Senior Design Projects – Fall 2017

Continued development of a water-wave electric generator system – Phase IV

In the Fall 2016, Winter and Summer 2017 semesters, teams of students successfully developed and refined a motor-driven test bed for the Oscillo Drive from Wave Water Works. The Oscillo Drive is a propriety mechanical transmission invented for capturing the oscillating mechanical energy from water waves and transforming it into a uni-directional rotation suitable to drive an electric generator. The test bed uses an electric motor and driver to produce an oscillatory input to the Oscillo Drive, and the output generates electricity by spinning an alternator. The goal of this Fall 2017 project is to test the Oscillo Drive system when it is driven by water waves.

The tasks required in the Fall 2017 semester are:

- Couple the Oscillo Drive to the float system supplied by Wave Water Works, install and test at one or more local sites. This task must be accomplished before mid-October 2017.
- Analyze the test data from the above test to calculate the efficiency of the water wave system, suggest changes to the system to increase energy capture and storage.
- Develop, simulate, construct and demonstrate an adjustable, universal float system to capture the motion of water waves (2-6 ft amplitude, 12-24 cycles per minute, 24-144 linear feet of upward wave motion per minute), that can improve and replace the float system tested above

Students will have access to the materials from the two previous semesters of work on this project. Non-disclosure and non-compete agreements are required before students can commence work on this project.

Feasibility and initial development of a "Stream Engine"

A local inventor has obtained a patent for a "stream engine," a method of converting the mechanical energy of a flowing river into electrical energy. The tasks associated with this Fall 2017 project are as follows:

- Starting with the inventor's sketches, develop a detailed CAD model of the proposed system
- Perform fluid flow, kinematic, stress and energy analyses on the proposed system
- Explore the feasibility of the proposed system in comparison to other alternative methods of electrical generation (solar, wind, wave motion, etc)
- Suggest alternatives to the proposed system, with the goal of producing a universal, easily implemented, safe method of producing electricity from the motion of rivers

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Continued development of a Rotary Valve IC Engine –Phase III

A local inventor has developed a patented concept for a rotary-valved, computer-controlled IC engine, and has been working with SECS senior design groups over the last year to produce a working prototype. The tasks to be undertaken this semester include:

- Focus on the revised design of the cylinder head together with the latest rotor and port shape
- Write specifications for the ceramic and metals testes in Summer 2017
- Finalize the complete packaging of the internal components with proper clearances allowing for thermal expansion, pressure and combustion forces
- Spec the sealing surfaces, support bearings and final drive components
- Eliminate the mechanical links to the valve, driving it entirely through a servo to allow for more control capacity

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Development and demonstration of a hybrid 3-wheeled scooter – Phase II

Berylline is a small company in the OU-INC business incubator, developing a 3-wheeled hybrid scooter to be used as secondary, short-range transportation. The Berylline hybrid system features a boost electric motor to improve both starting and hill-climbing performance while enhancing fuel economy.

In the Winter 2017 semester, two groups of students took on this challenge. One group tested a stock Ice Bear 150cc 3-wheeled scooter for acceleration performance and fuel economy on the Formula SAE dynamometer, converted it to EFI, then ran it through the identical dyno test to establish baseline performance metrics. In the process, they identified several issues with the Ice Bear scooter and its engine controller. The other group developed a comprehensive design for the hybrid drive and control system, including motor and battery packaging.

The Fall 2017 project consists of the following scope of work:

1. Review and refine (if necessary) the hybrid system developed in the Winter 2017 semester
2. Obtain, manufacture, assemble and adjust the components of the hybrid drive
3. Incorporate the hybrid drive onto the Ice Bear scooter
4. Using the fixture developed for the Formula SAE dynamometer, perform dyno test 3:

a. Vehicle/driver weight
b. Acceleration: 0-30MPH
c. Acceleration: 20-40MPH
d. Fuel Economy: Decide a specific driving loop, measure fuel consumption

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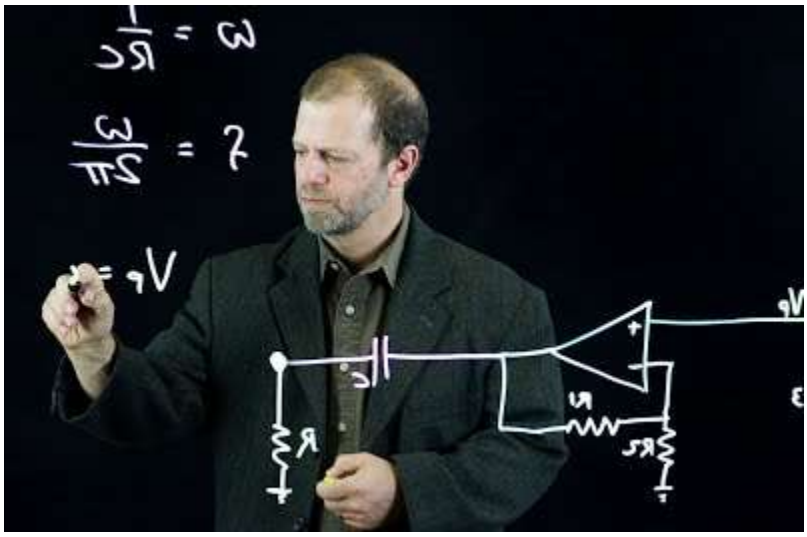
Development and construction of a Lightboard system

