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 17, 2019** to **August 1, 2019** 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 665596 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.

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2019 NOMAD PROJECT LIST

Mechanics of bolt loosening under dynamic loads

Bolt loosening occurs when a joint loses preload during exposure to dynamic loads such as mechanical shock or random vibration. The goal of this project is to gain a better understanding of the mechanics of bolt loosening and the mechanisms responsible for the loss of frictional restraints by simulating high-fidelity finite element models and validating the predictions with experimental measurements.

Investigation of electrical contact chatter in pin-receptacle contacts

Electrical contact chatter refers to the loss of good electrical current flow through a closed circuit, which may occur when electrical contacts are subject to random vibration environments. This project team will develop models and perform experiments on a simplified chatter tester, consisting of a single pin-receptacle contact pair, to understand which parameters have the greatest influence on chatter performance.

Force reconstruction at mechanical interfaces

Force reconstruction methods in structural dynamics can predict the magnitude and location of an externally applied force with a high degree of accuracy. In this project, the team will explore the potential of characterizing the forces in a joint using these methods by developing models and performing experiments on hardware designed to explicitly measure the joint forces for validation purposes.

Modeling and experimental validation of a pylon subassembly mockup with multiple nonlinearities

A demo aluminum aircraft has been equipped with discrete nonlinear elements designed to replicate real-world engine pylon subassemblies. The NOMAD team will generate high-fidelity model predictions of the pylon subassembly and validate the results with experimental data collected on a dedicated test fixture to understand which nonlinear sources contribute most to the complex dynamic response of the aircraft assembly.

Development of reactive potentials for molecular dynamic simulations

Reactive bond-order potentials are known to provide high accuracy for pair-interactions in atomistic molecular dynamics simulations. The computational effort during NOMAD will seek to expand and develop novel material parameterizations for reactive potentials by designing and implementing a computational optimization method necessary for the parameterization. The team will build upon existing methods, adding complexity and detail.

Indentation of heterogeneous materials: Factors affecting the indentation results and a comparison to bulk material testing

Indentation behavior of heterogeneous materials, with indentation penetration well into the composite microscopic features, is not well understood. This project aims at studying the correlation between the indentation-derived material properties (e.g., elastic modulus and hardness) with the overall (macroscopic) mechanical properties, for materials containing microscopic constituents with distinctly different mechanical features.

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