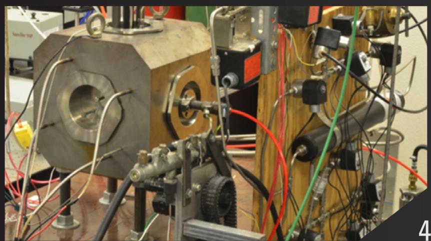
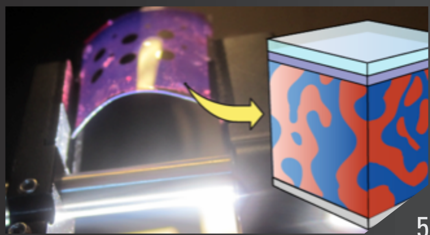
IN THIS ISSUE

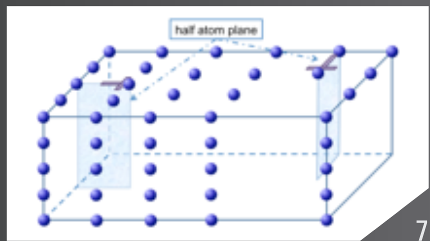
On the cover: MAE students work on a diesel engine in the 1950s.



4



5



7

UPDATE FROM THE DEPARTMENT HEAD

Dear Friends and Alumni,

Greetings from your home department! There is a fury of activity at the university as we continue to grow to provide opportunities to more students while dealing with the current economic conditions. To address new economic realities, the university has embarked on a campus realignment strategy. Colleges and departments are involved in this exercise. The goal is to do more with less. At the same time, the new Hunt library, just a few hundred yards from the MAE department, is close to completion. This facility will be a model for future libraries, with its collaborative spaces and meeting rooms that will allow for student group work, to its robotic book retrieval system. Additionally, a Centennial Campus student housing village is being built adjacent to our building. This space will have 6 residence halls, a dining facility and bookstore. If you have not had a chance to visit our new building on Centennial Campus, please do so. Based on responses from those who have had this opportunity, you will be very impressed and proud of your department. The College of Engineering is planning a Fall homecoming event on Nov. 2, 2012 that we hope you can attend. Contact Mr. Brian Campbell, Exec. Dir. for Development and College Relations, for details.

Your MAE department continues to grow in student enrollment, graduates, and research expenditures. In 2010–2011 we graduated 345 students – 62 BSAE, 29 MSAE, 4 PhDAE, 185 BSME, 51 MSME, and 14 PhDME. With 1,402 undergraduate and 398 graduate students, we are the largest engineering department at NC State, in the state of North Carolina, and the second largest department overall at NC State. We exceeded $12.5M in total research expenditures this past year, a record for the department, and one of the key metrics used for national rankings. The department underwent a formal graduate program review this past fall. The external reviewers were very complimentary, citing that we have one of the best facilities of MAE departments in the country, and that our faculty are high quality and are accessible and engaged with their students. Despite the tough economy, four new faculty have joined us: Drs. Chih-Hao Chang, Yun Jing, and Nancy Moore, and Mr. Andy Meyers. These new positions reflect the needs of our large programs and the state's commitment to engineering education. During this period, Dr. Kara Peters was promoted to Full Professor and Dr. Fuh-Gwo Yuan was named the Langley Professor. Drs. Fred DeJarnette and Bob Nagel will be moving to phased retirement starting in July 2012.

We compete head-to-head with top engineering programs and have a culture of innovation and creativity. One key differentiator for top engineering programs is the level of endowment funds. Top engineering departments have endowments of $30M to $100M. Approximately, 4 percent of the endowment principal is plowed back into to the department to provide students with differentiating experiences (global experiences, student clubs and organizations, design experiences throughout the curriculum, student travel to conferences and competitions, open shop and fabrication areas, seminar series, scholarships, fellowships, professorships, …). Our endowment is well below the level of the top ME and AE programs. You – our alumni – are critical to our future. We sincerely hope that you can be part of our efforts to improve our educational programs and student experiences. Your donations support critical activities that are not supported by state funds.

There are many exciting things happening in the department. In this newsletter we have highlighted energy-related research; student, staff and faculty honors; a featured alumnus; and other updates. I hope you enjoy this edition of our newsletter. If you have any questions, suggestions, or want to know how you can be of assistance, please contact me at gould@ncsu.edu.

