ASME CORNELL UNIVERSITY

MECHANICUS

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ASME Ice Cream Social this Wednesday!!!!!!!

Dear fellow MechEs,
Please join us for this scrumptious opportunity to socialize and eat nommy ice cream.

May 1st, 2013, 12:00-1:45pm
Upson Lounge

Sincerely yours,
ASME

WE WANT YOU!

Cornell ASME's executive board is currently looking for dedicated leaders to help enrich the engineering student experience for all MechEs.

As an executive board member, you will have various responsibilities including planning events such as information sessions or social events for your peers. In the process, you will develop beneficial relationships with upperclassmen, recruiters from various companies, and the professors of the Sibley School.

If you are interested, please email asme@cornell.edu by May 3rd listing your name, class year, and top three position choices (secretary, social chair, newsletter editor, outreach chair, or webmaster).

Ushers Needed for Commencement

Ushers are still needed for the MAE Commencement Ceremony on Sunday, May 26 in Bailey Hall. If interested, please email Nanette Peterson at np18@cornell.edu. From noon-1:30pm, free catered lunch, free M.E. shirt, and lots of fun! $10 per hour.

Wing Mill Energy Harvesting

by Henry Ekwaro-Osire, ASME Secretary

The Wing Mill, or perhaps more accurately "wing turbine," has the potential to be the next big thing in harnessing wind energy. It has numerous features that distinguish it from traditional horizontal-axis wind turbines (HAWTs) like the ones you see towering over country landscapes—specifically that its purpose is to generate electrical energy from flapping motions.

The Wing Mill Energy Harvesting research group is a project of Professor Ephrahim Garcia's Laboratory for Intelligent Machine Sys-

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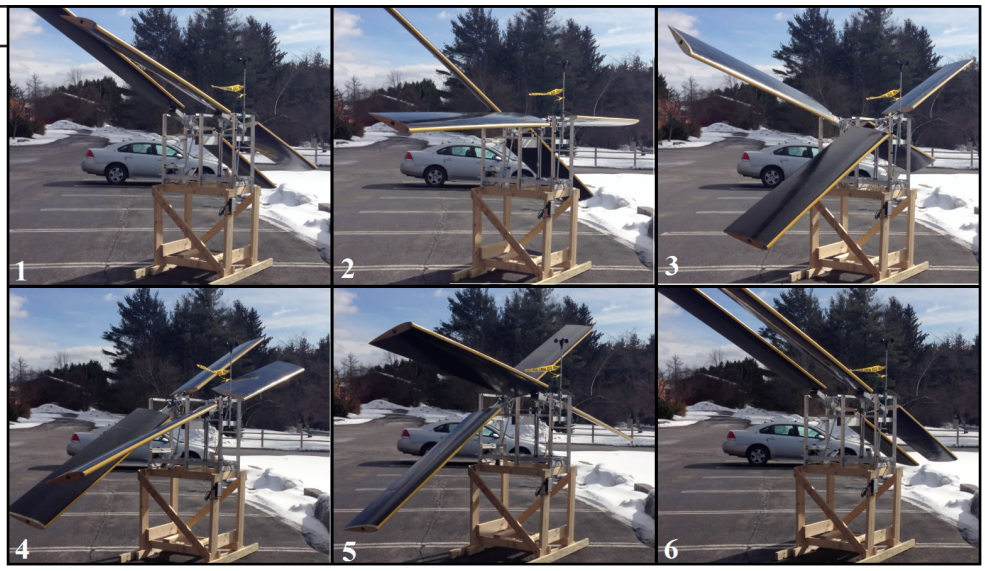

Motion of wing mill through one cycle. *– (1) The wing mill begins with a slight angle of attack, the wind pushes the front wing downwards (2). In (3), the wing has reached the bottom of the cycle and its wings are pitched to create lift (4,5) and move back to its original position (6). The rear wing is 90° out of phase from the front wing.*

Meet the New MAE Professors!

This semester the MAE department welcomed two new professors to the Sibley School. Mechanicus sat down with them to find out about their classes, their research, and how they are adjusting to life on the Hill.

Professor Meredith Silberstein

Hailing from University of Illinois Urbana-Champaign and MIT, Professor Meredith Silberstein joined the mechanical engineering faculty in January and has been teaching Statics and Mechanics of Solids (ENGRD 2020) throughout the semester.

Professor Silberstein's research interests lie primarily in mechano-chemically active materials, which are materials which can support a chemical reaction driven or started by mechanics. An example of this would be starting a fire by striking flint.

Another example of this is damage detection via color change in safety glasses. The way this works is that molecules are embedded and tightly held in a clear, polymer specimen, and when the specimen is twisted, it will go from transparent to colored.

"You take just a normal, industry-type material, like safety glasses, and then you change the manufacturing process slightly so that one of every tens of thousands of molecules is this other type of molecule. And so now you still have your fully functioning safety glasses, but now when they start to get damaged, you have a color change warning," Professor Silberstein explained.

Silberstein's research with polymers is very interdisciplinary and related to both materials science and chemistry through mechanics. It also involves a lot of math and simulations to describe and understand what is happening in the materials.

"Basically, I work on how you understand that process and design materials to do this from a totally macro scale down to the really tiny molecules; how to link a lot of different sizes and time scales together to create this crazy model," she said.

Professor Silberstein will be taking the fall semester off from teaching to set up her lab for her research, and is looking forward to teaching 2020 again next spring. She can be reached at ms2682@cornell.edu.

