Rutgers University

Department of Mechanical & Aerospace Engineering

2023-2024 Senior Design Projects

14:650:467/468 Design and Manufacturing I/II

Mechanical Engineering Projects

Table of Contents

ME PROJECT 1

Mechanical Fish

Advisor: Prof. Prosenjit Bagchi

Email: pbagchi@soe.rutgers.edu

Project Abstract: Conceptualize, design and build a device that swims like a fish

Project Goals: Building mechanical fish-- an underwater device that can swim like a fish using body undulations.

Project Envisioned Outcomes: Design and fabrication of soft swimming devices.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining		☑			
3D printing		☑			
Welding		☑			
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)		☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol		☑			
Python	☑				
Ansys		☑			
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 2

Wheelchair Modification

Advisor: Prof. Haim Baruh

Email: baruh@soe.rutgers.edu

Project Abstract: Wheelchair Modification

Project Goals: Giving a complex wheelchair capability to clean its wheels

Project Envisioned Outcomes: Using motorization and scraping techniques to make a wheelchair that has traveled on muddy surfaces clean itself before going indoors.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools			☑		
Traditional Machining			☑		
CNC machining			☑		
3D printing			☑		
Welding			☑		
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding			☑		
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python			☑		
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX		☑			
LabView		☑			
E-Calc		☑			
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 3

Drone Based Water Sampling and Quality Testing – Special Application in the Raritan River

Advisor: Prof. Onur Bilgen

Email: o.bilgen@rutgers.edu

Please contact Dr. Bilgen via email with the subject line starting with "Senior Design: Project Name – Your Name".

Project Goals: The goal of this project is the design, analysis, fabrication and testing of an unmanned aerial vehicle (UAV) and a ground station, both equipped with 5G transmitters/receivers to evaluate water quality in rivers and other waterways. The system will be tested in the Raritan River. The team will design, fabricate, and test multiple iterations of the vehicle, and the ground station, as well as develop necessary control algorithms. The drone will sample water (from the water surface and/or at varying depths in the water column) and bring it back to a testing station near the shore (or within the range of the drone.) This system must be fully autonomous.

Previous Success: The 2022-2023 Team received a highly competitive NASA USRC award to conduct research on this topic. Selected students will be able to conduct funded research during summer 2023 and/or summer 2024.

This is a collaborative project with Professor Nicole Fahrenfeld of the Civil & Environmental Engineering. Using the drone will significantly increase spatial resolution of sampling while providing improved ability to provide composite samples for analysis. The anticipated outcome will be reducing labor/need for sampling vessels to while generating more representative samples to improve our understanding of contaminant fate and transport in surface waters. Example target contaminants include emerging (e.g., microplastics) or regulated (e.g., pathogens linked to compliance with Section 303d of the Clean Water Act).

The students should be very comfortable with at least one of the following: 1) Design/analysis and programming software such as Matlab, Xfoil, AVL, E-Calc, Mission Planner, Ansys, Solid Works, Siemens NX or other CAD packages, LabVIEW, etc.; 2) Simple analog or digital electronics such as resistors, capacitors, op-amps, microcontrollers (i.e. Arduino, Raspberry Pi), wiring, soldering, etc.; 3) Fabrication techniques such as 3D printing, bonding, vacuum bagging, manual fabrication, etc.

All team members are expected to have an exceptional work ethic and dedication to the project. Students from all backgrounds who are interested in continuing to graduate school are highly encouraged to join. Please contact Dr. Bilgen via email (o.bilgen@rutgers.edu) with the subject line starting with "Senior Design: Project Name – Your Name".

Project Envisioned Outcomes: See above.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools				☑	
Traditional Machining				☑	
CNC machining	☑				
3D printing				☑	
Welding	☑				
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol	☑				
Python				☑	
Ansys	☑				
SolidWorks				☑	
Other CAD packages	☑				
Siemens NX				☑	
LabView				☑	
E-Calc				☑	
AVL				☑	
Xfoil				☑	
Machine vision program				☑	

Additional Requirements and Information:

Application Process:

Please send an email to Dr. Bilgen (o.bilgen@rutgers.edu) with the subject line starting with "Senior Design: " and include the following content:

1) A brief statement indicating interest

2) Project(s) of interest (primary and secondary can be indicated)

3) Cumulative GPA (in major)

4) Theoretical (subject) strengths (i.e. dynamics, solids, fluids, control, design, etc.)

