DOCTORATE DEGREES IN ENGINEERING & COMPUTER SCIENCE

PURSUE DISCOVERY AND ADVENTURE

MONTANA STATE UNIVERSITY | College of ENGINEERING

BOLD RESEARCH VENTURES

Montana State University is one of only two public universities west of the Mississippi River with the following combination of classifications by the Carnegie Foundation for the Advancement of Teaching: **"very high research activity"** and **"award doctorate degrees, STEM-dominated."**

MSU is one of only 108 universities in this top-tier research classification—out of 4,634 institutions. Other institutions in this research classification include Harvard; MIT; and UC Berkeley.

Major sources of federal funding include the National Institutes of Health, the National Science Foundation, the U.S. Department of Energy, the U.S. Department of Agriculture, NASA and the U.S. Department of Transportation.

UNIQUE PERSONALITY

Financial Support

The College of Engineering offers the Benjamin Fellowship, a $25,000 stipend plus tuition in the first year, to highly qualified Ph.D. students. Students receive research and teaching stipends for subsequent years. Apply early (before February 15th) to ensure consideration for the Benjamin Fellowship.

Admission Procedures

Applicants to the College of Engineering Ph.D. program are expected to have an excellent academic record with a bachelor's or master's degree in engineering or computer science. If you have a background in the physical sciences, we encourage you to apply. We will help you develop a program of study that bridges any gaps in areas necessary to your degree. About 50% of Ph.D. students in the College of Engineering enter the program with a bachelor's degree and attain a master's degree en route to a Ph.D.

Choosing a Research Area

Applicants can contact faculty directly and inquire about research opportunities in their groups. If you are interested in several areas or several research groups, we can customize your first year experience so that you can gain experience in different areas during your first semester and find the best fit for your interests and skills.

Doctoral Degrees

- Computer Science
- Engineering with options in
  - Applied Mechanics
  - Chemical Engineering
  - Civil Engineering
  - Electrical & Computer Engineering
  - Industrial Engineering
  - Mechanical Engineering

work across traditional boundaries

Earning your Ph.D. in Montana State University's College of Engineering means that you will be encouraged to work across disciplinary boundaries. You will have the freedom to explore your specialty area in depth. You can expect direct involvement with your advisor and support of other faculty members. Because several courses are required for all doctoral candidates, you will have ample opportunities to interact with graduate students in other disciplines and options.

KATHRYN PLYMESSER

Hometown
Cleveland, Ohio

Doctoral Degree
Engineering

Option
Civil Engineering

Advisor
Joel Cahoon, Civil Engineering

"I have made a lot of contacts that will continue to benefit me."

Kathryn "Katey" Plymesser is one of only 14 students nationally chosen as a 2011 Hydro Research Foundation fellow. The $94,000 award will fund two years of research.

helping fish reach spawning sites

Katey Plymesser is studying Steeppass fishways, typically used in smaller streams and remote areas. Many previous studies only analyzed velocities in the downstream direction, but Katey is characterizing velocities in three dimensions to account for swirls and eddies.

She is studying American shad, a species of herring native to the Atlantic Ocean that spawns in freshwater rivers. "We know that American shad are not swimming through existing fishways well, but we don't know why," according to Katey.

Annual shad harvests of 17.5 million pounds at the turn of the 20th century in Chesapeake Bay dwindled to less than two million pounds by the 1970s.

Katey will use her data to develop a computer model that characterizes fishways in the Connecticut River and ultimately help engineers design or retrofit fishways to help fish move upriver.

Katey cites working one-on-one with her advisor, Joel Cahoon as something that sets MSU apart from other universities.

understanding avalanche conditions

David Walters, left, and Tony LeBaron analyze samples in MSU's Subzero Science and Engineering Research Facility, which occupies 2,700 square feet. It has eight room-sized cold laboratories, three low-temperature biological incubators, two additional environmental chambers, a temperature-controlled computed tomography (CT) scanner, and a refrigerated epifluorescence microscope.

