Opportunity Title: Computational Micromechanics and Microstructure-Sensitive Analysis for Advanced Metallic Materials
Opportunity Reference Code: 0051-NPP-NOV26-LRC-Aeronautics

Organization National Aeronautics and Space Administration (NASA)

Reference Code 0051-NPP-NOV26-LRC-Aeronautics

How to Apply All applications must be submitted in Zintellect

Please visit the NASA Postdoctoral Program website for application instructions and requirements: How to Apply | NASA Postdoctoral Program (orau.org)

A complete application to the NASA Postdoctoral Program includes:

1. Research proposal
2. Three letters of recommendation
3. Official doctoral transcript documents

Application Deadline 11/1/2026 6:00:59 PM Eastern Time Zone

Description **About the NASA Postdoctoral Program**

The NASA Postdoctoral Program (NPP) offers unique research opportunities to highly-talented scientists to engage in ongoing NASA research projects at a NASA Center, NASA Headquarters, or at a NASA-affiliated research institute. These one- to three-year fellowships are competitive and are designed to advance NASA's missions in space science, Earth science, aeronautics, space operations, exploration systems, and astrobiology.

Description:

The primary focus of this opportunity is to perform computational and experimental research in the Structures and Materials Division at NASA Langley Research Center to advance microstructure-sensitive modeling, high-fidelity experimental characterization, and uncertainty quantification capabilities for metallic aerospace materials, with emphasis on additively manufactured (AM) metals.

The Durability, Damage Tolerance, and Reliability Branch (DDTRB) conducts a broad-based research and technology program that quantifies behavior, durability, and damage tolerance of structural materials; develops efficient, physics-based analytical and computational methods; develops new innovative test methods; and validates performance of advanced materials and structures for aerospace applications in support of NASA, other government agencies, and the aerospace industry. Deployment of AM metallic components in aerospace applications is inhibited by an insufficient understanding and quantification of the relationship between process-induced microstructural variability and mechanical performance. The broad vision of this work is to develop computational tools and frameworks that connect microstructure characterization data to predictions of mechanical behavior, damage evolution, and fatigue performance in these materials.

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Quantitative validation of these computational tools is of particular interest to support next-generation qualification processes for aerospace structures.

Computational efforts in this area are focused on crystal plasticity and damage modeling at the grain scale, with particular interest in understanding how microstructural features such as grain morphology, crystallographic texture, porosity, surface roughness, and residual stress influence local and global mechanical response. A key challenge is that typical experimental characterization methods (e.g., electron backscatter diffraction, digital image correlation) provide only surface-level grain structure information, while the subsurface microstructure remains uncharacterized. Understanding the sensitivity of model predictions to these unobserved subsurface features is critical for establishing the fidelity and reliability of simulation-informed qualification approaches.

Also of interest are methods for constructing micromechanical models directly from multi-modal experimental data, including synchrotron X-ray measurements, computed tomography, and surface characterization techniques. The development of automated pipelines for image-based model construction, registration across measurement modalities, and propagation of data processing uncertainties into downstream mechanical predictions is an active area of research. Experience in generating, processing, and interpreting these rich experimental datasets is highly relevant to this work.

Opportunities exist to participate in all aspects of the research, development, and application of computational micromechanics modeling efforts, including experimental characterization activities that inform and validate the computational work. Researchers in the group have experience with crystal plasticity using finite element and fast Fourier transform methods, fatigue indicator parameters, process modeling and machine learning methods for microstructure generation, and uncertainty quantification approaches for model calibration and validation.

Successful applicants should have a PhD in an appropriate field of study and have programming experience related to finite element analysis and scientific computing in Python.

Field of Science: Aeronautics

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Questions about this opportunity? Please email npp@orau.org

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Qualifications

The candidate should have a PhD in Mechanical Engineering, Aerospace Engineering, Materials Science and Engineering, or a related technical discipline.

The candidate should have experience in finite element analysis software packages, such as Abaqus.

The candidate should have experience in scientific computing with Python, including familiarity with computational libraries for numerical analysis and data processing.

The candidate should have experience or demonstrated interest in one or more of the following areas: crystal plasticity, microstructure-sensitive fatigue, computational damage mechanics, uncertainty quantification, or image-based model construction.

The candidate should have experience or demonstrated interest in advanced microstructural characterization of metallic materials (e.g., synchrotron X-ray diffraction, computed tomography, electron backscatter diffraction, digital image correlation).

Point of Contact Mikeala

Eligibility Requirements

- **Citizenship:** LPR or U.S. Citizen
- **Degree:** Doctoral Degree.