5) Software strengths

6) Hands-on, fabrication, testing strengths and experiences (outside of courses and labs)

7) Student organizations involved

ME PROJECT 4

Design and Testing of a Drone to Conduct Zero-G Experiments

Advisor: Prof. Onur Bilgen

Email: o.bilgen@rutgers.edu

Project Goals:

The goal of this project is the design, analysis, fabrication and testing of a small quad-copter unmanned aerial vehicle (UAV) to act as a platform to conduct Zero-G experiments. The team will design, fabricate, and test multiple iterations of the vehicle, as well as develop necessary control algorithms.

Previous Success: The 2020 Team presented a paper at the AIAA 2021 Region I Conference, and received the 1st place prize in the team category.

The new team will apply to the highly competitive NASA USRC program in June. If funded, students will be able to conduct funded research during the academic year, or during summer 2022.

The students should be very comfortable with at least one of the following: 1) Design/analysis and programming software such as Matlab, XFOIL, AVL, E-Calc, Mission Planner, Ansys, Solid Works, Siemens NX or other CAD packages, LabVIEW, etc.; 2) Simple analog or digital electronics such as resistors, capacitors, op-amps, microcontrollers (i.e. Arduino, Raspberry Pi), wiring, soldering, etc.; 3) Fabrication techniques such as 3D printing, bonding, vacuum bagging, manual fabrication, etc.

All team members are expected to have an exceptional work ethic and dedication to the project. Students from all backgrounds who are interested in continuing to graduate school are highly encouraged to join. Please contact Dr. Bilgen via email (o.bilgen@rutgers.edu) with the subject line starting with "Senior Design: Project Name – Your Name" .

Project Envisioned Outcomes: See above.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools				☑	
Traditional Machining	☑				
CNC machining	☑				
3D printing				☑	
Welding	☑				
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol	☑				
Python				☑	
Ansys	☑				
SolidWorks				☑	
Other CAD packages	☑				
Siemens NX				☑	
LabView				☑	
E-Calc				☑	
AVL				☑	
Xfoil				☑	
Machine vision program				☑	

Additional Requirements and Information:

Please send an email to Dr. Bilgen (o.bilgen@rutgers.edu) with the subject line starting with "Senior Design: " and include the following content:

1) A brief statement indicating interest

2) Project(s) of interest (primary and secondary can be indicated)

3) Cumulative GPA (in major)

4) Theoretical (subject) strengths (i.e. dynamics, solids, fluids, control, design, etc.)

5) Software strengths

6) Hands-on, fabrication, testing strengths and experiences (outside of courses and labs)

7) Student organizations involved

ME PROJECT 5

Solar Powered Terrain Walker I

Advisor: Prof. William Bottega

Email: bottega@soe.rutgers.edu

Project Abstract: Solar Powered Terrain Walker

Project Goals: design, analyze and manufacture a solar powered walking machine

Project Envisioned Outcomes: design and blueprints, analysis and manufacture of a walking machine that can negotiate various terrains. There will be two teams that will compete with one another for the best design. They will "race" against each other at the end of the academic year.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining					
3D printing	☑				
Welding	☑				
Wiring	☑		☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding	☑	☑			
Processing (e.g., vacuum bag, autoclave)	☑	☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 6

Solar Powered Terrain Walker II

Advisor: Prof. William Bottega

Email: bottega@soe.rutgers.edu

Project Abstract: Solar Powered Terrain Walker

Project Goals: design, analyze and manufacture a solar powered walking machine

Project Envisioned Outcomes: design and blueprints, analysis and manufacture of a walking machine that can negotiate various terrains. There will be two teams that will compete with one another for the best design. They will "race" against each other at the end of the academic year.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining					
3D printing	☑				
Welding	☑				
Wiring	☑		☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding	☑	☑			
Processing (e.g., vacuum bag, autoclave)	☑	☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 7

Design of a Biomechanical Hand

Advisor: Prof. Kimberly Cook-Chennault

Email: cookchen@soe.rutgers.edu

Project Abstract: Design of a Biomechanical Hand

Project Goals: To design a robotic hand that incorporates both mechanical and electrical functioning.

