PhD Opportunity (Spring 2026)

Mechanical Engineering, South Dakota Mines
Rapid City, SD, USA

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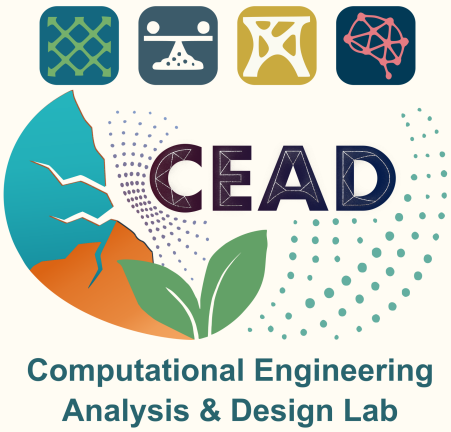
CEAD Lab



About the CEAD Lab

We aim to develop reliable models and simulations that advance understanding and inform design across engineering applications. Our research focuses on:

- Fracture and failure mechanics;
- Functional soft materials (magnetic and dielectric polymers);
- Granular and heterogeneous materials;
- Neural operators and machine learning for scientific computing, with a strong emphasis on error control.

We are currently seeking a PhD student to contribute to one of the projects listed below, with the flexibility to select a topic aligned with their interests.

Mechanics of Granular and Heterogeneous Materials

This project will develop a multi-fidelity simulation framework, based on the PeriDEM model, for materials with rich mesoscale structures (e.g., concrete, metal–ceramic composites). The framework will enable realistic simulation of deformation and fracture, capturing inclusion fracture, matrix cracking, and interfacial debonding. Potential applications include infrastructure durability, armor and protective systems, and advanced manufacturing, while opening new avenues for multi-scale design and optimization.

Mechanics and Design of Functional Soft Materials

This project will develop multiscale computational models for hard-magnetic and dielectric soft materials, explicitly linking microscale interactions, such as particle anisotropy, imperfect bonding, and dipole–dipole effects, to macroscale behavior. Neural operator surrogates with error control will be integrated to enable fast yet reliable simulations, supporting applications in topology optimization of actuators and multistable structures. Potential impacts include advances in soft robotics and adaptive systems.

Candidate Profile

- Strong background and interests in engineering mathematics, finite element methods, solid mechanics;
- Expert or highly motivated to develop skills in scientific programming (Python and C++);
- Motivated to work in the intersection of mechanics, computational modeling, and applied math.

▷ For more information on the application process, visit the SDSMT Graduate Admissions office here.

▷ Check out our computational efforts in Github: github.com/prashjha and github.com/CEADpx.