NOMAD
RESEARCH INSTITUTE

CUTTING EDGE RESEARCH. COLLABORATION. NETWORKING. SOUTHWEST CULTURE.

The Nonlinear Mechanics and Dynamics (NOMAD) Research Institute seeks to tackle research challenges in the field of nonlinear mechanics and dynamics by forming diverse teams of B.S., M.S., and Ph.D. students. The program is sponsored by Sandia National Laboratories and the University of New Mexico.

The Program.

- The program will run from **June 15 to August 7, 2026** at the University of New Mexico Campus in Albuquerque, NM
- You are matched with research projects based on your **research interests and skills**.
- **Internships available** to U.S. citizens, legal permanent residents, asylees or refugees in the U.S. (See job posting ID Grad #696396 & Undergrad #696395)

The Benefit.

- Meaningful work in your area of interest to improve understanding of cutting edge research and development
- Short-term position to accommodate the graduate research commitments of students
- An opportunity to present and publish novel research in nonlinear mechanics and dynamics

The Engineering Disciplines.

- Mechanical
- Civil
- Aerospace
- Engineering Mechanics
- Applied Mathematics
- Materials

The Contacts.

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PROJECTS SUMMER 2026

Implementing Multi-Input-Multi-Output Shock Capabilities

Multi-Input-Multi-Output (MIMO) testing capabilities have been recently implemented as an alternative to vibration shaker tables. They have many advantages, including more realistic boundary conditions, portable setups, and lower costs. This project will focus on the development and implementation of MIMO shock testing, including writing and implementing MIMO shock environment specifications, using MIMO shock capabilities in the Rattlesnake control software, and model integration with MIMO shock test data.

Dynamically Informed Topology Optimization of Nonlinear Bolted Structures

A recently developed topology optimization capability produces mock components that match the structural dynamics of the actual component, enabling higher-fidelity information earlier in the design process. Challenges to implementation include accounting for bolted joints when components are printed in multiple pieces, and distortion of thin-walled structures. This project will address these challenges using an additively manufactured, modally representative baseball bat.

Chaotic Vibration Response of Nonlinear Components Under Forced Vibration

High-fidelity numerical simulations of complex electromechanical devices have shown extreme sensitivity to non-physical parameters. This observed behavior is reminiscent of chaotic behavior for nonlinear dynamical systems. The goal of this project is to perform a set of vibration experiments to evaluate the sensitivity of the measured vibration response to various conditions, assess whether the system is behaving chaotically, and apply approaches to analyzing chaotic responses for a deterministic system.

Microstructure-Property Relationships in Tantalum Alloys

Understanding the effect of microstructure on ductility is vital to model tantalum alloys. The goal of this project is to understand the relationship between microstructure and macroscale response through modeling and simulation activities in tantalum alloys. Students will employ crystal plasticity and continuum-scale finite element models. Results will inform how grain morphology and crystallographic texture affect material response and reveal connections between micro- and macro-scale model parameters to facilitate multiscale modeling.

Experimental Characterization of Gas Transport in a Vibrated Multiphase System

This project aims to characterize vibrated liquid-gas interface breakup and subsequent gas transport in a simple multiphase system by acquiring and quantitatively analyzing images from high-speed videography. The desired outcome is an improved understanding of how these processes depend on key parameters, including vibration amplitude, vibration frequency, and total gas volume fraction.

Predicting Printability of Particle-Laden Inks

Additive manufacturing technologies based on material extrusion hinge on particle-laden inks that are printable. A new criterion based on particle loading in the ink differentiates printable inks from poor inks. The students will leverage existing datasets to perform particle packing simulations. Particle suspension constitutive equations to capture the rheology coupled to level set methods will be evaluated. Experiments will assess the impacts of feedstock modifications on printability to maximize particle loading.

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525. SAND2025-14788M