KRZYSZTOF S. STOPKA

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Homepage

RESEARCH INTERESTS

- Advanced manufacturing, specifically additive manufacturing of metals and alloys
- Model-based simulations of materials using frameworks such as crystal plasticity
- Microstructure characterization through conventional and advanced (e.g., synchrotron) techniques
- Data science and machine learning approaches to elucidate process-structure-property relationships

RESEARCH EXPERIENCE

Purdue University, *West Lafayette, IN*

Hypersonics Advanced Manufacturing Technology Center (HAMTC) — Mar 2023 – Present

Research Engineer

- Supporting projects on i) novel niobium alloy development for additive manufacturing, ii) scramjet redesign, and iii) critical joining technologies of ceramic components for boost glide vehicles

Dr. Michael D. Sangid Research Group — Jul 2021 – Present

Postdoctoral Research Associate

- Integrating crystal plasticity models, high energy x-ray diffraction experiments, and machine learning to promote the rapid qualification of additively manufactured materials

David L. McDowell Research Group, Georgia Institute of Technology, *Atlanta, GA* — Aug 2016 – May 2021

Graduate Research Assistant

- Performed large-scale crystal plasticity finite element method simulations of duplex Ti-6Al-4V and Al 7075-T6
- Implemented Python-scripted workflows to explore extreme value fatigue response of intrinsic (grain size, shape, and orientation distributions) and extrinsic (residual stress, surface roughness, inclusions, or pores, etc.) microstructure attributes under various loading (e.g., multiaxial) and boundary conditions
- Developed and currently maintain PRISMS-Fatigue open-source modeling framework

X-ray Science Division, Argonne National Laboratory, *Lemont, IL* — May – Sep 2020

Graduate Researcher

- Analyzed high-energy x-ray diffraction data collected *in situ* during fatigue testing of Ti-6Al-4V
- Reconstructed digital microstructure for crystal plasticity simulations using data fusion approaches

EDUCATION

Doctor of Philosophy, Mechanical Engineering — May 2021
Georgia Institute of Technology, *Atlanta, GA*
Thesis: "Integrated Computational Materials Engineering Workflows for Microstructure-Sensitive Fatigue of Advanced Alloys"
Advisor: Dr. David L. McDowell

Master of Science, Mechanical Engineering — May 2018
Georgia Institute of Technology, *Atlanta, GA*

Bachelor of Science, Mechanical Engineering — Nov 2015
Minor in Computational Science
Rose-Hulman Institute of Technology, *Terre Haute, IN*

PEER-REVIEWED PUBLICATIONS

16. **K. S. Stopka**, A. Desrosiers, A. Andreaco, and M. D. Sangid. A methodology for the rapid qualification of additively manufactured materials based on pore defect structures. *Integr. Mater. Manuf. Innov.*, (2024) doi
15. R. Bandyopadhyay, **K. S. Stopka**, and M. D. Sangid. Initializing intragranular residual stresses within statistically equivalent microstructures for crystal plasticity simulations. *J. Mech. Phys. Solids*, **184**, 105529 (2024) doi
14. **K. S. Stopka** and M. D. Sangid. Modeling fatigue behavior of additively manufactured alloys with an emphasis on pore defect morphology. *J. Mech. Phys. Solids*, **181**, 105429 (2023) doi

