Project-based research

Project Name:	Manufacturing agricultural fertilizer using twin screw granulation	**Project ID:**	R001
Supervisor:	Carl Wassgren	**Number of Positions**	1
Project Description:	The objective of this project is to determine the feasibility of manufacturing agricultural fertilizer granules using twin screw (TS) wet granulation. Feasibility will be determined by measuring critical quality attributes of the granules and the sensitivity of these attributes to the TS operating parameters. The student working on this project will need to complete the following tasks: (1) Complete laboratory safety training. (2) Complete twin screw granulation training. (3) Complete training on laboratory characterization equipment. (4) Review prior work to become familiar with the TS granulation unit operation. (5) Perform TS manufacturing runs at different operating conditions to produce granules. (6) Measure granule characteristics, including the size distribution, shape, density, friability, and dissolution time. (7) Help prepare a written report describing the project effort. The student will work closely with the Lab Manager, Dr. Clairmont Clementson.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	3 credit hours		
Final Deliverables:	The project deliverable is a written report describing the project effort. The student will also be expected to participate in weekly research group meetings where they'll provide short updates (~5 – 10 minutes) on their work.		
Desired Qualifications	The student working on this project should be comfortable working in a laboratory setting and have good communication skills. There is no requirement on having familiarity with TS granulation or laboratory characterization equipment as this training will be provided.		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Low light detection device	**Project ID:**	R002
Supervisor:	Euiwon Bae	**Number of Positions**	2
Project Description:	Students will work on developing PCB board integrated with photosensors designed for low level of light detection.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical **For Pay: hourly rate** Voluntary		
Final Deliverables:	PCB board design, prototype circuit		
Desired Qualifications	Strong background in electronics, Arduino coding		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Milling and Machining in Complex Materials	**Project ID:**	R003
Supervisor:	Prof. Siegmund	**Number of Positions**	1
Project Description:	I am seeking a student to work on milling and machining processes for a difficult to machine material. The work will be using a snapmaker, special fixtures (to be designed and manufactured as part of this project by 3D printing), machine path generation, execution of machining and milling operations.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical. Preferred For Pay: $12. Possible		
Final Deliverables:	Machining instructions, code, CAD files, execution of machining operations on the actual material of interest in coordination with a graduate student.		
Desired Qualifications	CAD, 3D printing, G-code		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	CAD and manufacturing of rubber bushings for machine design	**Project ID:**	R004
Supervisor:	Prof. Siegmund	**Number of Positions**	1
Project Description:	Assist with design, CAD, 3D printing, and analysis of rubber bushings for machine design.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical, preferred For Pay: hourly rate ($12), preferred		
Final Deliverables:	Report, CAD models, as manufactured 3D printed models		
Desired Qualifications	CAD, 3D printing, finite element analysis (desired but not necessary)		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Coarse Grained Modeling of Biomolecules	**Project ID:**	R005
Supervisor:	Arezoo M. Ardekani	**Number of Positions**	1
Project Description:	The interaction between biomolecules (proteins, lipids, carbohydrates, and nucleic acids) mediates a wide range of biological functions, and an improved understanding of the principles that govern biomolecular interactions can lead to new opportunities. For instance, engineering advanced materials that can mimic evolution and adapt their properties to address environmental changes. However, studying the behavior of these complex systems often requires long simulations, and classical atomistic computational approaches remain inefficient for thoroughly sampling their complex conformational landscapes. In contrast, coarse-graining (CG) approaches provide a more efficient solution, but the inherent simplifications limit their applications. The goal of this research is to develop a multiscale modeling technique that integrates data from atomistic simulations, and coarse-graining techniques to study the dynamics of complex biomolecules. The undergraduate researcher will be responsible for collaboratively writing codes in Fortran that take molecular dynamics trajectories as inputs and use them to calculate coarse-graining interaction parameters. The interaction parameters will be used to perform CG-MD calculations to simulate biomolecular dynamics.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credit For Pay Voluntary		
Final Deliverables:	1) A Fortran code to obtain CG parameters from MD inputs		
Desired Qualifications	Coding in Fortran		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Python programming related to biomolecular applications	**Project ID:**	R006
Supervisor:	Arezoo M. Ardekani	**Number of Positions**	2
Project Description:	An improved understanding of the principles that govern biological functions can create new avenues for the design of drugs and bio-inspired materials. The goal of this research is to develop a Natural Language Processing pipeline that 1) discovers causal relationships between molecular structure and physicochemical properties, and 2) predicts new biomolecules for novel applications. The undergraduate researcher(s) will be responsible for writing a python code to collect a corpus of biomedical literature. The corpus will be used to train word vectors that contain semantic information. The undergraduate researcher(s) will also curate data on biomolecular properties.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credit For Pay Voluntary		
Final Deliverables:	1) A corpus of biomedical literature, and 2) Data on biomolecular properties.		
Desired Qualifications	Coding in Python		