Project Envisioned Outcomes: Incorporate of electronics for programmable execution of movement of fingers.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools				☑	
Traditional Machining				☑	
CNC machining		☑			
3D printing				☑	
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding				☑	
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol		☑			
Python		☑			
Ansys		☑			
SolidWorks				☑	
Other CAD packages				☑	
Siemens NX		☑			
LabView		☑			
E-Calc		☑			
AVL		☑			
Xfoil		☑			
Machine vision program		☑			

Additional Requirements and Information:

Students will need experience with CAD and using arduino. Students will have ideally had a circuits class or similar experience to excel in this project.

ME PROJECT 8

Bio-Inspired Flapping Wing Energy Harvester I

Advisor: Prof. Mitsunori Denda

Email: denda@rutgers.edu

Project Abstract: Built on the latest in flapping flight research, the patent-pending technology at the core of this project has been shown to produce efficiencies higher than the best wind turbines on the market.

How? Recently, scientists discovered that birds use advanced flapping aerodynamics to move through the air up to 5 times more efficiently that man-made aircraft. The goal of this project is to use these recently discovered phenomena to efficiently harvest energy from the wind. Team members will design and construct their own wind energy harvester, then test its performance under different conditions. They will have access to CAD models of working prototypes that have been previously built and tested, and they will also have access to proprietary MATLAB programs which can predict efficiency before building the device.

Project Goals: The goal of this project is to use these recently discovered phenomena to efficiently harvest energy from the wind.

Project Envisioned Outcomes: Team members will design and construct their own wind energy harvester, then test its performance under different conditions.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python	☑				
Ansys		☑	7		
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 9

Bio-Inspired Flapping Wing Energy Harvester II

Advisor: Prof. Mitsunori Denda

Email: denda@rutgers.edu

Project Abstract: Built on the latest in flapping flight research, the patent-pending technology at the core of this project has been shown to produce efficiencies higher than the best wind turbines on the market.

How? Recently, scientists discovered that birds use advanced flapping aerodynamics to move through the air up to 5 times more efficiently that man-made aircraft. The goal of this project is to use these recently discovered phenomena to efficiently harvest energy from the wind. Team members will design and construct their own wind energy harvester, then test its performance under different conditions. They will have access to CAD models of working prototypes that have been previously built and tested, and they will also have access to proprietary MATLAB programs which can predict efficiency before building the device.

Project Goals: Design of Bio-Inspired Flapping Wing Energy Harvester

Project Envisioned Outcomes: The students will have access to CAD models of working prototypes that have been previously built and tested, and they will also have access to proprietary MATLAB programs which can predict efficiency before building the device.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining			☑		
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python	☑				
Ansys		☑	7		
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 10

Virtual Reality Cycling for Patient Rehabilitation

Advisor: Prof. German Drazer

Email: german.drazer@rutgers.edu

Project Abstract: This project will integrate mechanical engineering and rehabilitation science. We want to design the next generation of the VRACK (virtual reality cycling kit) system. It will contain sensorized pedals, handlebars and a heart rate monitor that are interfaced with a virtual environment. The objective is to create an inexpensive integrated solution that is tailored for persons who have had a stroke and would use it in rehabilitation. For this project we collaborate with J. Deutsch, a professor of physical therapy in the Department of Rehabilitation & Movement Sciences at Rutgers.

Project Goals: Design and manufacture a pedal that can be integrated into any bike

Project Envisioned Outcomes: A fully functional prototype to test in rehabilitation bicycles

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining	☑				
3D printing		☑			
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages	☑				
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 11

Automated Gantry System for Individualized Products

Advisor: Prof. Xi Gu

Email: xg107@soe.rutgers.edu

Project Abstract: Development of an Automated Gantry System for Individualized Products

Project Goals: The objective of this project is to design and construct a fully automated and flexible gantry system for individualized manufacturing/assembly. The system should be capable of picking, moving, and placing different items requested by individual users (by controlling the speed of movement, etc.) The students will have the flexibility to formulate the design problem with specified applications.

