PREP Research Associate

This position is part of the National Institute of Standards (NIST) Professional Research Experience (PREP) program. NIST recognizes that its research staff may wish to collaborate with researchers at academic institutions on specific projects of mutual interest, thus requires that such institutions must be the recipient of a PREP award. The PREP program requires staff from a wide range of backgrounds to work on scientific research in many areas. Employees in this position will perform technical work that underpins the scientific research of the collaboration.

Research Title:
Open-Architecture Additive Manufacturing Platform Development

The work will entail:
As part of its efforts to meet the needs of U.S. manufacturers in advanced manufacturing, the National Institute of Standards and Technology (NIST) has developed an open-architecture Additive Manufacturing (AM) platform. This platform consists of open-architecture AM testbeds, including the Additive Manufacturing Metrology Testbed (AMMT) and the Laser Processing and Metrology Testbed (LPDT), as well as an open-architecture AM processing software utility known as Smart Additive Manufacturing (SAM). AMMT is a full-scale AM machine equipped with dual lasers and the capability to emulate most commercial laser powder bed fusion machines while building industrial-scale parts. It is powered by open-architecture pointwise control technology and supports closed-loop control based on in-situ measurements of melt pool area using field-programmable gate array (FPGA)-based cameras and layer-wise surface profile measured by a laser profiler. LPDT is a portable testbed that can be installed and operated under high-energy synchrotron X-ray measurements to observe internal process phenomena, using the same control architecture as AMMT, and complements the AM process measurements conducted on AMMT. The SAM utility converts computer-aided design (CAD) designs into scan commands with maximum flexibility, compatible with both Common Layer Interface (CLI) and G-code and provides full transparency through intermediate output files including sliced layers, G-code, and pointwise commands, enabling unambiguous execution on open-architecture AM testbeds. Together, this platform enables research that advances additive manufacturing from a geometry-focused paradigm to a material-focused and process-aware framework. The Research Associate will assist NIST engineers in developing and improving this platform, including new mechanical, electrical, and optical hardware and control software for the AM testbeds, enhancing the SAM software utilities, supporting experiment planning and execution at NIST and external synchrotron X-ray facilities, and contributing to data processing, analysis, and dissemination efforts that support the NIST open-architecture AM platform.

U.S. Citizen preferred

Key responsibilities will include but are not limited to:
- Analyzing, pre-processing, and formatting data generated from NIST AM testbeds, and comparing these data with datasets acquired from other NIST systems and external collaborators.
- Developing methods to fuse multi-modality data from AM process monitoring for process anomaly detection and quality assessment.
- Presenting research results at internal and external meetings and assisting in organizing workshops to disseminate NIST open-architecture AM platforms.
- Providing assistance with CAD, digital signal processing hardware and algorithms, and prototyping of new measurement systems on the AM testbeds.
- Assisting in deploying real-time feedback control capabilities on AMMT and LPDT as a retrofit solution for existing AM systems.

- Providing technical support for the planning, execution, and data collection phases of experiments conducted on the AMMT at NIST.
- Providing end-to-end support for synchrotron-based research, from the logistics of LPDT transport and setup at external facilities to the post-experimental analysis of complex X-ray diffraction data

Qualifications

- PhD degree in Mechanical Engineering, Information Science, or a closely related field.
- Eight or more years of relevant research experience in additive manufacturing or closely related advanced manufacturing systems.
- Demonstrated expertise in laser-based metal additive manufacturing processes.
- Extensive experience with in-situ measurements and process monitoring applied to advanced manufacturing processes. Experience with high-speed visible and thermographic imaging techniques preferred.
- Strong background and demonstrated experience working with and developing applied machine learning and deep learning algorithms, with experience in machine vision and image processing applications preferred.
- Experience with AM system control frameworks and familiarity with industry AM communication protocols.
- Experience with FPGA-based sensing systems, including familiarity with FPGA architectures and at least one FPGA programming or integration workflow.
- Demonstrated professional service and leadership experience, including organizing workshops, seminars, conferences, or hackathon-style technical events.
- Strong oral and written communication skills, supported by a record of peer-reviewed publications and presentations to technical and multidisciplinary audiences.

Privacy Act Statement

Authority: 15 U.S.C. § 278g-1(e)(1) and (e)(3) and 15 U.S.C. § 272(b) and (c)

Purpose: The National Institute for Standards and Technology (NIST) hosts the Professional Research Experience Program (PREP) which is designed to provide valuable laboratory experience and financial assistance to undergraduates, post-bachelor's degree holders, graduate students, master's degree holders, postdocs, and faculty.

PREP is a 5-year cooperative agreement between NIST laboratories and participating PREP Universities to establish a collaborative research relationship between NIST and U.S. institutions of higher education in the following disciplines including (but may not be limited to) biochemistry, biological sciences, chemistry, computer science, engineering, electronics, materials science, mathematics, nanoscale science, neutron science, physical science, physics, and statistics. This collection of information is needed to facilitate administrative functions of the PREP Program.

Routine Uses: NIST will use the information collected to perform the requisite reviews of the applications to determine eligibility, and to meet programmatic requirements. Disclosure of this information is also subject to all the published routine uses as identified in the Privacy Act System of Records Notices: NIST-1: NIST Associates.