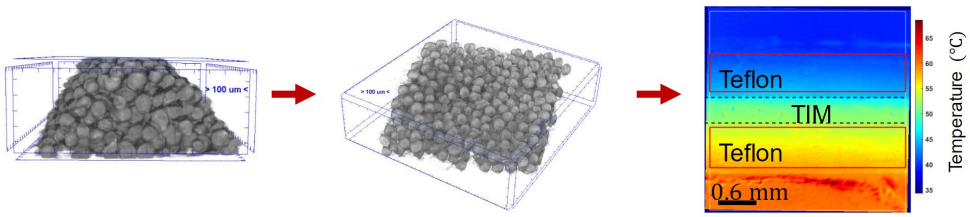
PURDUE UNIVERSITY | Mechanical Engineering

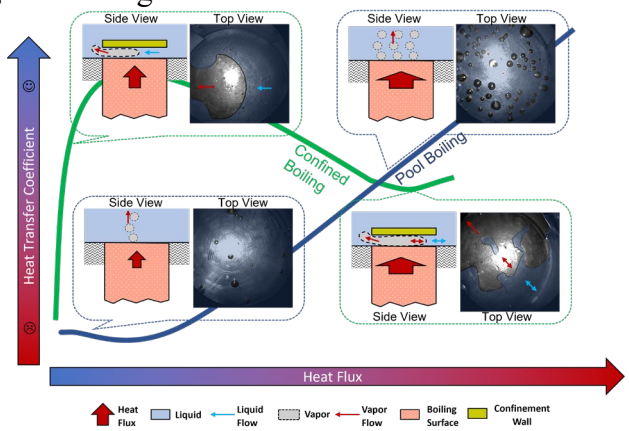
Project-based research

Project Name:	Product Σ -Design & Prototype	**Project ID:**	R007
Supervisor:	Greg Jensen	**Number of Positions**	3
Project Description:	Develop sophomore level mechanical design projects that once engineered/design/modeled in CAD, require traditional and non-traditional manufacturing processes to realize/produce.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical For Pay: hourly rate Voluntary		
Final Deliverables:	CAD Models; CAD Drawings; Manufacturing Op Sheets; Physical parts/assemblies		
Desired Qualifications	Good working knowledge/skills using Siemens NX; Working Knowledge/Skills of: milling, turning; forming; welding/brazing/joining/…; grinding/polishing/deburring/…; 3D printing; casting; …		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Thermal Conduction in Advanced Composites for Electronics Packaging	**Project ID:**	R008
Supervisor:	Prof. Marconnet https://engineering.purdue.edu/MTEC	**Number of Positions**	1 or more
Project Description:	To enhance the thermal conductivity of polymers used in electronics packaging applications, composites are formed by embedding high thermal conductivity particles in a polymer matrix. The arrangement of the particles within the matrix is critical for achieve high thermal conductivity and uniformity in thermal conductivity. In this project, we will prepare samples with different fabrication parameters and measure their thermal conductivity using high resolution infrared microscopy and/or laser flash thermal diffusivity measurements. In collaboration with Prof. Chawla's group in Materials Engineering, we will use X-Ray Computed Tomography (XRCT) to measure the particle locations and dimensions with microscale precision within the composite structure and predict the thermal conductivity.  *XRCT images of a composite sample (left) before and (right) after squeezing and (right) an infrared thermal map used for estimating thermal conductivity of the composite Thermal Interface Material (TIM) samples.*		
Weekly Working Hours	20 hours/week		
For Credits	For credits: 3 credits typical Voluntary		
Final Deliverables:	All students will be expected to prepare a final report documenting their methods and results. Depending on the number of students on the project, the following deliverables will be assigned. • Preparation of samples at different compression rates and forces • XRCT data for samples prepared at varying conditions • Thermal data for samples prepared at varying conditions • Numerical model for estimating thermal conductivity based on the extracted XRCT data		
Desired Qualifications	Required: • Familiarity with CAD and MATLAB or Python • Thermodynamics (A- or better, preferred) Preferred: • Fluid Mechanics (A- or better, preferred) • Heat Transfer (A- or better, preferred) • Familiarity with finite element simulation tools		