Project Envisioned Outcomes: A built gantry system with control.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools			☑		
Traditional Machining			☑		
CNC machining			☑		
3D printing			☑		
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)				☑	
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol		☑			
Python		☑			
Ansys		☑			
SolidWorks				☑	
Other CAD packages			☑		
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 12

Utilization of Solar Power

Advisor: Prof. Zhixiong Guo

Email: zguo@rutgers.edu

Project Goals: Engineering practice of natural renewable resources

Project Envisioned Outcomes: Design and analysis, Device building and test

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools			☑		
Traditional Machining		☑			
CNC machining		☑			
3D printing	☑				
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)	☑				
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol			☑		
Python	☑				
Ansys		☑			
SolidWorks		☑			
Other CAD packages		☑			
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 13

Layer-Wise Optical Inspection of Additively Manufactured Parts

Advisor: Prof. Yuebin Guo

Email: yuebin.guo@rutgers.edu

Sponsor: National Security Innovation Network

Project Abstract: Optical FDM Monitoring and the optimization of the 3D printing process

Project Goals: Study the effects of printing temperatures and cooling times between layers on the overall strength of the print

Project Envisioned Outcomes: Students will study the effects of printing temperature as well as cooling time allowed between layers and their role in the overall strength of the material. This study would quantify the key differences in bond and material strength given different temperatures and cooling times. With that knowledge, a thermal optical system can be created to monitor the layer and bed temperature and ensure proper bonding between layers in turn creating stronger prints.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design					
Analysis					
Hand tools					
Traditional Machining					
CNC machining					
3D printing					
Welding					
Wiring					
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)					
Microcontrollers (e.g., Arduino)					
Bonding					
Processing (e.g., vacuum bag, autoclave)					

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab					
Comsol					
Python					
Ansys					
SolidWorks					
Other CAD packages					
Siemens NX					
LabView					
E-Calc					
AVL					
Xfoil					
Machine vision program					

ME PROJECT 14

Wind Energy System

Advisor: Prof. Yogesh Jaluria

Email: jaluria@soe.rutgers.edu

Project Goals: Design of a system to demonstrate the use of wind energy to pump water and store energy. The system consists of the wind turbine, energy storage and arrangement to pump water for distribution or to a given height. A windy day may be used to test the system, or the wind may be simulated by means of an electric fan. The system is to be designed, optimized, fabricated, and tested.

Project Envisioned Outcomes: System that can be fabricated and tested

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis			☑		
Hand tools			☑		
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol		☑			
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages			☑		
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 15

Concentrated Solar Energy System

Advisor: Prof. Yogesh Jaluria

Email: jaluria@soe.rutgers.edu

Project Goals: Design and fabricate a concentrated solar energy system, with tracking of the Sun, to heat water, which may be used for thermal processing, desalination, or heating. Also, include an energy storage system to take care of night-time and other durations when solar energy is not available.

Project Envisioned Outcomes: System that can be fabricated and tested

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis			☑		
Hand tools			☑		
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages			☑		
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 16

Rotating Disk Jet Impingement Deposition Equipment

Advisor: Prof. Yogesh Jaluria

Email: jaluria@soe.rutgers.edu

Project Goals: Design, fabricate and test a deposition system consisting of a vertical air jet impinging on a rotating disk for processes, such as painting, coating, and spray deposition, which are used in manufacturing. High flow rate and uniform flow over the rotating surface are desirable. The rotational speed and inlet velocity should be variable for different processes.

Project Envisioned Outcomes: Fabricate and test system to show uniformity of flow on rotating surface

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis			☑		
Hand tools		☑			
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring	☑				
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages		☑			
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 17

Design of Lighter-Than-Air Surveillance Vehicle

Advisor: Prof. Doyle Knight

Email: ddknight@rutgers.edu

Project Goals: Design, fabricate and test lighter-than-air surveillance vehicle

Project Envisioned Outcomes: Design, fabricate and test lighter-than-air surveillance vehicle

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design	☑				
Analysis			☑		
Hand tools	☑				
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python		☑			
Ansys			☑		
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 18

3D Printer Capable of Printing Elastomeric Composites

Advisor: Prof. Jennifer Lynch-Branzoi

Email: jklynch@soe.rutgers.edu

Meeting Place: https://rutgers.webex.com/meet/jklynch

Project Abstract: 3D printing is used to quickly fabricate prototypes. With the development of new materials, including polymeric nanocomposites, 3D printing is a good choice to easily fabricate parts from these novel feedstocks and perform materials characterization. However, high concentration of nanoparticles in a polymer matrix nanocomposite can cause difficulties when using a 3D printer. The aims of this project are to develop and build a 3D printer capable of printing elastomeric composites with a high concentration of nanoparticles and characterize printed novel elastomeric composites, as well as the elastomer alone as a control.

