Opportunity Title: Engineering/Mathematics: Additive Manufacturing/Data Analytics - Faculty
Opportunity Reference Code: ERDC-ITL-2022-0004-F

Organization U.S. Department of Defense (DOD)

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How to Apply Click on *Apply* now to start your application.

Description The US Army Engineer Research and Development Center (ERDC) is an integral component of the Office of the Assistant Secretary of Defense for Research and Engineering and helps solve our Nation's most challenging problems in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, Department of Defense, civilian agencies, and our Nation's public good. The Information Technology Lab (ITL) at ERDC, in collaboration with university and industry partners, have collected unprecedented databases of well curated "meta data" that encode the environmental, processing, mechanical, and material features influencing the properties and performance of AM manufactured components.

What will I be doing?

You will be collaborating with ERDC researchers in activities related to exploratory searches of additive manufacturing (AM) production dependencies (materials, temperature, geometries, scale, etc.) paired with post manufacturing testing metrics of erroneous and quality outcomes associated with polymer additive manufacturing processes. Under the guidance of a mentor, you will research along side ERDC researchers using machine learning (ML) techniques by querying sensor collections and associated physical metrics gathered and stored in a data warehouse. You will leverage existing and/or develop new machine learning techniques and tools to identify patterns within the data sets and provide statistical levels of certainty related to quality assurance. Specifically, you will seek to leverage these data in extracting compact, easily understood closed-form expressions for predicting outcomes from various components within the stack comprising the overall AM workflow. The benefit of such closed form expressions is that they compress the complex and subtle patterns present in the data, that are hard/impossible for humans to detect, into meaningful mathematical expressions that are familiar to engineers and processing technicians. In a sense, these equations represent the ultimate "reduced order model," as the approach to achieving a desired technological aim can be uncovered with pencil and paper, or small scripts, as opposed to running cumbersome high fidelity simulations. In addition, the resulting form of the closed form expression provides hints regarding the underlying physical mechanisms at work in creating the patterns within the collected data. Such mechanistic bases for these mathematical expressions then allow one to extrapolate out from the data that have been observed; thus enabling much more robust processing design efforts for improving AM performance and outcomes. The discovery of such compact, closed-form mathematical expressions will require novel machine learning architectures, that are different from the standard ML architectures that have been so useful in transforming our everyday world. The data that these standard ML approaches ingest are typically vast and have almost no noise. In contrast, the technological spheres, within the physical world, yield data that are frequently biased and noisy. To achieve our above stated aims for improving AM processing outcomes, we require a new approach to ML: something we call scientific machine learning (SciML). The desired SciML architectures should be able to work with real-world processing data, so as to discover subtle, elusive patterns, and then present these in a human-readable (i.e. mathematical) form. The anticipated SciML architectures we seek should be portable and extensible; thus we desire that existing state-of-the-art ML libraries (i.e.PyTorch and TensorFlow) form the backbone of any such effort. You will incorporate these tools and or processes into the data warehouse software to help automate the analysis processes for future research.

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Where will I be located? Remote

Why should I apply?

This fellowship provides the opportunity to independently utilize your skills and engage with experts in innovative ideas to move the proposed
research forward.

What is the anticipated start date?

ERDC-ITL is ready to make an appointment immediately. Exact start date will be determined at the time of selection and in coordination with the selected candidate.

What are the benefits?

You will receive a stipend to be determined by ERDC-ITL. Stipends are typically based on the participant's academic standing, discipline, experience, and research facility location. Other benefits may include the following:

- Health Insurance Supplement. Participants are eligible to purchase health insurance through ORISE.
- Relocation Allowance
- Training and Travel Allowance

This ORISE appointment is a part-time twelve month opportunity. Appointments may be extended depending on funding availability, project assignment, program rules, and availability of the participant.

Nature of the Appointment

You will not enter into an employee/employer relationship with ORISE, ORAU, DOD, or any other office or agency. Instead, you will be affiliated with ORISE for the administration of the appointment through the ORISE appointment letter and Terms of Appointment.

Qualifications

Degrees in Engineering and Mathematics. Specifically a background in Scientific Computing. Scientific Computing is the collection of tools, techniques, and theories required to solve on a computer mathematical models of problems in engineering and science. Experience and or research projects using novel mathematical and computational approaches that enable deep understanding of natural and engineered systems. Demonstrations of practical challenges involving the principled treatment of uncertainty, sparse sensing, and intrinsic complexity in various systems.

A complete application consists of:

- Zintellect profile
- Educational and Employment History
- Curriculum Vitae (PDF)
- Salary Certification from your university

Submitted documents must have all social security numbers, student identification numbers, and/or dates of birth removed (blanked out, blackened out, made illegible, etc.) prior to uploading into the application system. If you have questions, send an email to usace@orise.orau.gov. Please list the reference code of this opportunity in the subject line of the email. Please understand that ORISE does not review applications or select applicants; selections are made by the sponsoring agency identified on this opportunity. All application materials should be submitted via the "Apply" button at

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the bottom of this opportunity listing. Please do not send application materials to the email address above. All documents must be in English or include an official English translation.

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Eligibility Requirements

- **Citizenship:** U.S. Citizen Only
- **Degree:** Doctoral Degree.
- **Academic Level(s):** Postdoctoral.
- **Discipline(s):**
  - **Computer, Information, and Data Sciences** (17 👁)
  - **Earth and Geosciences** (21 👁)
  - **Engineering** (27 👁)
  - **Environmental and Marine Sciences** (14 👁)
  - **Life Health and Medical Sciences** (48 👁)
  - **Mathematics and Statistics** (11 👁)
- **Age:** Must be 18 years of age