13. M. Yaghoobi, **K. S. Stopka**, D. L. McDowell, L. Graham-Brady, and K. Teferra. Effect of sample size on the maximum value distribution of fatigue driving forces in metals and alloys. *Int. J. Fatigue*, **176**, 107853 (2023) doi
12. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, N. Krutz, A. Andreaco, and M. D. Sangid. Intentionally seeding pores in additively manufactured alloy 718: process parameters, microstructure, defects, and fatigue. *Addit. Manuf.*, **66**, 103450 (2023) doi
11. T. Gu, **K. S. Stopka**, C. Xu, and D. L. McDowell. Modeling the statistical distribution of fatigue crack formation lifetime in large volumes of polycrystalline microstructures. *Acta Mater.*, **246**, 118715 (2023) doi
10. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Microstructure-sensitive modeling of surface roughness and notch effects on extreme value fatigue response. *Int. J. Fatigue*, **166**, 107295 (2023) doi
9. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Simulated effects of sample size and grain neighborhood on the modeling of extreme value fatigue response. *Acta Mater.*, **224**, 117524 (2022) doi
8. A. Lakshmanan, M. Yaghoobi, **K. S. Stopka**, et al. Crystal plasticity finite element modeling of grain size and morphology effects on yield strength and extreme value fatigue response. *J. Mater. Res. Technol.*, **19**, 3337-3354 (2022) doi
7. **K. S. Stopka**, M. Yaghoobi, J. E. Allison, and D. L. McDowell. Effects of boundary conditions on microstructure-sensitive fatigue crystal plasticity analysis. *Integr. Mater. Manuf. Innov.*, **10**, 393-412 (2021) doi
6. M. Yaghoobi, **K. S. Stopka**, A. Lakshmanan, V. Sundararaghavan, et al. PRISMS-Fatigue computational framework for fatigue analysis in polycrystalline metals and alloys. *npj Comput. Mater.*, **7**, 38 (2021) doi
5. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational multiaxial fatigue of Al 7075-T6 and duplex Ti-6Al-4V. *Int. J. Fatigue*, **133**, 105460 (2020) doi
4. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational estimates of driving forces for surface versus subsurface fatigue crack formation in duplex Ti-6Al-4V and Al 7075-T6. *JOM*, **72**, 28-38 (2020) doi
3. **K. S. Stopka**, T. Gu, and D. L. McDowell. Effects of algorithmic simulation parameters on the prediction of extreme value fatigue indicator parameters in duplex Ti-6Al-4V. *Int. J. Fatigue*, **141**, 105865 (2020) doi
2. T. Gu, **K. S. Stopka**, C. Xu, and D. L. McDowell. Prediction of maximum fatigue indicator parameters for duplex Ti-6Al-4V using extreme value theory. *Acta Mater.*, **188**, 504-516 (2020) doi
1. A. E. Tallman, **K. S. Stopka**, L. P. Swiler, Y. Wang, et al. Gaussian-process-driven adaptive sampling for reduced-order modeling of texture effects in polycrystalline alpha-Ti. *JOM*, **71**, 2646-2656 (2019) doi

CONFERENCE PROCEEDINGS

2. **K. S. Stopka**, J. Smallwood, A. Chokshi, S. D. Heister, and M. D. Sangid. Structural and fatigue analysis of a rotating detonation rocket engine. *American Institute of Aeronautics and Astronautics (AIAA) SciTech Forum* (2023) doi
1. **K. S. Stopka**, G. Whelan, and D. L. McDowell. Microstructure-sensitive ICME workflows for fatigue critical applications. *Society of the Advancement of Material and Process Engineering (SAMPE)* (2019) doi

CONFERENCE PRESENTATIONS AND TALKS

21. UPCOMING: **K. S. Stopka**, Y. Sun, P. Kenesei, J-S. Park, J. Solano, A. Desrosiers, A. Andreaco, G. Lin, and M. D. Sangid. Multimodal Characterization and Modeling of Additively Manufactured Alloys with Intentionally Seeded Pores. *The Minerals, Metals & Materials Society (TMS 2024),* Orlando, FL, March 7th, 2024.
20. UPCOMING: **K. S. Stopka** and M. D. Sangid. Crystal Plasticity Fatigue Modeling of Additively Manufactured Materials with Various Pore Defect Morphology. *TMS 2024,* Orlando, FL, March 5th, 2024.
19. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, N. Krutz, A. Andreaco, and M. D. Sangid. Intentionally seeding pores in laser powder bed fusion IN718: microstructure, defects, and fatigue. *TMS 2023,* San Diego, CA, March 22nd, 2023.
18. **K. S. Stopka** and M. D. Sangid. Modeling fatigue resistance in additively manufactured alloys with porosity defects. *TMS 2023,* San Diego, CA, March 22nd, 2023.
17. **K. S. Stopka**, J. Smallwood, A. Chokshi, S. D. Heister, and M. D. Sangid. Structural and fatigue analysis of a rotating detonation rocket engine. *AIAA SciTech Forum,* National Harbor, MD, January 26th, 2023.
16. **K. S. Stopka** and M. D. Sangid. Experimental validation of crystal plasticity models with additively manufactured defects. *AIAA SciTech Forum,* National Harbor, MD, January 23rd, 2023.
15. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, A. Andreaco, and M. D. Sangid. Examining the micromechanical response of additively manufactured Alloy 718 intentionally seeded with pores. *Workshop on High-Energy Diffraction Microscopy analysis using Microstructural Imaging using Diffraction Analysis Software (MIDAS),* Lemont, IL, November 9th, 2022.
14. INVITED: **K. S. Stopka** and M. D. Sangid. Micromechanical modeling of porosity defects in additively manufactured alloys. *International Conference on Additive Manufacturing (ICAM 2022),* Orlando, FL, November 3rd, 2022.
13. **K. S. Stopka**, A. Desrosiers, T. Nicodemus, A. Andreaco, and M. D. Sangid. Progress towards a standard for rapid qualification of additively manufactured materials based on defect structures. *ICAM 2022,* Orlando, FL, November 2nd, 2022.