Project Name:	High Resolution Metrology for Confined Boiling	**Project ID:**	R009
Supervisor:	Prof. Marconnet https://engineering.purdue.edu/MTEC	**Number of Positions**	1 or more
Project Description:	The high heat transfer coefficient associated with boiling is attractive for increasing the thermodynamic efficiency of power and refrigeration cycles. For emerging applications such as liquid cooling of next generation electronics, understanding boiling within small confined spaces is required. This project will focus on developing metrology tools to understand the evolution of bubbles and surface temperatures in such applications, as well as the impact of surface coatings on boiling enhancements.  *Illustration of regimes of boiling for confined boiling.*		
Weekly Working Hours	20 hours/week		
For Credits	For credits: 3 credits typical Voluntary		
Final Deliverables:	All students will be expected to prepare a final report documenting their methods and results. Depending on the number of students on the project, the following deliverables will be assigned. • Updated confined boiling test setup enabling thermal imaging through a IR transparent heater • Data for temperatures, heat fluxes, and bubble geometry as a function heater power • Evaluation of different patterned surface coatings on the thermal response during confined boiling		
Desired Qualifications	Required: • Thermodynamics (A- or better, preferred) Preferred: • Fluid Mechanics (A- or better, preferred) • Heat Transfer (A- or better, preferred) • Familiarity with MATLAB and LabView		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Additive manufacturing of soft materials by ink-jet printing	**Project ID:**	R010
Supervisor:	Yung C Shin	**Number of Positions**	2
Project Description:	This study is to explore the additive manufacturing capabilities of novel soft materials combining different polymers, metal + polymers or ceramic + polymers, including energetic materials, using a new 3D inkjet type printer available in the supervisor's lab. The student is expected to optimize the process parameters to build successful samples using various specified materials and characterize their microstructural and mechanical properties. The participating student needs to carry out the following tasks: 1. Literature review of related field. 2. Design experiments and carry out a systematic parametric study on the relationship between process parameters and welding quality using the available laser micro-welding system. 3. Characterize the resultant weld quality using various optical measurement techniques such as optical microscope and optical surface profiler. 4. Optimize process parameters to achieve the best quality and throughput. 5. Generate a technical report summarizing all the findings.		
Final Deliverables:	It is expected to submit weekly reports describing the findings and results of the research project during the regularly scheduled meetings. A final written report is required for the final grade, which contains all the experimental results, collected testing results and analysis results.		
Weekly Working Hours	20		
For Credits/Pay	For credits: 3 For Pay: (Hourly rate) NA Voluntary: NA		
Desired Qualifications	Sophomore or higher standing with the minimum GPA of 3.4		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Laser micromachining of polymers and glasses	**Project ID:**	R011
Supervisor:	Yung C Shin	**Number of Positions**	1
Project Description:	Creating micro features on various materials is necessary for various engineering products. This research involves in creating micro channels and pockets on polymeric parts using laser ablation. Different lasers are available for this purpose depending on the optical properties of materials. This goal of this project is to conduct an experimental study on micromachining using a CO_2 laser to explore the feasibility of micromachining glasses and polymers and to optimize process parameters for the best quality and high throughput. Potential applications of these microchannels are micro heat exchangers or microfluidic devices. To this end the student will carry out the following tasks: 1. Literature review of the related field. 2. Design experiments and carry out a systematic parametric study on the relationship between process parameters and microchannel quality using the available laser micromachining system. 3. Characterize the resultant microchannel quality using various optical measurement techniques such as optical microscope and optical surface profiler. 4. Optimize the process parameters to achieve the best quality and throughput. 5. The following learning and tasks are expected: • The student will learn how to schedule and prioritize his/her work according to the overall goals and tasks. He/she will have weekly meetings with the supervisor to discuss the progress and future directions. • The student will be required to write weekly reports summarizing the results, ideas and future plans. • The student will gain knowledge and skills about lasers, the operation of the laser, micromachining and the characterization methods. • The student will gain the essential knowledge about how to do research or solving an open ended problem using creative thinking.		
Final Deliverables:	A final written report is required for the final grade, which contains literature review, experimental design and results, collected post characterization data and analysis results. In addition, it is expected to make a final presentation (30 min) during the final's week.		
Weekly Working Hours	20		
For Credits/Pay	For credits: 3 For Pay: (Hourly rate) NA Voluntary		
Desired Qualifications	Sophomore or higher standing with the minimum GPA of 3.4		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Data-driven modeling of microstructure-properties relationships for additively manufactured metal parts	**Project ID:**	R012
Supervisor:	Yung C Shin	**Number of Positions**	3