Project Goals: The project goals are to (1) develop and build a 3D printer capable of printing elastomeric composites with a high concentration of nanoparticles, (2) enable accessories to be used with the printer including a spot heater to aid curing and a thermal imager to monitor curing, and (3) characterize these printed novel elastomeric composites, as well as the elastomer alone as a control.

Project Envisioned Outcomes: The primary outcome of this project will be a functioning 3D printer enabling printing of novel polymeric nanocomposites with in situ monitoring of the curing process, which will aid in materials optimization for a specific application and prototyping.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining	☑				
3D printing		☑			
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab		☑			
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages		☑			
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Use Excel or Origin for data analysis

A similar project can be found at http://3dprintingfromscratch.com/common/how-to-build-a-3d-printer-from-scratch/

ME PROJECT 19

3D Printer for Thermoplastics, Thermosets, Conductive and Metallic Materials

Advisor: Prof. Rajiv Malhotra

Email: rajiv.malhotra@rutgers.edu

Meeting Place: https://rutgers.webex.com/meet/rm1306

Project Abstract: The project involves the integration of lasers and other light sources with an in-development 3D printer for printing thermoplastics, thermosets, conductive and metallic materials within the same process. A setup has been developed in past projects for this process. This particular project will involve integration of a fiber-laser with this setup to enable laser processing of these materials as well.

Project Goals: The project involves the integration of lasers and other light sources with an in-development 3D printer for printing thermoplastics, thermosets, conductive and metallic materials within the same process.

Project Envisioned Outcomes: Integration of lasers and other light sources with an in-development 3D printer for printing thermoplastics, thermosets, conductive and metallic materials within the same process.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis	☑				
Hand tools			☑		
Traditional Machining			☑		
CNC machining			☑		
3D printing			☑		
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab					
Comsol					
Python					
Ansys					
SolidWorks					
Other CAD packages					
Siemens NX					
LabView					
E-Calc					
AVL					
Xfoil					
Machine vision program					

ME PROJECT 20

Detachable Propulsion Unit for Surfboards of Varying Size I

Advisor: Prof. Aaron Mazzeo

Email: aaron.mazzeo@rutgers.edu

Project Abstract: Surfing requires a high level of fitness to paddle with sufficient speed and power to catch green waves as they break. For beginning and intermediate surfers, paddling with sufficient speed can be challenging and lead to difficulty in popping up to catch waves and develop skills. This project will focus on the design and manufacture of a detachable propulsion unit that can fit on the underside of surfboards of varying size. The goal is not to create a fast-traveling vehicle but provide enough power in a portable, lightweight attachment to allow surfers to catch waves automatically based on the measured paddling rate of the surfer's arms. Future applications may include systems that assist lifeguards in rescue of drowning surfers.

Project Goals: Create a safe and lightweight system for hydraulic propulsion. Create a control system that uses wireless accelerometers mounted on the upper arm to determine when to power the propulsion system. Collect information from the surfer to then aid in customized instruction.

Project Envisioned Outcomes: Detachable propulsion system. Control system with wireless accelerometers; Data science to aid beginning surfers and help them learn to surf more quickly; Low-cost prototype that we can think about marketing.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design	☑				
Analysis	☑				
Hand tools	☑				
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring	☑				
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)	☑				
Microcontrollers (e.g., Arduino)	☑				
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks	☑				
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Two teams -- one focusing on propulsion; one focusing on the accelerometers.

ME PROJECT 21

Detachable Propulsion Unit for Surfboards of Varying Size II

Advisor: Prof. Aaron Mazzeo

Email: aaron.mazzeo@rutgers.edu

Project Abstract: Surfing requires a high level of fitness to paddle with sufficient speed and power to catch green waves as they break. For beginning and intermediate surfers, paddling with sufficient speed can be challenging and lead to difficulty in popping up to catch waves and develop skills. This project will focus on the design and manufacture of a detachable propulsion unit that can fit on the underside of surfboards of varying size. The goal is not to create a fast-traveling vehicle but provide enough power in a portable, lightweight attachment to allow surfers to catch waves automatically based on the measured paddling rate of the surfer's arms. Future applications may include systems that assist lifeguards in rescue of drowning surfers.

Project Goals: Create a safe and lightweight system for hydraulic propulsion. Create a control system that uses wireless accelerometers mounted on the upper arm to determine when to power the propulsion system. Collect information from the surfer to then aid in customized instruction.