Lightboards are gaining popularity to facilitate online instruction. A lightboard is essentially a large pane of glass that is lit from the edges. When written on with a special marker, the writing "glows" and is easily visible, especially when it is viewed against a black backdrop. Lightboard systems are used to produce instructional videos of lectures and other training aids. Lightboards kits are available for purchase, but do not come with the necessary microphones, cameras and software necessary to produce high-quality instructional videos. Detailed instructions and hints are readily available online, for example at http://lightboard.info



The OU e-Learning Center has asked us to design and construct a lightboard system for faculty use at Oakland. This system needs to fit into the limited e-Learning space, must be constructed to fold into the available storage space when not in use, and must be complete with the proper lights, microphone, camera, presenter monitor and software necessary for a complete system.

Refinement of an ergonomic shin support system

HBS Systems has developed a novel, ergonomic shin support to help alleviate the pain and fatigue of standing for long hours working at a machine or workstation. The company has generated considerable interest in the product. Refinements to the product must be addressed and developed before it can be commercially viable.

This project will take the current rudimentary design and consider its baseline materials, structure, features and function with respect to applications, materials and costs; develop alternatives to optimize its look/feel as well as suggest alternative manufacturing approaches and/or material substitution to reduce weight, cost and complexity.

Non-disclosure and non-compete agreements are required before students can commence work on this project.

Development of a hand-held marker for cryogenic test tubes

There is a need to develop a fast, reliable, permanent method to mark plastic test tubes for cryogenic biological testing. Current methods of marking ("permanent" markers, adhesive labels) test tubes are well known to be both slow and non-permanent.

Methods to be explored include all that are used to permanently mark industrial parts and to date code perishable consumer items. The goal of the project is to identify the appropriate technologies and to develop a convenient, reliable, fast, hand-held tool for permanently marking plastic test tubes.

Non-disclosure and non-compete agreements are required before students can commence work on this project.

Lear Corp. – Wire Harness Installation

Wire harness products are extremely labor intensive to assemble and install. Many new technologies have been developed for installing complicated parts to vehicle assemblies, however, wire harness products have found very limited gains from these technologies. Commonly when asked the question "what would make the harness easier to install?" most auto workers will respond with "make it install itself".

OBJECTIVES

A. Understand challenges of wire harness assembly, packaging and installation.
B. Understand how these challenges can affect the product performance in the final installed position.
C. Develop enhancements to overcome these challenges for improved product performance with reduction of installation time.

DELIVERABLES

- Detailed definitions of product enhancements with supporting documentation of experiments conducted.
- Prototype product/s samples with the defined design enhancements.
- Time trial studies of before and after enhancement products around areas of assembly, packaging and installation.

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Lear Corp. – Energy Harvesting

Energy harvesting from vehicle electromagnetic field (Non-stable Energy) passing through a loop area (wires) which in turn induces current that can become an energy producing source. These electromagnetic Non-Stable Energy sources can come from electrical/electronic circuits, lighting, RF transmitter, high speed data, electric motor, video displays, engine coils, near high frequency PWM electronics etc.

OBJECTIVES

A. Understand specification drivers for: Power requirement, Safety aspect, Reliability and Sustainability
B. Understand the potential of the flux and to what extend that can be used as a source solution of power
C. Understand other potential power source innovation

DELIVERABLES

- Illustrate and demonstrate captured EMI field measurements (EH sweet spots) conducted in a vehicle (electromagnetic disturbances)
- Show key components that are vital to the functioning of an energy harvesting system
- Energy to Voltage conversion mechanisms
- Demonstrate energy storage mechanism and energy storage element
- Quantify energy generated and power management energy captured efficiency

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Lear Corp. – Testing of Tin/Silver Wire Plating

Provide evidence of the maximum temperature that Silver and Tin plating options can be used to conduct electrical current both reliably and predictably. Determine failure modes when maximum temperatures are exceeded and determine a solution to bring tin plating to a 150°C maximum use temperature (currently 130°C) and bring silver to a 200°C maximum use temperature (currently 150°C). The solution is not limited to material selection. It should be expanded to mechanical design performance (ex: effects of forces acting on the mechanical interfaces).

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GKN – Test Fixture for AWD Differential

GKN has identified a differential transmission component of their AWD system that introduces unacceptable vibration in to the system. This differential, supplied by a sister company, is nominally within specification, yet individual transmissions exhibit unacceptable performance when assembled into the entire system. GKN is looking for a fast, convenient test fixture that they can use to test the differential at the assembly point and weed out components that are likely to degrade performance.

Working with GKN engineers and technicians, this design group will design, test and demonstrate a test fixture that will:

- Quickly secure the differential in its ready-to-assemble configuration without restricting its motion,
- Apply an 800-rpm rotation to the input shaft while providing a nominal resistive load to load the gears,
- Measure the torque and vibration of the differential through strain gages

Non-disclosure and non-compete agreements are required before students can commence work on this project.

FCA PREP project

This project, sponsored by FCA, is open only to students in the PREP program.

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