Project Description:	This study is to investigate the mechanical properties of metal alloy parts built by various additive manufacturing (AM) processes in terms of the resultant microstructure and to establish a data-driven model between the microstructure and mechanical properties. Additive manufacturing is gaining global popularity due to its unprecedented capabilities in shaping complex shapes. However, one of the challenges remaining for widespread industrial use of AM is to predict/control the resultant mechanical properties. Additive manufacturing due to its inherent nature of localized heating and cooling produces heterogeneous microstructure, which affects resultant mechanical properties. Due to the number of parameters used in AM, predicting the resultant mechanical properties is very time-consuming and expensive, which remains one of the main obstacles for wide adoption in the industry. This study is to establish property-structure relationships of AM-built metal parts, which will contribute to the drastic reduction of process lead time and certification of parts. The participating student(s) is expected to establish microstructure-mechanical property relationships by collecting scattered data in the literature and then using a machine learning technique such as multilayer neural networks and deep learning methods. In addition, opportunities exist to printing actual tensile specimens using the available facilities in the supervisor's lab, conduct heat treatment, if necessary, carry out microstructure measurement, and perform mechanical testing using a universal testing machine available in the supervisor's lab.		
Final Deliverables:	It is expected to submit weekly reports describing the progress, findings and results of the research project during the regularly scheduled meetings. A final written report is required for the final grade, which shall contain a literature review, collected microstructure data, all the experimental results, modeling and prediction results and findings.		
Weekly Working Hours	20		
For Credits/Pay	For credits: 3 For Pay: (Hourly rate) N/A Voluntary: N/A		
Desired Qualifications	Junior or higher standing with the minimum GPA of 3.5		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Realization of meta-material via 3D additive manufacturing	**Project ID:**	R013
Supervisor:	Yung C Shin	**Number of Positions**	2
Project Description:	Metamaterials are artificial or man-made materials which are crafted to achieve physical behaviors which are not demonstrated by the constitute material in its conventional sense. They are achieved by cumulating the behaviour of the unit cell designed into the macro scale and thereby the effects are also translated into macro scale. Auxetic, acoustic and electromagnetic metamaterials are the most pondered subjects in the research field as they have large applications/potential. This research is to experimentally exploit the feasibility of building different metamaterials by using 3D additive manufacturing. 3D additive manufacturing provides unprecedented capabilities of building complex 3D structures from CAD drawings. The participating student needs to carry out the following tasks: 1. Literature review of related field. 2. Design 3D metastructure and build them using a 3D printer in the lab. 3. Characterize the resultant properties of meta-material. 4. Optimize process parameters to achieve the best quality and throughput. 5. Generate a technical report summarizing all the findings.		
Final Deliverables:	It is expected to submit weekly reports describing the findings and results of the research during the regularly scheduled meetings. A final written report is required for the final grade, which must contain literature review, design of experiments, all the experimental results, collected microstructure data and analysis results.		
Weekly Working Hours	20 (flexible in schedule)		
For Credits/Pay	For credits: 3 (ME298 or ME498) For Pay: (Hourly rate) NA Voluntary: N/A		
Desired Qualifications	Sophomore or higher standing with a minimum GPA of 3.4		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Adhesion between dissimilar materials	**Project ID:**	R014
Supervisor:	Prof. Monique McClain	**Number of Positions**	1
Project Description:	In order to expand the types of different materials that can be 3D printed together, understanding of the adhesion between composite mixtures and thermoplastic filaments is required. The student researcher will help design and conduct experiments that test adhesion between solid propellant (cast or 3D printed) and thermoplastic filaments of various compositions. The student researcher will be responsible for conducting experiments and analyzing data from such experiments.		
Weekly Working Hours	12-15 hours/week		
For Credits/Pay	For Credits: 3 credits		
Final Deliverables:			
Desired Qualifications	Materials or chemistry knowledge, particularly about polymers, is preferred though not required.		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Energy Storage Analytics	**Project ID:**	R015
Supervisor:	Partha P. Mukherjee	**Number of Positions**	3
Project Description:	Lithium ion (Li-ion) batteries are ubiquitous. Thermal safety and degradation characteristics of these systems are critical toward safer and high-performance batteries for electric vehicles. As part of this research, data-driven analytics of experimental and simulated performance under normal and anomalous operating conditions of Li-ion cells will be performed.		
Final Deliverables:	The final deliverable will be one end-of-semester research report (based on weekly progress presentations and updates) and one final presentation.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For credits: (# of credits) 3; voluntary (for pay: to be discussed with the supervisor)		
Desired Qualifications	Strong analytical skill and desire to learn new experimental and modeling & analysis tools.		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Course improvements for ME 354	**Project ID:**	R016
Supervisor:	Beth Hess	**Number of Positions**	4
Project Description:	This project would develop in-class demonstrations, case studies and/or projects to be implemented in future semesters of ME 354. Examples include, but are not limited to, fatigue testing using a rotating bending fatigue tester, variability in bolt tension using a bolt tension measuring device, and case studies based on real applications.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical For Pay: hourly rate Voluntary		
Final Deliverables:	Detailed manual and/or rubric		
Desired Qualifications	Have taken ME 354		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	3D Printing by Design	**Project ID:**	R017
Supervisor:	Darrin Wilcoxson	**Number of Positions**	3
Project Description:	The goal is to develop a workshop to take a deep dive into FDM 3D pringing and to learn how to utilize design software and slicing software for 3D printing. Through this project students will understand: infill, support, material, retractrion rate, proper print bed adhesion, tolerance, temperature & cooling fans, and orientation of parts. Utilizing their CAD skills students will be able to develop parts that tie into a growing milestone project.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical For Pay: hourly rate Voluntary		
Final Deliverables:	Students will provide documentation, worksheets, video's, and exemplar 3D printed parts to support a new project for M.E. students to complete throughout the school year.		
Desired Qualifications			