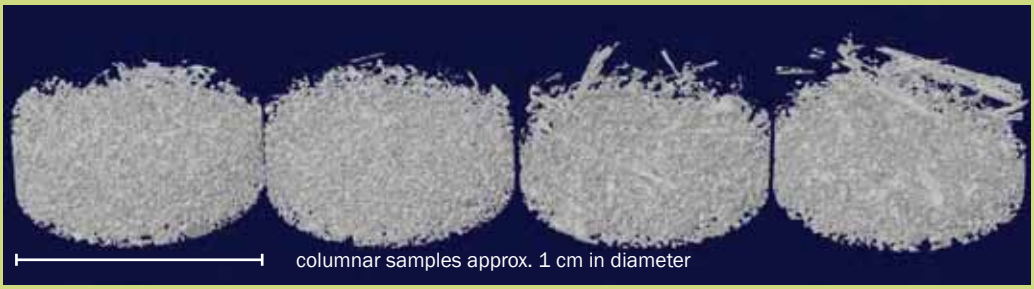
DAVID WALTERS

Hometown
Wixom, Michigan

Doctoral Degree
Engineering

Option
Applied Mechanics

Advisor
Ed Adams, Civil Engineering



This series of micro-CT scanner images of a snow sample shows the progression of radiation recrystallization from left (none) to right (fully developed).

David is investigating the formation of radiation recrystallized snow layers and their mechanical properties. Radiation recrystallized layers are thin layers of snow that form near the surface of a snowpack on sunny mountain slopes. Once they are buried deeply, these layers often cause snow avalanches. The layers undergo significant changes in mechanical properties as the recrystallization process occurs. He is developing a model which uses the snow's microstructure to calculate changes in the direction and magnitude of macroscopic properties such as stiffness and strength. The Subzero Science and Engineering Research Facility allows him precise control over meteorological parameters to replicate mountain conditions as well as the ability to perform tests that cannot be conducted outdoors. He also conducts field work regionally and frequently collaborates with area avalanche experts.

David came to MSU because here he can merge his professional interests in engineering mechanics and his personal interest in all things snow.

CHRIS ALLEN

Hometown
El Dorado Hills, California

Doctoral Degree
Engineering

Option
Environmental Engineering

Advisor
Otto Stein, Civil Engineering

treating wasterwater with natural systems

Chris is working with faculty members based in the College of Engineering and in other MSU colleges to evaluate the use of constructed wetlands to remove pollutants from wastewater. Treatment wetlands not only offer a low-cost, sustainable alternative to traditional wastewater treatment systems, which are often energy intensive; they also provide ecological benefits, such as wildlife habitat. Many removal processes are affected by the seasonal variation of temperature and plant growth. Regulations typically require wastewater treatment processes to remove nitrogen-containing compounds because they can be toxic to fish and humans and degrade downstream water quality. Chris is analyzing the effects of plant species, temperature, and nutrient loading on the removal of nitrogen compounds from the wetlands. Research sites include a greenhouse and a field site in the Bridger Bowl Ski Area. Preliminary data indicate that appropriate plant selection and certain design criteria might allow treatment wetlands to perform well year-round in cold climates.

live in a dreamtown

MSU is in the heart of Bozeman, Montana, which routinely lands on "best of" lists. It was #4 on Outside Magazine's 2013 "Best Town Ever" list and #3 on Livability's list of Top 10 Winter Cities. As number two on Bizjournals.com list of top 10 "dreamtowns", it was among the cities described as "well-rounded places with light traffic, healthy economies, moderate costs of living, impressive housing stocks, strong educational systems and easy access to big-city attractions."

JESSICA MUELLER

Hometown
Knoxville, Tennessee

Doctoral Degree
Engineering

Option
Industrial Engineering

Advisor
Laura Stanley, Mechanical & Industrial Engineering

assessing driving simulators

Jessica received an MSU College of Engineering fellowship and works with Western Transportation Institute's Advanced Driving Simulation Lab. She also has a research grant from Montana Academy of Sciences to study how the complexity of driving simulator scenarios affect how people behave while driving.

Jessica is exploring how people respond while driving on real roads compared to how they respond to those same environments modeled in WTI's advanced driving simulator. Her investigation includes drivers' physiological, behavioral, and subjective responses. Jessica's research will help people assess the efficacy of high-fidelity driving simulators, with the ultimate goal of improving safety for drivers and the general public.