Project Envisioned Outcomes: Detachable propulsion system. Control system with wireless accelerometers; Data science to aid beginning surfers and help them learn to surf more quickly; Low-cost prototype that we can think about marketing.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design	☑				
Analysis	☑				
Hand tools	☑				
Traditional Machining	☑				
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring	☑				
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)	☑				
Microcontrollers (e.g., Arduino)	☑				
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks	☑				
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Two teams -- one focusing on propulsion; one focusing on the accelerometers.

ME PROJECT 22

Working Model of The Human Cochlea

Advisor: Prof. Andrew Norris

Email: norris@rutgers.edu

Project Goals: A tabletop demonstration of the mechanism underlying the cochlea in the inner ear. The key to the cochlea is that different sound frequencies are "heard" at different locations along the cochlea. How does the ear do this spatial filtering? The goal is a hydrodynamic analog device that demonstrates visually how this works.

Project Envisioned Outcomes: The team will design and then make a device that looks a bit like a a large church organ, with tubes of different heights that are filled with water. Each tube corresponds to a different frequency. The project combines vibration with basic hydrodynamics, along with aesthetics to come up with a working device that shows how a given input vibration frequency causes the water in a unique tube to oscillate up and down.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis			☑		
Hand tools			☑		
Traditional Machining		☑			
CNC machining		☑			
3D printing		☑			
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol		☑			
Python	☑				
Ansys	☑				
SolidWorks		☑			
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

Interest in vibrations and/or acoustics
https://doi.org/10.1121/1.419497

ME PROJECT 23

RFR Powertrain Dynamometer

Advisor: Prof. Assimina Pelegri

Email: pelegri@rutgers.edu

Project Abstract: Dynamometer's are data acquisition tools to measure the torque and speed for a motor. We want to build a dynamometer that can mechanically load through viscous damping our Emrax motor and custom made battery pack. This dyno will record power output of the motor and electrical loading response behavior of the battery pack.

Project Goals: The goal is to create a powertrain dyno for Emrax 208, a motor that is being used in the Rutgers Formula Racing 2022 car. The powertrain dyno for electrical motors with power output up to 90kW. Additionally, we want to gather temperature data from our batteries to ensure proper cooling.

Project Envisioned Outcomes: A working powertrain dynamometer that will provide accurate, usable numbers.

Note: This project is closed.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis			☑		
Hand tools				☑	
Traditional Machining				☑	
CNC machining			☑		
3D printing		☑			
Welding	☑				
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol				☑	
Python			☑		
Ansys			☑		
SolidWorks			☑		
Other CAD packages		☑			
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 24

Advanced Thermal Management Solution for Battery Fast Charging

Advisor: Prof. Amin Reihani

Email: amin.reihani@rutgers.edu

Project Goals: The aim of this project is to create innovative battery packaging components that integrate advanced thermal management solutions. Specifically, the students will perform comprehensive numerical simulations to analyze the transient heat conduction occurring within the battery pack during rapid charging and discharging. Subsequently, the students will design packaging components that incorporate new heat transfer materials, heaters, and thermometers to precisely monitor and regulate the cell temperatures during fast charging and discharging operations.

Project Envisioned Outcomes: The outcome of this project will result in the development of a battery pack prototype consisting of a minimum of six Li-ion pouch cells with integrated thermal management components. This system will provide precise control over the transient temperature of each cell, even when subjected to fast charge/discharge cycles under varying ambient temperatures. Throughout battery cycling, the degradation of the cells will be continuously monitored by measuring cell impedance. The advanced thermal management solutions implemented in the prototype are anticipated to reduce the rate of cell degradation during rapid charge/discharge cycles.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design			☑		
Analysis				☑	
Hand tools				☑	
Traditional Machining			☑		
CNC machining		☑			
3D printing		☑			
Welding		☑			
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol				☑	
Python			☑		
Ansys			☑		
SolidWorks			☑		
Other CAD packages		☑			
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 25

Test Setup for Thermal Characterization of Battery Cells

Advisor: Prof. Amin Reihani

Email: amin.reihani@rutgers.edu

Project Goals: The objective of this project is for the students to construct and calibrate a test setup to accurately measure the in-plane and through-plane thermal conductivity, as well as 2D distribution of temperature in individual of Li-ion pouch cells during charging/discharging cycles. The test setup will require utilizing low-noise analog circuits, flexible heaters and a thermal camera connected to a LabView program to operate the test setup and record the data. The test setup needs to be reconfigurable to allow measurements on cells with different dimensions.