-Reporting by April Schneider, Newsletter Co-Editor

Professor Robert Shepherd

Professor Robert Shepherd recently arrived at Cornell after receiving a Ph.D. in materials science (and an MBA) from the University of Illinois, and completing a post-doctoral fellowship at Harvard. While he is not teaching any classes this semester, he is hard at work preparing a brand new course for the fall 2013 semester. The course, titled Innovative Product Design via Digital Manufacturing, will be one of the department's most exclusive. "Since it's my first time teaching in this area—and it's a new course—we decided to limit it to 20 students for the first time it's offered," Shepherd said, "It's limited now but the next semester we'll open it up past that."

In the course students, "are going to be making new mechanical designs within a particular constraint to solve a problem (and I'll define that problem later)… and then they'll use digital manufacturing tools, mostly 3D printers, to prototype their designs and then get feedback from their potential customers (other students outside of the class). Then from that feedback they will change their mechanical designs and then produce new prototypes using the 3D printers, retest them, do failure analysis on them as well using some prior coursework, and then improve their designs and in the end end up with a prototype that they might feel comfortable with pursuing as a product." It can also be taken for senior design credit.

Since he is not teaching classes this semester, Professor Shepherd had been able to focus on bringing his exciting research to Cornell. One of the most interesting areas of his research is the concept of soft machines. Asked to define this concept, he explained, "Soft machines are basically mechanisms built off of components that deform. It's actually not a well-defined area yet, because soft is an extrinsic property." Elaborating, he said, "You can have a soft machine that is built off a hard material," giving a steel spring as an example. The

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Wing Mill

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tems (LIMS). In order to exploit the differences and optimize power output through experiments, the team started by asking, "Why do you need this machine? Aren't wind turbines good enough already?"

In answer to this question, it must be considered that a typical HAWT achieves its best performance in steady, laminar winds. Unfortunately, the desired air flow for traditional wind turbines is present in relatively few locations, and installation of these turbines often results in vehement opposition from local residents due to noise and aesthetic concerns.

The Wing Mill is designed to take advantage of unsteady and turbulent flow profiles. This would allow for it to be effectively used in urban environments in addition to the typical offshore and plains locations. The turbine itself is nearly silent, and reportedly has a "soothing effect" for the listener. Instead of gigantic, potentially dangerous HAWTS that require zoning permits for their excessive height, the Wing Mill can be placed on any building rooftop or field that experiences wind.

This research challenges the popular image of vast arrays of large white turbines on enormous towers. The hope is that the LIMS Wing Mill will introduce a new way to harvest wind energy that can overcome some of the limitations of the traditional wind turbine. However, at this point it is not designed to replace conventional HAWTs, but simply to supplement them in environments that HAWTs cannot efficiently or practically function.

To create an efficient and functional wind energy generator that could fulfill the requirements, master's students initially constructed a mid-sized model a few years ago. Based on their initial research, the full-scale Wing Mill was commissioned and has been subsequently improved upon by the current research team.

The turbine consists of two pairs of heavily cambered (NACA 0015) symmetric airfoils which are placed 90 degrees out of phase and coupled to a central shaft using four bar linkage mechanisms, resulting in a coupled, rocking oscillation. The four bar linkages are the most notable recent addition, and are a complete redesign from the original model. In the previous mechanism, passive rubber stoppers would collide with the wing tips, and the full-scale prototype did not operate reliably; consequently, a considerably more complex four bar linkage was designed and implemented. The addition of the new mechanism allows for accurate control of each wing's angle-of-attack, resulting in lift being induced upward for two airfoils and downward for the other two at any given time.

The offset heaving motion results in a relatively smooth rotational output from the crankshaft. Experimentation and confirmation of theory consisted primarily of outdoor testing, placing the wing mill in variable, turbulent low speed winds (5 – 20 mph).

The data collected and analyzed includes the torque produced at the output shaft, the shaft's angular speed, each airfoil's angular position, and wind speed. Further analysis will allow for fine-tuning and better understanding of the device for future iterations and hopefully commercialization.

Professor Shepherd

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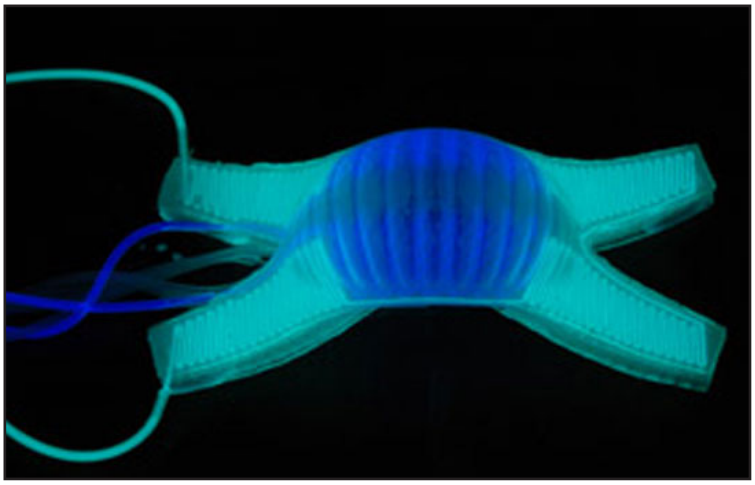
professor's research, though, goes far beyond springs, involving the design and creation of tools using soft organic materials, creating items such as a compressed air powered gripper capable of picking up a raw egg without the need for pressure sensors—a difficult task in traditional robotics.

The other research focuses of the professor's newly formed Shepherd Laboratory include 3D printing and granular systems. For students interested in participating in this research, Shepherd said, "I'm always looking for motivated undergraduates and graduate students." Professor Shepherd can be contacted at rfs247@cornell.edu.



One of Professor Shepherd's soft machines. See it move at mae.cornell.edu/research/groups/shepherd/

-Reporting by Noah Kantro, Newsletter Co-Editor