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Design of an IoT4Ag Robotic Sensor Deployment System	**Project ID:**	R018
Supervisor:	Prof. David Cappelleri	**Number of Positions**	2-3
Project Description:	The goal of this project is to design an IoT4Ag sensor deployment system for autonomous agricultural ground robot. Two types of IoT sensors must be deployed by the robotic platform. Chaff sensors need to be distributed on the surface of soil at locations with designated spacing to ensure appropriate spatial coverage for the field of interest. The second type of sensors similarly need to be spread about the field but require them to be inserted into the soil at a depth of approximately 3" deep. Thus, the developed sensor deployment system should be able to 1. Store the sensors that need to be deployed; 2. Distribute sensors at a designated spacing above the soil; and 3. Insert the sensors into the ground at a designated spacing in the soil; and 4. Log the type of sensor that has been distributed, its sensor ID, and its placement location. This project will require the mechanical design of the deployment systems, mechatronic system design for operating and controlling the systems, and integration and interfacing with the agricultural ground robot for execution and tracking of sensor deployment locations. Field tests will be conducted at the Purdue University Agronomy Center for Research and Education (ACRE) facility.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical For Pay: hourly rate Voluntary		
Final Deliverables:	Working prototype; final report		
Desired Qualifications	Mechanical design, mechatronics, 3D printing, electronics, robotics, programming experience preferred.		

