Rutgers University

Department of Mechanical & Aerospace Engineering

2021-2022 Senior Design Projects

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

Mechanical Engineering Projects

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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

Multi-Mode Hybrid Unmanned Delivery System: Combining Fixed-Wing and Multi-Rotor Aircraft with Ground Vehicles

Advisor: Prof. Onur Bilgen

Email: o.bilgen@rutgers.edu

Project Goals: The goal of this project is to investigate novel concepts for a multi-mode unmanned aerial system. For example, a VTOL vehicle attached (docked) to a fixed-wing (i.e. STOL) vehicle. In this case, the fixed-wing aircraft does the long-distance "cruising." Once the system within the vicinity of the delivery location, the multi-rotor will detach and will take care of the vertical movement for a controlled delivery to the ground. Navigation, planning, logistics, policy issues, docking/undocking, platforms etc. are all very interesting and relevant problems – such issues will be looked at by the design team.

Previous Success: The 2020 team received a research award from the highly competitive NASA USRC program. (https://mae.rutgers.edu/news/senior-design-team-captures-nasa-research-challenge).The new team will apply to the same program in June. In addition, the 2020 Team presented a paper at the AIAA 2021 Region I Conference, and received the 3rd place prize in the team category.

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:

https://mae.rutgers.edu/news/senior-design-team-captures-nasa-research-challenge

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.

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		☑			

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

Desktop-Size Non-Destructive Material Identification Device

Advisor: Prof. Alberto Cuitiño

Email: alberto.cuitino@rutgers.edu

Project Abstract: To develop a desktop-size non-destructive material identification device. This device will be based on mechanical testing of small samples. Elastic moduli (E) of the material will be obtained by recording the buckling load that for a given sample geometry and testing configuration, is only dependent on E. the By selecting the geometry of the sample and loading condition, buckling can be triggered before material material failure.

Project Goals: To miniaturize a mechanical testing machine for buckling at relatively low cost in such a way engineering students, with the proper design and documentation, can build their own testing device for testing material at home.

Project Envisioned Outcomes: A tested machine design with a full set of documentation for a DIY project for engineering students. The device should include all the components of hardware, software and integration.

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 9

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: 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

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 11

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 12

Automated Gantry System for Individualized Production

Advisor: Prof. Xi Gu

Email: xg107@soe.rutgers.edu

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

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 13

Solar Energy Harvesting or Water Desalination Device

Advisor: Prof. Zhixiong Guo

Email: zguo@rutgers.edu

Project Abstract: The amount of solar irradiation on earth's surface is gigantic, but most of which remains unutilized while we keep depleting traditional fossil fuels. Photovoltaic (PV) or solar cells convert light energy into electricity. The yearly installation capacity of solar photovoltaic facilities has seen a continuous significant increase worldwide in recent years. Solar energy is also used for natural illumination and water and space heating. 97% of the water on the Earth is salt water. Water scarcity is among the major problems to be faced by human beings. Solar desalination is a technique to desalinate water using solar energy.

In this project, you could bring in some "wild" ideas to harvest or use solar power. For example, you may consider harvest solar energy for illumination and water heating via a smart window, build a small solar cell power generator, or design a solar desalination device. The objective of this project is to design, build, and analyze a device for solar energy harvesting or water desalination for engineering practice of natural renewable resources.

Project Goals: Idea, analysis, design, device build, and test.

Project Envisioned Outcomes: A device with some innovative or practical idea

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

Hybrid Manufacturing of Customized Knee Implant

Advisor: Prof. Yuebin Guo

Email: yuebin.guo@rutgers.edu

Project Abstract: Students will design, manufacture, and testing a Customized Knee Implant through an integrative method.

Project Goals: Learn and practice comprehensive knowledge in design concept, CAD/CAM, numerical simulation, manufacturing, and testing. Oral and written communication and team skills are also emphasized.

Project Envisioned Outcomes: Customized Knee Implant and written report

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

Low-Cost Ventilators for COVID-19 Patients

Advisor: Prof. Yuebin Guo

Email: yuebin.guo@rutgers.edu

Project Abstract: Students will design, manufacture, and testing a Low Cost Ventilator for COVID-19 Patients through an integrative method.