12. INVITED: **K. S. Stopka**, M. Yaghoobi, J. E. Allison, D. L. McDowell, and M. D. Sangid. Modeling fatigue using digital microstructures: applications of DREAM.3D. *2022 Workshop on Methods for Three-Dimensional Microstructure Studies,* Pittsburgh, PA, August 17th, 2022.
11. **K. S. Stopka**, M. Yaghoobi, A. Lakshmanan, J. E. Allison, and D. L. McDowell. Microstructure-sensitive modeling of surface roughness and notch effects on extreme value fatigue response. 2022 *Annual PRISMS Center Workshop,* August 12th, 2022, virtual event.
10. **K. S. Stopka,** M. Yaghoobi, J. E. Allison, and D. L. McDowell. Effects of boundary conditions on microstructure-sensitive fatigue crystal plasticity analysis. *The 6th World Congress on Integrated Computational Materials Engineering (ICME 2022)*, Incline Village, NV, April 25th, 2022.
9. **K. S. Stopka** and M. D. Sangid. Micromechanical modeling of porosity defects in additively manufactured alloys. *TMS 2022,* Anaheim, CA, March 2nd, 2022.
8. **K. S. Stopka,** M. Yaghoobi, J. E. Allison, and D. L. McDowell. Microstructure effects on the extreme value fatigue response of FCC metals and alloys: effects of sample size and grain neighborhood. *TMS 2022*, Anaheim, CA, March 1st, 2022.
7. **K. S. Stopka**, M. Yaghoobi, A. Lakshmanan, V. Sundararaghavan, J. E. Allison, and D. L. McDowell. PRISMS-Fatigue: overview and case studies. 2021 *Annual PRISMS Center Workshop,* August 3rd, 2021, virtual event.
6. **K. S. Stopka**, J.S. Park, H. Sharma, et al. Reconstruction of microstructure and defects in an Alpha + Beta processed Ti-6Al-4V plate product using High-energy X-ray Diffraction Microscopy and DREAM.3D. *5th International Congress on 3D Materials Science (3DMS 2021)*, July 1st, 2021, virtual event.
5. **K. S. Stopka** and D. L. McDowell. Effects of surface roughness on microstructure-sensitive computations of fatigue crack formation driving force in duplex Ti-6Al-4V and Al 7075-T6. *TMS 2020*, San Diego, CA, February 26th, 2020.
4. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational estimates of driving forces for surface vs. subsurface fatigue crack formation in Duplex Ti-6Al-4V and Al 7075-T6. *Materials Science and Technology (MS&T) 2019*, Portland, OR, September 30th, 2019.
3. **K. S. Stopka** and D. L. McDowell. Microstructure-sensitive computational multiaxial fatigue. *12th International Conference on Multiaxial Fatigue and Fracture (ICMFF12) 2019*, Bordeaux, France, June 24th, 2019.
2. **K. S. Stopka**, A. E. Tallman, L. P. Swiler, Y. Wang, S. R. Kalidindi, and D. L. McDowell. Gaussian-process-driven adaptive sampling for reduced-order modeling of texture effects in polycrystalline alpha-Ti. *TMS 2019*, San Antonio, TX, March 12th, 2019.
1. **K. S. Stopka** and D. L. McDowell. Computational statistics of formation and early growth of microstructurally small cracks in Ti-6Al-4V. *MS&T 2018*, Columbus, OH, October 17th, 2018.

