fluid dynamics imposed finite element method (CIFEM), which utilizes a combined deep convolutional autoencoder and deep neural network to integrate PAMSIM with high-fidelity computational fluid dynamics simulations; improved thermal simulation accuracy by ~36% and increased efficiency by ~30x
- Developing a temperature-dependent FE heat source model that improves the robustness of thermal process simulations by considering the melt pool size evolution from CFD simulations based on the local thermal environment
- Extracting and analyzing large amounts of data from experiments and simulation; operating the Robo-Met materials characterization system to grind, polish, etch, and characterize melt pools from hundreds of slices of printed samples; exploring the use of database management systems in SQL to visualize and manage the data efficiently

NASA Langley Research Center, Hampton, VA

Visiting Technologist Researcher May 2022 – August 2022 | May 2023 – August 2023

- Developed means of indirectly communicating a Bayesian-based calibration model created by a NASA research collaborator to PAMSIM via automated, online data transfer; used this paradigm to perform model calibration
- Collected, analyzed, and managed data obtained from optical microscopes and Robo-Met; worked with NASA engineers to transfer the data to a NASA-maintained database management system in SQL
- Collaborated with lead NASA engineers to explore methods of accelerating high-fidelity thermal process simulation of L-PBF and methods for simulation-based defect recognition to promote the use of L-PBF for safety-critical, next-generation spaceflight applications

University of Pittsburgh Bioengineering Department, Pittsburgh, PA October 2018 – August 2019
Undergraduate Research Assistant

- Assisted Dr. Kurt Beschorner to understand the effect of design parameters on the efficacy of a novel offloading insole
- Performed extensive FE simulations using ANSYS Workbench to model the highly nonlinear and large-deformation contact region between hyperelastic foot tissue and soft insole material
- Quantified the effect of different insole designs on offloading efficacy; presented and interpreted the results to the research team and independently developed a manuscript that was accepted for publication; see https://popsole.com/

INDUSTRY EXPERIENCE

Curtiss-Wright EMD, Cheswick, PA
Generator & Motor Design Co-Op, Lead Co-Op May 2018 – August 2018

- Acted as a liaison between the co-ops and the co-op coordinator; facilitated tasks and coordinated events for 35 co-ops
- Analyzed shear loading capabilities of glass epoxy insulation; created ANSYS Workbench simulations to test the material's behavior and verified the results with hand calculations
- Performed experimental testing to determine that stainless steel would behave equally well as silicon-bronze locknuts
- Utilized MATLAB Simulink to determine an optimum mass flow rate for the generator's heat exchanger
- Assigned a lead role in the drawing revision process; updated over 20 drawing revisions for a secondary propulsion unit

Pump Design & Development Co-Op September 2017 – December 2017

- Developed a series of experimental tests on critical component thrust bearings and analyzed the results; performed load capacity testing on the bearings and determined an optimum minimum film thickness; presented findings to a proprietary customer and was awarded continued funding for the project
- Utilized ANSYS Workbench to conclude that fastener preload effects were local to the point of load application; used this fact to simplify geometry in conjunction with a fastener bench testing project
- Determined an optimum design for thrust bearing holders which would aid in resisting the effects of thermal transients
- Designed a guard for a resistance temperature detector that protected it from exterior loading

Stress & Thermal Analysis Co-Op January 2017 – April 2017

- Performed FE simulations utilizing ANSYS Mechanical APDL and Workbench; created a subroutine to plot stress lines along the circumference of complicated geometry
- Conducted tooling analysis to verify that stress and deflection limits were not exceeded for a given loading condition
- Created a series of extensive Visual Basic Excel macro files to validate a proprietary stress analysis program

ACADEMIC WORK EXPERIENCE

University of Pittsburgh Mechanical Engineering Department, Pittsburgh, PA October 2018 – December 2018
Student Grader

- Assisted Dr. John Whitefoot as a student grader in Applied Thermodynamics

University of Pittsburgh Excel Program, Pittsburgh, PA January 2018 – April 2018
Tutor

- Tutored historically underrepresented engineering students in Calculus, Differential Equations, and Thermodynamics

RELEVANT COURSEWORK

Computational Methods	Data Science & Machine Learning	Heat Transfer & Thermal-Flow
Applied Computational Physics	Bayesian Statistics	Applied Fluid Mechanics
Numerical Methods	Computer Vision	Applied Thermodynamics
Optimization Methods	Database Management	Computational Fluid Dynamics
Parallel Computing & Computation	Deep Learning & Artificial Intelligence	Heat & Mass Transfer
Materials Science	**Mathematical Analysis**	**Solid Mechanics**
Elements of Materials Science & Engr.	Introduction to Theoretical Mathematics	Elasticity & Fracture Mechanics
Materials & Manufacturing	Numerical Mathematical Analysis	Finite Element Analysis
Materials Structure & Properties	Partial Differential Equations	Statics & Mechanics of Materials