Project Envisioned Outcomes: The outcome of the project is a reconfigurable test setup which can accurately characterize the thermal properties of operating li-ion pouch cells. The students will conduct measurements on at least two different types of battery cells, compile the raw data and present them in appropriate graphs. Successful measurements from this instrument will aid the development of accurate thermal models of battery cells and design of advanced battery management systems.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis			☑		
Hand tools				☑	
Traditional Machining			☑		
CNC machining			☑		
3D printing		☑			
Welding		☑			
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)			☑		
Microcontrollers (e.g., Arduino)			☑		
Bonding		☑			
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol			☑		
Python		☑			
Ansys	☑				
SolidWorks			☑		
Other CAD packages	☑				
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program			☑		

ME PROJECT 26

Vacuum Tube Solar Steam Generator

Advisor: Profs. Todd Rossi, Michael Muller

Email: todd.m.rossi@rutgers.edu,

Project Abstract: Solar thermal energy collectors are more appropriate than PV for industrial heat driven processes (e.g., water desalination). In this project, we will enhance, build, and operate a vacuum tube solar steam generator at 15 psi.

Project Goals: 1) Update design and build 15 psi solar steam generator prototype, 2) Operate, test, and measure performance, 3) Refine design as needed, 4) Setup continuously operating outdoor prototype with instrumentation, automated controls, and remote monitoring.

Project Envisioned Outcomes: Continuously operate a 15 psi solar steam generator with automated controls and remote performance monitoring and reporting

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining	☑				
3D printing	☑				
Welding	☑				
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding	☑				
Processing (e.g., vacuum bag, autoclave)	☑				

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab	☑				
Comsol	☑				
Python		☑			
Ansys	☑				
SolidWorks		☑			
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

Additional Requirements and Information:

https://drive.google.com/drive/folders/18ZTBnLddnsjitu4uhlxUGKu2hgHAAfg8?usp=sharing

ME PROJECT 27

Multiple Metric Device for Mixedness of Dense Pastes

Advisor: Profs. Jerry Shan and German Drazer

Email: jshan@soe.rutgers.edu, german.drazer@rutgers.edu

Sponsor: National Security Innovation Network

Project Goals: Design and build a mixing device that has multiple methods of measuring mixedness for dense energetic materials.

Project Envisioned Outcomes: The project aims to create a device integrating torque, texture analyzing, and optical analysis to evaluate mixedness of dense pastes, enhancing manufacturing processes by automating the mixing and assessment. It addresses the task of manual mixing by providing real-time feedback on paste homogeneity, reducing processing time, and ensuring consistent quality. By employing a mix of sensors and analytical techniques, including torque analysis, force measurement, and optical inspection, the device streamlines the manufacturing process, offering potential applications in industries like pharmaceuticals and ammunition manufacturing. The device uses non-destructive measurement methods to maintain the chemical and mechanical properties in energetic materials.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design					
Analysis					
Hand tools					
Traditional Machining					
CNC machining					
3D printing					
Welding					
Wiring					
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)					
Microcontrollers (e.g., Arduino)					
Bonding					
Processing (e.g., vacuum bag, autoclave)					

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab					
Comsol					
Python					
Ansys					
SolidWorks					
Other CAD packages					
Siemens NX					
LabView					
E-Calc					
AVL					
Xfoil					
Machine vision program					

ME PROJECT 28

Test Sample Burning Box

Advisor: Prof. Jonathan Singer

Email: jonathan.singer@rutgers.edu

Sponsor: National Security Innovation Network

Project Goals: Design and build an ignition chamber to test the controlled combustion of MINET materials manufactured at Rutgers.

Project Envisioned Outcomes: The MINET materials manufactured in Dr. Singer's Laboratory are being developed as a printable energetic material that demonstrates a promising potential for lower volatility compared to other energetic materials while maintaining energetic potential and combustion properties. The project aims to design and build test chamber as a specialized apparatus for controlled combustion, measuring essential properties and the performance of these materials through an optical camera, thermal camera, and partial pressure oxygen detector.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design					
Analysis					
Hand tools					
Traditional Machining					
CNC machining					
3D printing					
Welding					
Wiring					
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)					
Microcontrollers (e.g., Arduino)					
Bonding					
Processing (e.g., vacuum bag, autoclave)					

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab					
Comsol					
Python					
Ansys					
SolidWorks					
Other CAD packages					
Siemens NX					
LabView					
E-Calc					
AVL					
Xfoil					
Machine vision program					

ME PROJECT 29

Smarty Carty for Grocery Shopping

Advisor: Prof. Stephen Tse (with Innovation Lab creator Jennifer Haines)

Email: sdytse@rutgers.edu

Project Goals: Smarty Carty is looking to develop a product to ease the dreadful days of grocery shopping. Having your own personal shopping cart will eliminate the pain and experience of shopping the way it always should have been. We strive to be consumer-friendly to create the best experience for our customers while also being eco-friendly to our environment.