LIESSMAN STURLAUGSON

Hometown
Carson, North Dakota

Doctoral Degree
Computer Science

Advisor
John Sheppard, Computer Science

predicting power supply failure

Liessman's research is focused on artificial intelligence and machine learning. He is interested in probabilistic graphical models, in particular continuous-time models, and has been applying them to problems of electronic diagnostics and prognostics. For example, he has used data from a set of power supplies that have been run until failure under various conditions to build a computer model that monitors a new power supply, detects its level of degradation, and predicts when it will ultimately fail.

improving human health

DONNY ZIGNEGO

Hometown
Vancouver, Washington

Doctoral Degree
Engineering

Option
Mechanical Engineering

Advisor
Ron June, Mechanical & Industrial Engineering

Donny is studying biomechanics and biomedical engineering. His goal is to understand how cartilage cells (chondrocytes) sense and respond to mechanical loading, and how this can result in osteoarthritis (OA). OA is the most common joint disorder, affecting more than 100 million people worldwide, 27 million of them in the United States. OA is a degenerative joint disease often associated with excessive loading and aging of the joint. In articulating body parts, such as knees and hips, chondrocytes are subjected to almost constant loading. How they respond to mechanical deformations is extremely important in understanding and improving joint health. Donny's lab work involves harvesting chondrocytes, growing them in tissue culture, embedding them in 3D hydrogels, mechanically deforming them, and analyzing their biological outputs using mass spectrometry.

SARAH JANE VOGT

Hometown
Rolla, Missouri

Doctoral Degree
Engineering

Option
Chemical Engineering

Advisor
Joseph Seymour, Chemical & Biological Engineering

Sarah Jane, left, and Dr. Sarah Codd, Professor of Mechanical Engineering, work together in the Magnetic Resonance Laboratory.

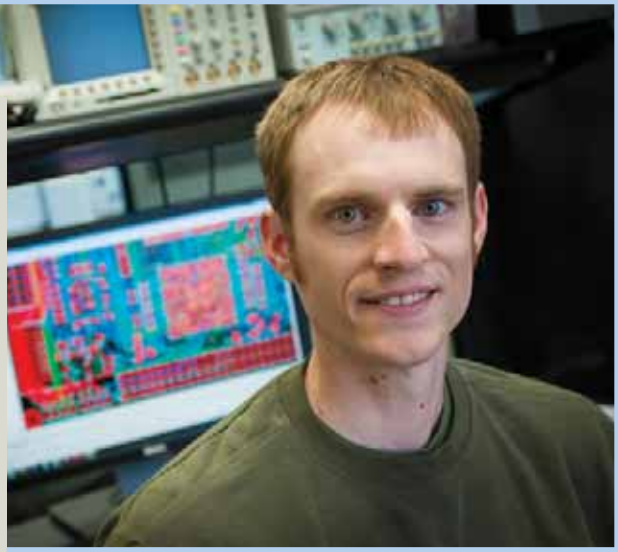
addressing challenges in medicine & industry

Sarah is using magnetic resonance imaging (MRI), a well-known medical imaging tool, to study engineering systems. MRI noninvasively characterizes the structure of porous materials such as ceramics and rocks, gels like cheese and tissue culture biomaterials and can measure the motion and transport of fluids such as water flow through pipes. Sarah integrates advanced math, physics and chemistry concepts to develop new engineering models of complex systems. She has studied the motions of molecules in a wide range of technologically important materials and flowing systems. This work helps people understand how biomedical and industrial filters get clogged. Such knowledge has broad applications, such as treating wastewater, refining biofuels, cleaning up environmental pollution, modeling the potential impacts of oil spills on sea ice formation, conserving water and energy in food production, and using biomedical gels to grow tissues for organ regeneration.

designing electronics for space

Justin is developing a radiation-tolerant computer system. By using commercial off-the-shelf devices, he hopes to increase the flexibility and performance of space-based computing. Radiation from high-energy particles adversely affects electronics in space. The research team's system uses programmable logic devices to detect and mitigate radiation-induced faults. NASA and the Montana Space Grant Consortium are funding the project.

Justin enjoys testing systems in a representative environment. For this project, he and others have sent the system on a number of high-altitude scientific balloon flights. The computer system reached altitudes between 90,000 and 120,000 feet for up to 12 hours at a time. The team is preparing for a suborbital rocket launch which will take the computer system 73 miles above the Earth.



JUSTIN HOGAN

Hometown
Albuquerque, New Mexico

Doctoral Degree
Engineering

Option
Electrical Engineering

Advisor
Brock LaMeres, Electrical & Computer Engineering

build a rewarding career

MSU grad students are building components for NASA satellites, developing software for Google, discovering new medical treatments, and creating energy alternatives.

Because of MSU's collaborative culture, you can draw on numerous disciplines as you explore solutions to critical issues. Design a curriculum to suit your interests and strengths and prepares you for a successful career.

Work in state-of-the art facilities and work one-on-one with world-class faculty.

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