Best regards,
Richard D. Gould
R J Reynolds Professor and Head

RETIREMENT ANNOUNCEMENTS

DR. ROBERT NAGEL

I have been asked to write a little note appropriate to my phased retirement at the end of this spring semester. I have been here at NC State since August of 1980. During those 30 some years, the MAE department has experienced many changes and it has been a wonderful experience for me to have been part of it. I feel I have made some lasting contributions along the way; I hope it is true. I am grateful to the university for the opportunity to work with so many fine students and colleagues. I have enjoyed all of my time here and I will miss the environment, the interactions and our new anechoic chamber. Participating in the education and research process, the Center for Sound & Vibration, the NIA and the last eight years as associate department head and director of graduate programs has molded me and my life and allowed me to help mold the lives of so many others. Education is the hinge upon which a good life turns. I hope I continue to be in touch with my many friends and former students. The mechanism of phased retirement will have me here spring semesters for a few years. I think it will be a fine transition.

DR. FRED DEJARNETTE

Dr. Fred DeJarnette joined NC State in 1970 and spent a career studying engineering methods with an emphasis on computational methods in aerothermodynamics. During his career he made significant contributions to engineering methods of calculating aero-heating on high-speed vehicles. As an educator, Fred's enthusiasm was contagious, sharing with his students his fascination in that relatively simple approximations can be used for the design of heat shields and vehicle trajectories.

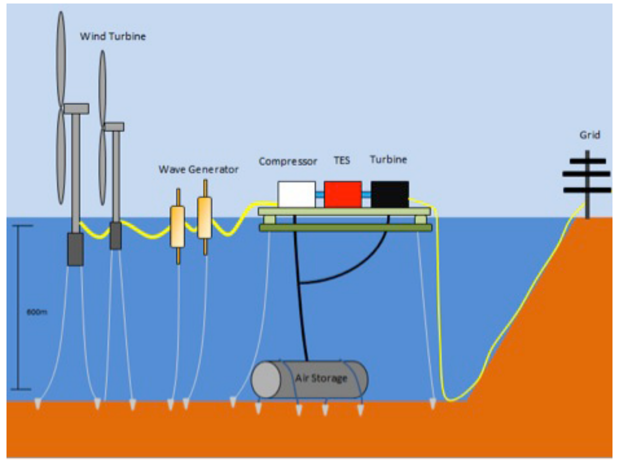
At the graduate level, he taught Hypersonic Aerodynamics and Aerodynamic Heating and at the undergraduate level he taught many aerospace engineering classes, most recently Aerospace Vehicle Performance and Boundary Layer Theory. Fred was also the founding Director of the Mars Mission Research Center, served as Department Head of Mechanical and Aerospace Engineering, and was the director of the NC Space Grant Consortium. He is presently completing a senior/first-year graduate level textbook on Boundary Layer Theory and Aerodynamic Heating which he plans to test out in a boundary layer class over the next few years. With phased retirement, Fred is planning on spending more time traveling with his wife Nadene and visiting family.

OCEAN COMPRESSED AIR ENERGY STORAGE SYSTEM

faculty Dr. Andre Mazzoleni, Dr. Paul Ro

students Saniel Lim, Brendan Quinlan, Joong Kyoo Park

With plenty of clean energy potential in the windy "First in Flight" state, a project aiming to harness the hundreds of megawatts of wind and ocean renewable energy off North Carolina's coast has begun. Since the intermittency of renewable energy sources requires significant energy storage capacity, compressed air energy storage (CAES) systems are becoming promising candidates for storing energy generated by renewable energy sources. CAES systems can be used to balance intermittent renewable energy and varying electricity demand.



Our current research focuses on a conceptual design of an ocean compressed air energy storage (OCAES) system, in which the hydrostatic pressures in the deep ocean enable compressed air to be kept at constant high pressures. In addition, design of a thermal energy storage (TES) is being pursued to promote overall efficiency by using heat extracted from the compression process to reheat the compressed air before it goes into the turbine generator.