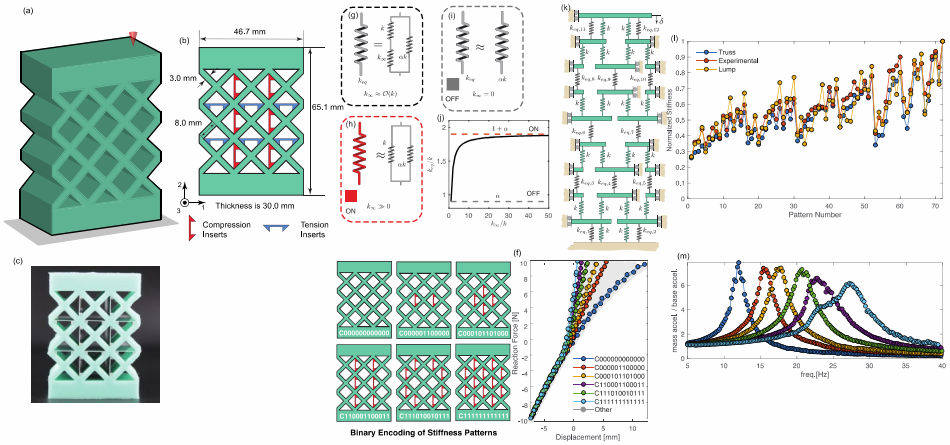
PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Microcontroller Workshop	**Project ID:**	R019
Supervisor:	Steve Kessler Bert Gremalspacher	**Number of Positions**	2-3
Project Description:	The students will provide a 5-6 hour workshop that is broken into two separate 2-3 hour teaching sessions. The first session will include approx 1 hour lecture on the basics of Arduino microcontroller systems and communication protocols. Topics to include: AD/DA, I2C/SPI, WIFI/Bluetooth and ethernet. This session will also include a 1-2 hour hands-on lesson on loading the 'Blink' and 'Helloworld' programs into an Arduino. The second session should be another aprox 1 hour lecture on programming the Arduino using state machine concepts. This session will include a 1-2 hour hands-on lesson on 'state machine' coding using CASE structures. It will also include hands-on experience creating a CASE structured program that will then be able to read a basic sensor and operate a motor.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical For Pay: hourly rate Voluntary		
Final Deliverables:	Students should provide the presentation material for the lectures (Presentation material or video of lectures) Students to provide all documentation, hardware and coding used for workshops		
Desired Qualifications	C/C++. Some MPU knowledge, some electronics knowledge		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Viscoelastic Programmable Materials	**Project ID:**	R020
Supervisor:	James Gibert	**Number of Positions**	1-2
Project Description:	Motivated by the lack of systematic techniques and theories to conceptualize mechanical metamaterials to reveal the physics and to establish a mathematical foundation that governs the interplay of a heterogeneous mechanical metamaterial's topology, nonlinear deformation, nonlinear material behavior and time dependent material behavior for use in applications ranging from vibration suppression to shock absorption to the development of metamaterials with self-sensing capabilities. The heterogeneity arises from: 1) an inclusion in the topology of an elastomeric matrix, coined a "digital element", and 2) the combination of materials whose behavior is primarily viscoelastic with a material whose behavior is primarily elastic and or hyperelastic. Furthermore, the selective placement /and or removal of these digital elements allows for the systematic programming of a single host structure to exemplify a host of inertial and elastic behaviors leading to a range of dynamic. The effct of the 1st form of the the hetergoenetity gives rises to structures seen in Figure 1.  The focus of this project will be on exploring the 2nd form of the heterogeneity, i.e., developing viscoelastic composites. The project will explore methods to manufacture the composite, and map composition to response to develop nascent programming structures for the materal.
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical		
Final Deliverables:			
Desired Qualifications	Interest in dynamics and solid mechanics, basic matlab, basic data acquisition such as experience with Aurdino's		

