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, as well as post-doctoral and early-career researchers. The program is sponsored by Sandia National Laboratories and the University of New Mexico.

The Program.

- Held from **June 15, 2020** to **July 30, 2020** 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 (see job posting ID 670582 for undergrad, 670584 for grad)

The Benefit.

- Meaningful work in your area of interest to improve understanding of **cutting edge research and development**
- Collaborate with researchers from around the world under the mentorship of the **professional community**
- **Short-term position** to accomodate 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.

Dr. Robert Kuether
NOMAD Technical Lead
Sandia National Laboratories
rjkueth@sandia.gov

Brooke Allensworth
Logistics Coordinator
Sandia National Laboratories
ballens@sandia.gov

Visit NOMAD online at sandia.gov by visiting **http://tinyurl.com/gw8r5wf**

Sandia National Laboratories | UNM | N-O-MAD Research Institute | U.S. Department of Energy | NNSA National Nuclear Security Administration

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.
SAND2019-15090 HR SB

2020 NOMAD PROJECT LIST

Nonlinear Analysis of Mechanical Joints in Finger-Like Mechanism-Based Morphing Wing Devices

Morphing wing designs can adaptively change the wing geometry and reconfigure themselves into multiple and optimal shapes for specific flight conditions. The NOMAD team will experimentally and computationally investigate the nonlinear response within a finger-like mechanism subassembly with several jointed connections. The goal of the project is to better understand the influence of nonlinearity on the modal characteristics, such as damping and resonant frequency.

Neural Network Informed Uncertainty Quantification for Structural Dynamics Reduced Order Models

Reduced order models (ROMs) with discrete single-valued parameters, stochastic parameters (sROMs) or varying parameters (PROMs) are of interest for digital twin applications. This research project seeks to leverage data science to update the ROM parameter space based on actual sensor readings from a deployed system. The team will develop a machine learning framework that links to the ROM and suggests updated, physically realizable parameter values or distributions.

Assessment of Bolted Joint Integrity using Modal Filtering Techniques

Previous work has shown that estimates of modal contributions obtained by modal filtering can be used to successfully locate applied forces, local system changes, and nonlinear contact/forces. An application of these techniques will be explored to assess the integrity of bolted joints. Experiments will be performed on a jointed steel tube assembly in several bolt preload or loosening scenarios with the intention to determine the technique's robustness, reliability, and limitations.

Nonlinear Normal Mode Force Appropriation Techniques to Investigate Wing-Pylon Assembly

Nonlinearity in structural dynamics require alternate approaches to system identification and computational modeling to better understand complicated, nonlinear physics. This project will investigate the dynamics of a wing-like structure designed to replicate the next level subassembly of a pylon with concentrated nonlinearity at the wing connection. The team will use nonlinear normal mode theory to characterize the frequency-amplitude backbones and internal resonances of both the isolated pylon and the next-level wing-pylon subassembly.

Using Modal Analysis to Inform the Design of Electrical Switches

Electrical switches function by mechanically connecting two electrically conductive metal contacts together and provide a means of opening and closing electrical circuits. The objective of this project will be to assess whether linear or nonlinear modal analysis can inform the design of electrical switches to mitigate contact chatter in severe vibration environments. The NOMAD team will develop computational models and perform experiments of a pin-receptacle contact pair to explore the resonant behavior.

Correlation of Reduced-Order Model of Threaded Fastener

Models of threaded fasteners in system-level models need to be greatly simplified for computational efficiency but also need to resolve multiaxial behavior to capture the potentially tortuous ways the fastener can be loaded. The NOMAD team will develop and correlate three variants of reduced-order models of a threaded fastener to test data obtained in combined tensile and shear loading. The goal of the project will be to contrast the advantages and limitations of each model when considering the multiaxial load scenarios.

Sandia National Laboratories | UNM | N-O-MAD Research Institute | U.S. Department of Energy | NNSA National Nuclear Security Administration

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.
SAND2019-15090 HR SB