EXPERIMENTAL STUDY OF BIODIESEL AND DIESEL SPRAY COMBUSTION IN A CONSTANT VOLUME CHAMBER

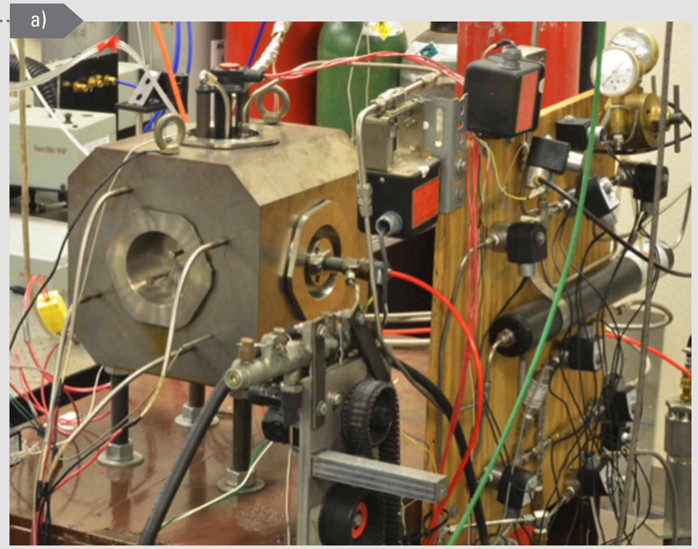
faculty Dr. Tiegang Fang

students Ji Zhang

It is becoming more attractive to utilize biodiesel (fatty acid methyl esters, or FAME, derived from the transesterification of oils and fats) in compression ignition engines to meet both green house gas reduction and energy security concerns. Biodiesel has been proven effective in reducing particulate matter (PM) emissions. It is hypothesized that the oxygen content in biodiesel helps reduce soot formation and enhances oxidation. Experimental results, however, show that the use of biodiesel may slightly increase nitrogen oxides (NOx) emissions. It is hypothesized that biodiesel combustion may present a higher flame temperature, leading to the increased NOx emissions through the Zel'dovich mechanism. But this hypothesis has not been widely accepted.

This study works from these hypotheses and measures the flame temperature and soot concentration (KL factor) of diesel and biodiesel spray combustion employing a high speed two-color pyrometry. A constant volume chamber was used to simulate typical diesel engine compression conditions (Fig. 1a). Diesel and biodiesel fuels were injected at 1000 bar into an ambient gas with 21% oxygen concentration and temperature of 1000 K. A high speed camera (Phantom® 4.3) fitted with two band-pass filters (550 nm and 650 nm with 10 nm FWHM) was used to capture the natural flame luminosity at 4504 frames per second.

a)



The measured temperature and soot concentration fields at a given time are shown in Fig.1b. Diesel shows broader soot areas compared to biodiesel. Both diesel and biodiesel flames show a higher temperature in the near-wall region. Diesel shows a slightly higher number of localized high temperature regions and appears to have a larger area than biodiesel. At this time, both diesel and biodiesel show a large KL factor at the two edge-wings of the flame, but biodiesel shows fewer localized regions of high concentration inside the soot area. The spatially averaged temperature and total soot for both fuels are plotted in Fig.2. During the quasi-steady stage, the average temperature of biodiesel flame is about 50~100 K lower than diesel. This observation raises a question about the connection of the flame temperature to the often observed increased NOx emissions of biodiesel combustion pointing towards other reasons that may also play important roles. For example, the portion of the combustion that is premixed may be important. The total soot results clearly show that biodiesel fuel produces less soot during the combustion process. This research was supported in part by the Faculty Research and Professional Development (FRPD) Fund from North Carolina State University and by the National Science Foundation.

b)