Project Envisioned Outcomes: Smarty Carty will be looking to have a unique design with replaceable wheels in case of a damaged wheel, can also include a three-in-one wheel attachment to be able to go upstairs. We want Smarty Carty to be easily stored and folded inside the car/in-house with lightweight eco-friendly materials that are easy to maneuver. Ideally would like to work with a carbon-lined material for the shopping cart and an eco-friendly mesh on the outside, in an attempt to make the cart as lightweight as possible. Our dimensions will be fitted to the average height of a car/SUV so the legs of the cart can be folded into most cars.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools				☑	
Traditional Machining				☑	
CNC machining				☑	
3D printing				☑	
Welding				☑	
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding				☑	
Processing (e.g., vacuum bag, autoclave)				☑	

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python			☑		
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX	☑				
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 30

Automated Foosball

Advisor: Prof. Stephen Tse (with Innovation Lab creator Jennifer Haines)

Email: sdytse@rutgers.edu

Project Goals: Automate Foosball players

Project Envisioned Outcomes: Play against automated foosball players

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design				☑	
Analysis				☑	
Hand tools				☑	
Traditional Machining				☑	
CNC machining				☑	
3D printing				☑	
Welding				☑	
Wiring				☑	
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)				☑	
Bonding				☑	
Processing (e.g., vacuum bag, autoclave)				☑	

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol			☑		
Python			☑		
Ansys			☑		
SolidWorks			☑		
Other CAD packages			☑		
Siemens NX	☑				
LabView		☑			
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 31

High Strength, Light Weight Cylindrical Pressure Vessel with Fiber-Reinforced Composites

Advisor: Prof. George Weng

Email: gjweng@rutgers.edu

Project Abstract: Use carbon fibers and epoxy resin to make polymer composites, and use the composites to build a cylindrical pressure vessel

Project Goals: To build a light-weight composite cylindrical pressure vessel that can sustain high pressure without failure.

Project Envisioned Outcomes: A hardware composite cylindrical pressure vessel.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design		☑			
Analysis		☑			
Hand tools		☑			
Traditional Machining		☑			
CNC machining		☑			
3D printing		☑			
Welding		☑			
Wiring		☑			
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)		☑			
Microcontrollers (e.g., Arduino)		☑			
Bonding			☑		
Processing (e.g., vacuum bag, autoclave)			☑		

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab			☑		
Comsol	☑				
Python	☑				
Ansys	☑				
SolidWorks	☑				
Other CAD packages	☑				
Siemens NX	☑				
LabView	☑				
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program	☑				

ME PROJECT 32

Robotic Gripper Design for Fast Manipulation of Small Parts in Manufacturing

Advisor: Prof. Jingang Yi

Email: jgyi@rutgers.edu

Project Goals: Design, fabrication and testing of new robotic gripper for manipulating small parts in manufacturing

Project Envisioned Outcomes: The robotic gripper will be used to improve the productivity and efficiency.

Students Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Design					☑
Analysis					☑
Hand tools				☑	
Traditional Machining				☑	
CNC machining				☑	
3D printing				☑	
Welding		☑			
Wiring			☑		
Simple analog or digital electronics (e.g., resistors, capacitors, op-amps)				☑	
Microcontrollers (e.g., Arduino)					☑
Bonding				☑	
Processing (e.g., vaccum bag, autoclave)		☑			

Software Expertise:

	None	Beginner	Intermediate	Serious Hobbyist	Professional
Matlab				☑	
Comsol			☑		
Python					☑
Ansys			☑		
SolidWorks					☑
Other CAD packages				☑	
Siemens NX		☑			
LabView			☑		
E-Calc	☑				
AVL	☑				
Xfoil	☑				
Machine vision program					☑

Additional Requirements and Information:

Real-time control systems