# 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 M.S. and Ph.D. students, as well as post-doctoral and early-career researchers, from the U.S. and abroad. The program is sponsored by Sandia National Laboratories and the University of New Mexico.

### The Program.

- Held from **June 18, 2018** to **August 2, 2018** 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 and foreign citizens attending U.S. institutions (see job posting ID 660515 for undergrad and 660517 for grad)
- Interested foreign citizens attending foreign universities should contact the NOMAD technical lead

### 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.


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# 2018 NOMAD PROJECT LIST

## Constructing Optimal Surrogate Models for Bolted Fasteners in Multiaxial Loading.

This project will develop optimally calibrated, reduced-order models to simplify accurate predictions of the response of threaded fasteners under multiaxial loading while also exploring the most practical and appropriate constitutive material model to reproduce multiaxial failure.

Mentors: John Mersch (Sandia National Laboratories), Jeff Smith (Sandia National Laboratories), Gustavo Castelluccio (Cranfield University), John Emery (Sandia National Laboratories), and Peter Grimmer (Sandia National Laboratories).

## Influences of Modal Coupling on Experimentally Extracted Nonlinear Modal Models.

This project will use a state-of-the-art system identification technique to populate nonlinear quasi-modal models of an experimental system with jointed interfaces using both narrow and broadband excitation techniques, and validate their models using excitations over an extensive range of amplitudes.

Mentors: Dan Roettgen (Sandia National Laboratories), Ben Pacini (Sandia National Laboratories), Matt Allen (University of Wisconsin-Madison), and Rob Kuether (Sandia National Laboratories).

## A Priori Methods to Assess the Strength of Nonlinearities for Design Applications.

The goal of this project is to explore a metric for design to quantify the strength of a nonlinearity in bolted structures using the magnitude and uniformity of the contact pressure within an interface and assessing the loads applied to the interface during modal excitation.

Mentors: Matt Brake (Rice University), Adam Brink (Sandia National Laboratories), Ben Pacini (Sandia National Laboratories), Rob Flicek (Sandia National Laboratories), Christoph Schwingshackl (Imperial), and Eric Dodgen (National Security Campus).

## Fatigue Properties of Additively Manufactured Hiperco.

In this study, the students will explore the effect of inherent flaws on the fatigue life of additively manufactured (AM) Hiperco material coupons in comparison to conventionally manufactured specimens and develop finite element models to predict crack growth as a correlation of the observed flaw size in AM materials.

Mentors: Kyle Johnson (Sandia National Laboratories), Tariq Khraishi (University of New Mexico), Adam Brink (Sandia National Laboratories), and Scott Grutzik (Sandia National Laboratories).

## Material Failure Model and Properties for Puncture Simulations.

In this project, a team of students will use state-of-the-art material failure models to predict the kinetic energy required for a probe to penetrate a coupon of 7075-T651 aluminum and validate the predictions with existing experimental measurements.

Mentors: Neal Hubbard (Sandia National Laboratories), and Lin Zheng (Sandia National Laboratories).

## Predictive Structural Dynamics Modeling of Bolted Interfaces.

This project will explore the predictability of a structural dynamics finite element model of a bolted structure with preloaded interfaces by perturbing the discretized mesh to capture the curvatures on the interface observed with optical measurements and validating the predictions with experimental modal analysis.

Mentors: Rob Kuether (Sandia National Laboratories), Paolo Tiso (ETH Zurich), and Adam Brink (Sandia National Laboratories).

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