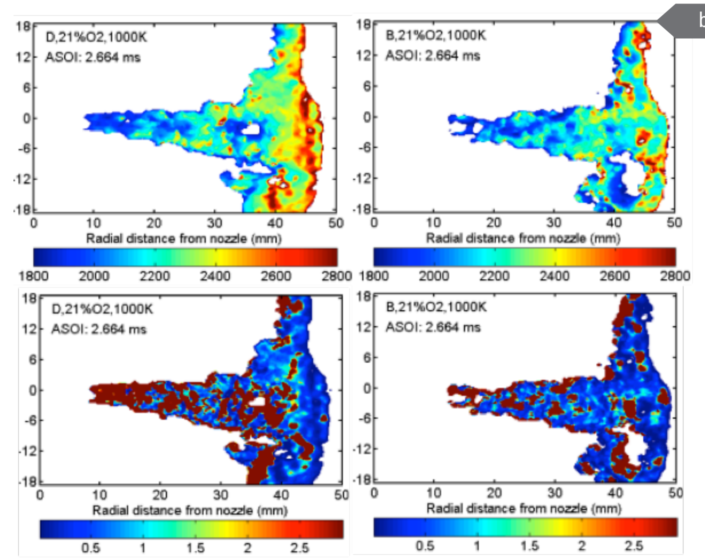


Fig. 1. a) Constant volume combustion chamber system; b) Soot (bottom) and temperature (top) fields of diesel (left) and biodiesel (right) spray combustion.

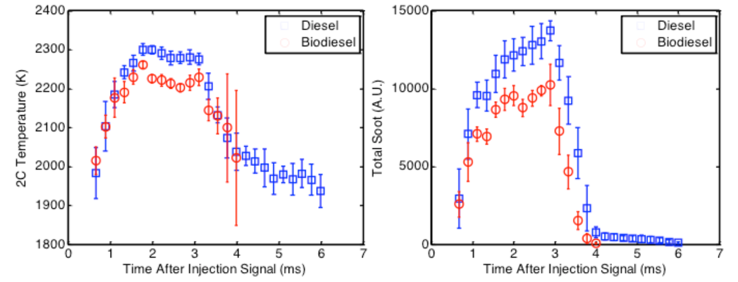


Fig. 2. Pixel-averaged temperature (left) and total soot (right) of diesel and biodiesel spray combustion a s a function of time.

DEVELOPING FLEXIBLE LOW-COST SOLAR POWER

faculty Dr. Brendan O'Connor

students Omar Awartani

The sun is an enormous energy resource that is able to easily meet the energy demands of modern society. However, to date, solar power technologies have not been widely adopted by consumers. This is due in part to the high cost of electricity produced by solar power as compared to fossil fuel sources. Therefore, there remains a need to develop solar power technologies that are cost competitive. Solar cells based on organic materials (carbon based molecules) may meet this challenge. The advantages of this technology include low materials costs, and compatibility with low-cost manufacturing methods. Organic semiconductor films are also extremely thin (~200 nanometers), lightweight, and inherently flexible. While, organic solar cell technology is rapidly advancing, in order to compete with other solar power technologies and successfully enter the market, it is necessary that the advantages that are unique to this material set are fully exploited; namely the lightweight and flexible characteristics. Applications where these attributes are critically important range from solar cells integrated into awnings and roofing, to wearable solar cells to charge personal electronics.

Dr. Brendan O'Connor's research group is helping turn these ideas into reality by developing organic solar cells that improve power conversion efficiency and enable efficient and flexible operation. Current research efforts in O'Connor's group focus on correlating the active organic layer morphology to device performance, and developing processing methods and device designs that enable high efficiency and flexible organic solar cells. Fig. 1 pictures a flexible organic solar cell fabricated in O'Connor's laboratory along with an illustration of the constituent layers including the active organic semiconductor materials poly(3-hexylthiophene) (P3HT) and Phenyl-C61-butyric acid methyl ester (PCBM). The active layer is a blend of these two materials maximizing the probability that absorbed light will result in current driven through an external circuit. Bending the solar cell results in a complex stress distribution throughout the device and potential failure due to delamination or fracture of the active layers. It has been recently demonstrated by O'Connor's research group that fabrication methods can influence not only device performance but also have a strong affect on mechanical behavior. In Fig. 2 the blend morphology is shown to influence the power conversion efficiency and the crack onset strain of the organic semiconductor layer. A goal of this research is to developing processing methods for efficient and mechanically robust solar cells. The results of this research will help guide processing methods that result in low-cost, highly durable and flexible solar power.