PUBLICATIONS

1. **Strayer, S.T.**, Olleak, A., Vulimiri, P., Hinnebusch, S., Frieden Templeton, W.J., Narra, S.P. and To, A.C., 2024. Controlling Multi-Track Melt Pool Size Variation Based on Local Thermal Environment for Inconel 718 Laser Powder Bed Fusion via Data-Driven Approaches. *In preparation*.
2. **Strayer, S.T.**, Olleak, A., Vulimiri, P., Hinnebusch, S., Frieden Templeton, W.J., Narra, S.P. and To, A.C., 2024. CIFEM: Elucidating the Role of Local Thermal Environment on Multi-Track Melt Pool Morphology Variation for Inconel 718 Laser Powder Bed Fusion. *In preparation*.
3. **Strayer, S.T.**, Olleak, A., Vulimiri, P., Hinnebusch, S., Frieden Templeton, W.J., Narra, S.P. and To, A.C., 2024. Local Thermal Environment Dependent Goldak Heat Source for Robust Multi-Track Melt Pool Morphology Prediction of Inconel 718 Laser Powder Bed Fusion. *In preparation*.
4. Fody, J.M., Narra, S.P., **Strayer, S.**, Templeton, W.F. and Newman, J.A., 2024. A semantic segmentation algorithm for automated rapid melt pool identification from cross-sectional micrographs. *Materials Characterization*, *211*, p.113877.
5. Templeton, W.F., Hinnebusch, S., **Strayer, S.T.**, To, A.C., Pistorius, C. and Narra, S.P., 2023. A mechanistic explanation of shrinkage porosity in laser powder bed fusion additive manufacturing. *Acta Materialia*, p.119632.
6. Templeton, W.F., Hinnebusch, S., **Strayer, S.**, To, A. and Narra, S.P., 2023. Finding the limits of single-track deposition experiments: An experimental study of melt pool characterization in laser powder bed fusion. *Materials & Design*, *231*, p.112069.
7. Mostafaei, A., Ghiaasiaan, R., Ho, I.T., **Strayer, S.**, Chang, K.C., Shamsaei, N., Shao, S., Paul, S., Yeh, A.C., Tin, S. and To, A.C., 2023. Additive Manufacturing of Nickel-based superalloys: a state-of-the-art review on process-structure-defect-property relationship. *Progress in Materials Science*, p.101108.
8. **Strayer, S.T.**, Frieden Templeton, W.J., Dugast, F.X., Narra, S.P. and To, A.C., 2022. Accelerating High-Fidelity Thermal Process Simulation of Laser Powder Bed Fusion via the Computational Fluid Dynamics Imposed Finite Element Method (CIFEM). *Additive Manufacturing Letters*, *3*, p.100081.
9. Olleak, A., Dugast, F., Bharadwaj, P., **Strayer, S.**, Hinnebusch, S., Narra, S. and To, A.C., 2022. Enabling Part-Scale Scanwise process simulation for predicting melt pool variation in LPBF by combining GPU-based Matrix-free FEM and adaptive Remeshing. *Additive Manufacturing Letters*, *3*, p.100051.
10. Dugast, F., Apostolou, P., Fernandez, A., Dong, W., Chen, Q., **Strayer, S.**, Wicker, R. and To, A.C., 2021. Part-scale thermal process modeling for laser powder bed fusion with matrix-free method and GPU computing. *Additive Manufacturing*, *37*, p.101732.
11. Chen, Q., Zhao, Y., **Strayer, S.**, Zhao, Y., Aoyagi, K., Koizumi, Y., Chiba, A., Xiong, W. and To, A.C., 2021. Elucidating the effect of preheating temperature on melt pool morphology variation in Inconel 718 laser powder bed fusion via simulation and experiment. *Additive Manufacturing*, *37*, p.101642.
12. Paul, S., Liu, J., **Strayer, S.T.**, Zhao, Y., Sridar, S., Klecka, M.A., Xiong, W. and To, A.C., 2020. A discrete dendrite dynamics model for epitaxial columnar grain growth in metal additive manufacturing with application to inconel. *Additive Manufacturing*, *36*, p.101611.
13. **Strayer, S.T.**, Moghaddam, S.R.M., Gusenoff, B., Gusenoff, J. and Beschorner, K.E., 2020. Contact Pressures Between the Rearfoot and a Novel Offloading Insole: Results From a Finite Element Analysis Study. *Journal of Applied Biomechanics*, *36*(5), pp.326-333.