SERVICE

Peer reviewer (64 total manuscript reviews) for the following journals, Publons Profile — Mar 2019 – Present

- International Journal of Fatigue, International Journal of Fracture, Acta Materialia, Materialia, Engineering Failure Analysis, Engineering Fracture Mechanics, Frontiers in Materials, JOM, Mathematics, Applied Science

The Minerals, Metals & Materials Society (TMS), Committee member — Mar 2021 – Present

- Integrated Computational Materials Engineering (ICME), Mechanical Behavior of Materials

Grant proposal reviewer for the following organizations: — Aug 2023 – Present

- Deutsche Forschungsgemeinschaft (German Research Foundation); ~$400,000 budget requested

MENTORSHIP

Georgia Institute of Technology, *Atlanta, GA* — Aug 2018 – May 2019

Leadership Education and Development (LEAD) Coach

- Met one-on-one with undergraduate and graduate students for personalized coaching sessions
- Coached a total of six students during the 2018-2019 academic year

Purdue University, *West Lafayette, IN* — July 2021 – Present

Postdoctoral Research Associate, Dr. Michael D. Sangid Research Group

- Mentored undergraduate students during the 2021 Summer Undergraduate Research Fellowship (SURF) program and during the Spring 2023 term within Dr. Sangid's research group
- Mentored seven doctoral students and three master's students through weekly meetings

PROPOSAL PREPARATION

Purdue University, *West Lafayette, IN* July 2021 – Present
Postdoctoral Research Associate

- Wrote a Guest User Proposal (GUP) that was awarded beamtime at the Advanced Photon Source
- Assisted in writing a proposal for a NASA Space Technology Research Institutes (STRI) solicitation for *Accelerating Additive Manufacturing Certification with Model-Based Tools*
- Contributed to a white paper submitted to the Air Force Office of Scientific Research detailing the material, structural, and durability analyses of additively manufactured copper alloys for rotating detonation rocket engines (RDREs)
- Supported a grant proposal (funding opportunity number: DE-FOA-0003016) aimed at addressing the extreme unsteadiness and the associated large pressure and temperature gradients during operation of RDREs

PROFESSIONAL DEVELOPMENT

Georgia Institute of Technology, *Atlanta, GA* Fall 2019 – Fall 2020
Tech to Teaching, Center for Teaching and Learning

- Completed two graduate-level courses and a capstone teaching experience to prepare future faculty
- Delivered six lectures in graduate-level courses on *Fatigue of Materials and Structures* and *Fundamentals of Fracture Mechanics*

INDUSTRY EXPERIENCE

B/E Aerospace, *Rockford, IL* Dec 2015 – Jul 2016
Project Engineer

- Conducted Root Cause Analysis to improve reliability of Vacuum Pump
- Worked with customers / suppliers to improve Vacuum Pump performance for multiple aircraft
- Collaborated with design engineers to redesign Embraer Vacuum Waste System

GE Aviation, *Evendale, OH* Jun – Aug 2015
GEnx Engine Performance Intern

- Remedied process of deriving humidity and condensation fan speed adders for production
- Calculated Test Vectors to support new 76K thrust rating for Boeing
- Determined effects of engine's physical turbine deviation on thrust and SFC

Space Exploration Technologies (SpaceX), *Hawthorne, CA* Sep – Nov 2014
Structures Intern

- Designed testing fixture for v2.0 Landing Leg weather seal Research and Development
- Directed tensile, fatigue, torch, and vacuum testing to validate Pyron and Nomex felts as replacement for cork as Temperature Protection System on Falcon 9 Landing Legs
- Evaluated strength of Carbon Fiber samples with Composi-lok fasteners for v2.0 Landing Legs

GE Aviation, *Rockford, IL* Jun – Aug 2014
Manufacturing Engineering Intern

- Appraised LEAP combustor Nacelle Anti-Ice Valve drawings for manufacturability and cost
- Enhanced Qualification Matrix to expand site worker versatility
- Created drawings and process plans for developmental parts using SolidWorks

Tesla Motors, *Fremont, CA* Sep 2013 – Feb 2014
Craftsmanship Vehicle Engineering Intern

- Determined root cause and solution to Model S Instrument Panel fitment inconsistency
- Enriched Research and Development for Model X program to study what competitor vehicles are doing and set competitive or class leading margins for interior and exterior components
- Sourced an E-Cube and Blue Buck project to aid Model X future dimensional quality
- Lead and assisted in custom Model S builds to assess new and modified components

GE Aviation, *Terre Haute, IN* Mar – Aug 2013
Manufacturing Engineering Intern

- Completed weld certifications and gathered dimensional data for Passport and LEAP combustors
- Interpreted GD&T blueprints for online characteristic accountability system
- Updated operation sketches, part routers and check sheets

Diesel Radiator Company, *Melrose Park, IL* Jun – Aug 2012
Design and Manufacturing Engineering Intern

- Reduced steel scrap by an average of 9.7% for high quantity radiator jobs
- Designed facility apparatuses, such as stainless-steel ductwork, and a brass uncoiler and shear rail
- Resolved day to day computer numerical control issues affecting production