Project Goals: Learn and practice comprehensive knowledge in design concept, CAD/CAM, numerical simulation, manufacturing, and testing. Oral and written communication and team skills are also emphasized.

Project Envisioned Outcomes: Functional Low Cost Ventilator and written report.

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

Hybrid Solar and Wind Energy for a Practical Use Plus Storage

Advisor: Prof. Yogesh Jaluria

Email: jaluria@soe.rutgers.edu

Project Abstract: Use of hybrid solar and wind energy for a practical use plus storage

Project Goals: Develop and test the designed system

Project Envisioned Outcomes: Fabricate and test the system and the design

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

Table Top Subsonic Wind Tunnel

Advisor: Prof. Doyle Knight

Email: ddknight@rutgers.edu

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

Project Abstract: The project is the design, fabrication and demonstration of a table top subsonic wind tunnel measuring the lift and drag on an airfoil, air velocity, temperature and pressure.

Project Goals: Completion and demonstration of the table top subsonic wind tunnel.

Project Envisioned Outcomes: Demonstration of ability to design, manufacture and validate table top subsonic wind tunnel.

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

Color-Based Sorter

Advisor: Prof. Hao Lin

Email: hlin@rutgers.edu

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

Project Abstract: Design and manufacturing of a color-based sorter. Colorful objects are detected by sensor, moved down a dispenser and sorted by a compressed-air-puffing mechanism.

Project Goals: Design and manufacturing of a color-based sorter.

Project Envisioned Outcomes: 1. Design and manufacturing capability. 2. Hardware implementation with sorting and object aligning mechanisms. 3. Algorithm development and integration with hardware.

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

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 21

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 22

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 23

Dynamic Vibration Absorber

Advisor: Prof. Andrew Norris

Email: norris@rutgers.edu

Project Abstract: Dynamic Vibration Absorber: Elimination of unwanted vibration is a major challenge in many mechanical and aerospace systems, such as large electric turbines in power plants, or for accurate motion control in robots. The project will develop a simple but powerful dynamic vibration absorber (DVA) that significantly reduces machine vibration. The DVA design will focus on is a spring mass system which operates at frequencies close to the primary system (or machine) resonance. The project will combine analysis, design, fabrication and testing of an important mechanical engineering application.

Project Goals: The goal of the project is the analysis, design, and fabrication of a working bench-top system that demonstrates the principle of a single degree of freedom dynamic absorber. The project team will learn how to analyze a two degree of freedom machine plus DVA, design the mechanical components and electronic controls, and fabricate and test a robust working system.

Project Envisioned Outcomes: The end product is a robust device that can serve as an educational tool for future MAE students and can be used by undergraduates to apply and understand vibration control theory to minimize machine vibration. In the process the project team members will learn about the important mechanical engineering field of vibration absorption.

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:

Some understanding of vibration, experience with electric motors.
Links to similar projects:
https://www.youtube.com/watch?v=2_TjQoyV5RE
https://www.youtube.com/watch?v=x5BMlPe_mQY
https://www.youtube.com/watch?v=KxEJ0xkLO7g

ME PROJECT 24

RFR Brake Dynamometer

Advisor: Prof. Assimina Pelegri

Email: pelegri@rutgers.edu

Project Abstract: Design, model, fabrication, and testing of a brake dynamometer to measure the torque imposed on a rotor.

Project Goals: The goal is to identify the coefficient of friction on the pads of a car braking system under different loading and thermal conditions. The objectives are the design, model, fabrication, and testing of a brake dynamometer to measure the torque imposed on a rotor.

The brake dynamometer will measure the normal force applied through a caliper/load cell assembly. The friction coefficient can be determined by knowing the normal force applied to the rotor by the brakes and the data from the load cell. The team will correlate the friction coefficient ensued on the pads at different temperatures and different pad materials. The in-situ rotor temperature reading will be recorded during operation using an IR camera. The team will use the collected data on a custom-made data acquisition board to calibrate specialized sensors. This device should be capable of amplifying the load cell data, reading the IR thermal sensor temperatures, and reading hall effect sensors to determine rotor RPM. This information would be logged and displayed in real-time on a monitor.