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Project-based research

Project Name:	3D printing process monitoring system design	**Project ID:**	R021
Supervisor:	Song Zhang	**Number of Positions**	1-2
Project Description:	This project would develop integrated 3D imaging technology to monitor the quality of 3D printing process. Students will work with graduate and other undergraduate students to design and develop both software and hardware.		
Weekly Working Hours	Up to 40 hours/week		
For Credits/Pay	For Credits: 3 credits typical For Pay: hourly rate		
Final Deliverables:	CAD design, software source code, and reports		
Desired Qualifications	Matlab and C or C++ programing; strong communication skills; US citizens only.		

Project Name:	Design of automated calibration fixture	**Project ID:**	R022
Supervisor:	Song Zhang	**Number of Positions**	2-3
Project Description:	This project would design an automated fixture for 3D imaging system calibration. This includes CAD modeling, animation, and .		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical		
Final Deliverables:	Detailed manual, part quotes, estimated manufacturing cost		
Desired Qualifications	Strong communication skills		

Project Name:	3D microscopic imaging system development	**Project ID:**	R023
Supervisor:	Song Zhang	**Number of Positions**	1
Project Description:	This project is funded by the National Science Foundation. The student would be working with a graduate student to develop 3D microscopic imaging system during the summer.		
Weekly Working Hours	40 hours/week		
For Credits/Pay	For Pay: NSF REU rate		
Final Deliverables:	Detailed manual and/or rubric		
Desired Qualifications	Matlab and C or C++ programing; strong communication skills;		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Research in laser-based manufacturing and materials processing	**Project ID:**	R024
Supervisor:	Prof. Benxin Wu	**Number of Positions**	~2
Project Description:	Students are expected to perform work in the field of laser-based manufacturing and materials processing. A student may be involved in one or multiple topics in laser-based additive and/or substractive manufacturing.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical For Pay: No. Voluntary		
Final Deliverables:	Students will be evalualted based on the quantiy, quality and difficulty of the work performed. The exact form of deliverables depends on the actual topic(s) in which the student is involved.		
Desired Qualifications	Good hands-on, material chateracterization and/or machine shop capabilities, etc.		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Characterizatioin of the atomization of oil jet	**Project ID:**	R025
Supervisor:	Jun Chen	**Number of Positions**	1 or 2
Project Description:	The student will have opportunity to work with Purdue research team and industrial partners on characterizating the atomization process of an oil jet under a realistic working conditions. The student will work with the team to sett up the test rig and instrumentation system, as well as to analyze the data and present the results to industrial partners. Details will be released after signing Non-Disclosure Agreement (NDA).		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical		
Final Deliverables:	A final test report that summarizes (i) design of the test rig, (ii) introduction of the instrumentation, and (iii) test results.		
Desired Qualifications	• ME junior or senior, good GPA • Interested in hand-on lab work • Strong motivation to work independently and good team spirit • Personal transportation to Zucrow Lab (next to Purdue Airport)		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Design and analysis of modular riverine current energy converter	**Project ID:**	R026
Supervisor:	Jun Chen	**Number of Positions**	2
Project Description:	The student will have opportunity to work on the design and analysis of a modular riverine current energy converter that harvests energy carried by the river currents. The students will examine the design of individual parts in the system to explore ways to achieve the optimal system performance Details will be released after signing Non-Disclosure Agreement.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits		
Final Deliverables:	A final project report that summarizes the design and analysis of individual parts and sub-systems.		
Desired Qualifications	• ME junior or senior, good GPA • Interested in hand-on design work • CAD experience with Siemens teamcenter or NX preferred • Strong motivation to work independently and good team spirit		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Development of image-based sensors for measureing high-temperature liquid jet	**Project ID:**	R027
Supervisor:	Jun Chen	**Number of Positions**	1 or 2
Project Description:	The student will have opportunity to work with Purdue professors and graduste students to develop imaged -based sensors for non-contact measurement of high-temperature liquid jet. The student will participate in development of the hardware and software, as well as calibration test. Details will be released after signing Non-Disclosure Agreement (NDA). US citizenship or permanent residency (greencard) required.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits typical		
Final Deliverables:	A final project report that summarizes (i) design of the insturmentation, (ii) software module, and (iii) test results.		
Desired Qualifications	• US citizenship or permanent residency (greencard) • ME junior or senior, good GPA • Interested in hand-on lab work • Python programming experience (required) and digital image processing skills (preferred) • Strong motivation to work independently and good team spirit • Personal transportation to Zucrow Lab (next to Purdue Airport)		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	CO_2 Recycling	**Project ID:**	R028
Supervisor:	Jay Gore	**Number of Positions**	
Project Description:	Study the challenges, the opportunities, the efficiencies, the economics and the necessities of CO_2 Recycling		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits		
Final Deliverables:	Report 15 to 20 pages with 2 to 4 pages addressing each of the topics listed in the project description. The topics are to be addressed in an analytical and quantitative manner with numbers, graphs, and options.		
Desired Qualifications	ME 300, Interest in Energy, Policy, and Global Relations		

PURDUE UNIVERSITY | Mechanical Engineering

Project-based research

Project Name:	Thermal management impacts on grid energy storage efficiency	**Project ID:**	R029
Supervisor:	Rebecca Ciez	**Number of Positions**	3
Project Description:	Battery energy storage systems can help to incorporate more renewable energy into our electricity grids, but only if they are cost effective and safe. To ensure system safety, many safety technologies are implemented in battery cells and larger battery systems. Building on previous research about the safety technologies installed in battery systems, this project will examine how thermal management and safety systems of battery systems contributes to their overall efficiency and operating cost for different electricity grid applications and storage durations.		
Weekly Working Hours	20 hours/week		
For Credits/Pay	For Credits: 3 credits For Pay: $12/hour Voluntary		
Final Deliverables:	Python model of thermal management energy consumption, energy storage efficiency model accounting for thermal management consumption, report summarizing project methods and results.		
Desired Qualifications	ME 200, ECE 20001, Python, experience with GitHub is also a plus		