CONFERENCE PRESENTATIONS

1. **Strayer, S.T.**, Frieden Templeton, W.J., Olleak, A.A., Dugast, F.X., Narra, S.P., To, A.C. 2023. *CIFEM: Elucidating the Role of Local Preheat Temperature on Multi-track Melt Pool Morphology Variation for Inconel 718 Laser Powder Bed Fusion.* Solid Freeform Fabrication, 14-16 August, Austin, TX.
2. **Strayer, S.T.**, To, A.C. 2023. *A Robust Local Preheat Temperature Dependent Stochastic Finite Element Heat Source Model for Inconel 718 Laser Powder Bed Fusion.* Solid Freeform Fabrication, 14-16 August, Austin, TX.
3. **Strayer, S.T.**, Frieden Templeton, W.J., Olleak, A.A., Dugast, F.X., Narra, S.P., To, A.C. 2023. *Computational Fluid Dynamics Imposed Finite Element Method (CIFEM) for Accelerating High-Fidelity Thermal Process Simulation of Laser Powder Bed Fusion Additive Manufacturing.* 17th National Congress on Computational Mechanics, 23-27 July, Albuquerque, NM.
4. **(KEYNOTE) Strayer, S.T.**, Frieden Templeton, W.J., Olleak, A.A., Dugast, F.X., Narra, S.P., To, A.C. 2022. *Computational Fluid Dynamics Imposed Finite Element Method (CIFEM) for Accelerated High-fidelity Thermal Process Simulation in Laser Powder Bed Fusion Additive Manufacturing.* Society of Engineering Science, 16-19 October, College Station, TX.
5. **Strayer, S.T.**, Frieden Templeton, W.J., Olleak, A.A., Dugast, F.X., Narra, S.P., To, A.C. 2022. *Computational fluid dynamics data-driven heat source model for finite element process simulation in laser powder bed fusion additive manufacturing.* Materials Science & Technology, 9-12 October, Pittsburgh, PA.
6. Frieden Templeton, W.J., **Strayer, S.T.**, Hinnebusch, S., To, A.C., Narra, S.P. 2022. *Characterizing the Effects of Laser Power, Scanning Velocity, and Deposition Temperature on Inconel 718 Single-Track Melt Pool Geometry in Laser Powder Bed Fusion.* Materials Science & Technology, 9-12 October, Pittsburgh, PA.
7. Hinnebusch, S., Olleak, A.A., Barrett, C., **Strayer, S.T.**, Dugast, F.X., To, A.C. 2022. *Layerwise Thermal Process Simulation for Laser Powder Bed Fusion: Calibration and Validation with Infrared Camera.* Materials Science & Technology, 9-12 October, Pittsburgh, PA.
8. **Strayer, S.T.**, Frieden Templeton, W.J., Olleak, A.A., Dugast, F.X., Narra, S.P., To, A.C. 2022. *Computational fluid dynamics data-driven heat source model for finite element process simulation in laser powder bed fusion additive manufacturing.* Solid Freeform Fabrication, 25-27 July, Austin, TX.
9. Hinnebusch, S., Olleak, A.A., Barrett, C., **Strayer, S.T.**, Dugast, F.X., To, A.C. 2022. *Layerwise Thermal Process Simulation for Laser Powder Bed Fusion: Calibration and Validation with Infrared Camera.* Solid Freeform Fabrication, 25-27 July, Austin, TX.
10. **Strayer, S.T.**, Dugast, F.X., Olleak, A.A., Hinnebusch, S., Fody, J., To, A.C. 2021. *Methods for improved part-scale thermal process simulations in laser powder bed fusion.* Materials Science & Technology, 17-21 October, Columbus, OH.
11. To, A.C., Dugast, F.X., **Strayer, S.T.**, Dong, W., Liang, X., Chen, Q., Tran, H., Hinnebusch, S., Jimenez, X. 2021. *Lessons learned from Calibration and Validation of Process Models for Laser Powder Bed Fusion.* Materials Science & Technology, 17-21 October, Columbus, OH.
12. Chen, Q., **Strayer, S.T.**, To, A.C. 2020. *Pore Formation in Laser Powder Bed Fusion Inconel 718 through Multiphysics Modeling.* Materials Science & Technology, 2-6 November, Virtual.
13. **Strayer, S.T.**, Gershanok, S., Pilz, E., Sargent, N., To, A.C. 2019. *Build Plate De-Powdering Machine for use with Metal 3D Printers.* Modeling & Optimization Simulation Tools for Additive Manufacture (MOST-AM) Consortium Biannual Meeting, 1 May, Pittsburgh, PA.