Measurement of the brake torque and power of the motor ensures the safe and robust braking system and compliments the cyclic load testing of the car's rotors to failure. These two tests evaluate the operational stress levels the rotor undergoes and aids in determining appropriate safety factors.

Project Envisioned Outcomes: Design, model, fabrication, and testing of a brake dynamometer to measure the torque imposed on a rotor.

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 25

Vacuum Tube Solar Steam Generator

Advisor: Prof. Todd Rossi

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 26

Mechanical Device for Transdermal Drug & Gene Delivery

Advisor: Prof. Jerry Shan

Email: jshan@soe.rutgers.edu

Project Goals: Recent work has showed that vacuum suction (ie. cupping) applied to the skin can increase the uptake of DNA into skin cells for gene-based therapies. However, the mechanisms behind suction's effect on drug/gene delivery are not understood. We are seeking a group to design and construct a mechanical device that can provide controlled strain (and strain rate) to skin in 1 and 2 directions. The device will enable fundamental study of the mechanisms for transdermal delivery, as well as possibly serve as a therapeutic device for clinical applications.

Project Envisioned Outcomes: Mechanical device that can provide controlled strain (and strain rate) to skin in 1 and 2 directions.

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 27

Gecko-Like Foot Pad

Advisor: Prof. Jonathan Singer

Email: jonathan.singer@rutgers.edu

Project Abstract: Geckos have the unique ability to adhere to any surface except Teflon. Thanks to the microscopic hairs (setae) covered in tiny nano-scale spatulae located on the gecko's foot, the interactions between the gecko's feet and climbing surface are dictated by Van der Waals forces, making their feet grip exceptionally well. With the help of its setae, just one foot of the gecko can hold up to 20 times the animal's weight! This project aims to create a rubber surface that will replicate the adhesive properties of the gecko's foot by using an electrostatic spray method to replicate the microscale setae and nanoscale spatulae of the gecko's foot pad. The foot would be attached and detached from the wall by modulating air pressure within the foot's structure. The effectiveness of the finished surface will be analyzed through a variety of mechanical tests, utilizing inclined surfaces, various climbing surface materials, additional weights, and a variety of operating environments.

Project Goals: This project aims to create an adhesive surface that takes inspiration from the micro-scale setae and nano-scale spatulae on the foot of a gecko. A high surface area, complex micro/nanotextured pad similar to a gecko foot will be created through molding and electrospray deposition. The surface will be tested through its ability to adhere to several materials at various inclination angles. The response of the surface to different environmental conditions (temperature and humidity) and the amount of weight it can support will also be investigated.

Project Envisioned Outcomes: Proposed outcomes for this project include: (1) Use molding and/or 3D printing to create a soft pad that the electrospray coating can be applied to mimic the 'peel on or off' action of a gecko foot, (2) To use electrospray to develop a nanotextured surface capable of adhesion, (3) Measure coating efficacy on a variety of surfaces and inclines in several environments. As a stretch goal teams will work together to (4) Incorporate the gecko foot into a robot, allowing the robot to scale walls and inclined surfaces.

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 28

Gecko Robot

Advisor: Prof. Jonathan Singer

Email: jonathan.singer@rutgers.edu

Project Abstract: We wish to design and build a robot that can emulate the movement of a gecko. A robot such as this could be used in several different applications. We will utilize 3D modelling and simulation software to optimize our design before fully manufacturing the robot. Rigorous testing will be conducted in order to determine the robots optimal operating efficiency.

Project Goals: The goals of this project are to create a robot that can effectively utilize gecko-like feet to scale walls of varying steepness and material. The first goal is to design a foot that mimics a gecko's foot's ability to 'stick' to a surface and then easily pull it off when needed. This will involve being able to pull the foot away from a surface at an angle that is not perpendicular to the surface as well as pulling the foot away in a rolling motion which will deactivate the sticking properties of the foot. The second goal is to build a robot gecko that can move the feet allowing for movement and control. The robot will have to be light and have a center of gravity that sits as close to the ground (or wall) as possible.

Project Envisioned Outcomes: The final outcome of this project would be to integrate the work of another senior design group that will be creating a gecko-like foot pad with similar adhesion properties. By integrating the foot pad into our robot design, we would be able to use our robot at various inclines from flat ground all the way to a vertical wall. A robot such as this would have various applications such as stealth technology, search and rescue, safety, and maintenance. For example, the gecko robot could be used to search for survivors in collapsed buildings, as its small size and mobility would allow it to navigate rubble.

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 29

Equine Simulator

Advisor: Prof. Stephen Tse

Email: sdytse@rutgers.edu

Project Abstract: Riding feedback and jumping motion for Equine simulator.

Project Goals: Based on an equine simulator prototypes constructed in previous years, the students will modify the apparatus to allow for the user to make basic movements that cause the simulator to switch gaits (walk, trot, and canter). Additionally, active sensors will be incorporated to change movements to stabilize the rider and prevent falling, as needed.

Project Envisioned Outcomes: If possible, jumping motion will be added to the controlled movement.

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

Assistive Device for Wheelchairs/Scooters Users

Advisor: Prof. Stephen Tse

Email: sdytse@rutgers.edu

Project Abstract: Device to assist those in wheelchairs or scooters to get on and off rollercoaster rides

Project Goals: For this project, the students will design and build a device that can allow a person in a wheelchair/scooter to get on and off a rollercoaster car more easily and faster.

Project Envisioned Outcomes: The device can either be portable or stationed at the facility.

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

Fishing Equipment with Sensory Feedback

Advisor: Prof. Stephen Tse

Email: sdytse@rutgers.edu

Project Abstract: This project aims to develop a platform that enables individuals with physical changes to engage in a fulfilling fishing experience. This platform aims to lower the physical requirements of fishing yet provide sensory feedback. Students can work on the user interface, casting, reel-in, and hook setting functionalities. This project is heavily involved in microcontrollers, mechanisms, and general electronics. Work will be co-supervised by Frank Iattarelli (IP holder).

Project Goals: Complete 1 or more subsystems utilized in this platform. wheelchair/ scooter to get on and off a rollercoaster car more easily and faster.

Project Envisioned Outcomes: To produce an adaptive fishing platform that provides a sensory feedback experience to persons with physical challenges that would otherwise be unable to engage in this outdoor activity.

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

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 spherical pressure.

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

Project Envisioned Outcomes: A hardware composite spherical 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 33

A Smart Fertilizer Machine for Urban Organic Waste Recycling

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Project Abstract: In this project, we are creating one-of-its-kind smart machine that turns urban organic waste (e.g., vegetable and fruit left-out) into biogas and fertilizer. Urban agriculture has becoming an indispensable component of the food supply in big cities around the world, whereas in the contrast, organic waste has also becoming an increasingly critical environmental concern in these big cities as well. Thus, turning organic waste into biogas and fertilizer that can be directly used as energy resource and applied in urban agriculture, respectively, is not only very environmentally, but also economically beneficial. In this project, you are asked to build upon the outcome of the previous year's group, to improve their design and construction, and then build, and test a prototype machine that can automatically sort the organic waste, break them into small pieces, and convert them into biogas and fertilizer through fermentation process. The system you will make is a truly mechatronics system, and you will utilize the state-of-the-art sensing, actuation, computer vision, and onboard computation technologies to make the whole system completely autonomous, robust, and highly efficient that can be easily deported and installed in communities and/or urban farm factory in the future.

Project Goals: Create one-of-its-kind smart machine that turns urban organic waste (e.g., vegetable and fruit left-out) into biogas and fertilizer.

Project Envisioned Outcomes: A prototype machine that can automatically sort the organic waste, break them into small pieces, and convert them into biogas and fertilizer through fermentation 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	☑				

Additional Requirements and Information:

Arduino programming experience is required.