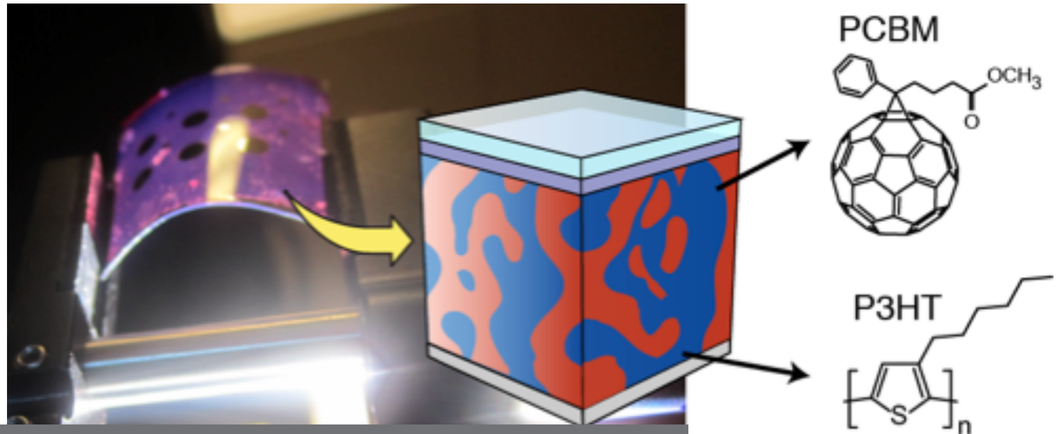


Fig. 1. Left, image of a flexible organic solar cell under simulated sunlight. Center, schematic of the organic solar cell with emphasis on the organic semiconductor layer, which is a blend of two materials - P3HT and PCBM that are illustrated on the right.

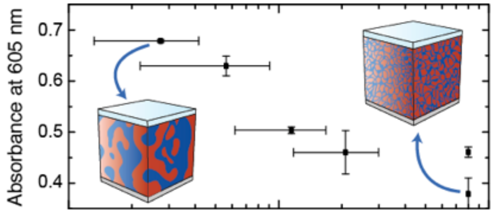
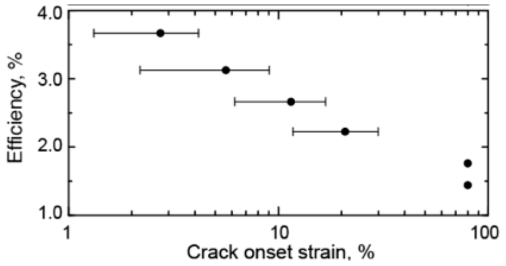


Fig. 2. Top, the relationship between the absorbance and crack onset strain of the P3HT:PCBM films. The absorbance is given at a wavelength of 605 nm where the variation is indicative of the level of segregation of the P3HT and PCBM components within the film. The absorbance data is normalized to the peak absorbance of each film. Inset, illustrations of the level of segregation of the films based on absorbance characteristics. Bottom, the crack onset strain as a function of solar cell power conversion efficiency showing that films with high disorder are ductile but have low efficiency.



Mechanics-Structure-Electrochemistry of Lithium-ion Batteries

faculty Dr. Hsiao-Ying Shadow Huang

students YiXu Richard Wang

Current prototype rechargeable lithium-ion batteries have been reported to lose capacity over thousands of cycles or under high charging rates (Fig. 1). This is the key obstacle faced by lithium-ion batteries, hindering many potential large-scale engineering applications, such as future transportation modalities and storage systems for renewable energy. It has been suggested that structural failure is the primary factor responsible for the observed rate-capacity fade of lithium-ion batteries.

In the present study, we report three different lithium intercalation-induced dislocation mechanisms explaining experimentally observed cracks (Fig. 2). We use the theory of elasticity to calculate dislocation stress fields. In most cases, dislocations are not perfectly parallel to one specific axis. Therefore, stress variations for arbitrary dislocation directions are investigated. In addition, multiple dislocations usually coexist and interact with each other in the crystal (Fig. 3); therefore we use the superposition method to investigate stress fields and forces between multiple dislocations. The stress fields manifesting between dislocations are numerically calculated and anisotropic material properties of electrodes are employed. The results provide links between stress fields and the observed structural failure in lithium-ion batteries (Fig. 4).

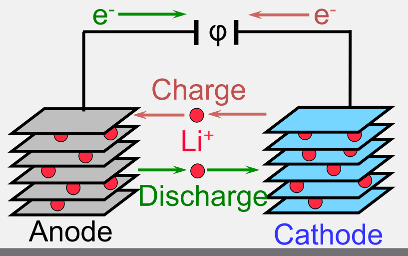


Fig. 1. Electrochemical processes in lithium-ion batteries during (dis)charging.

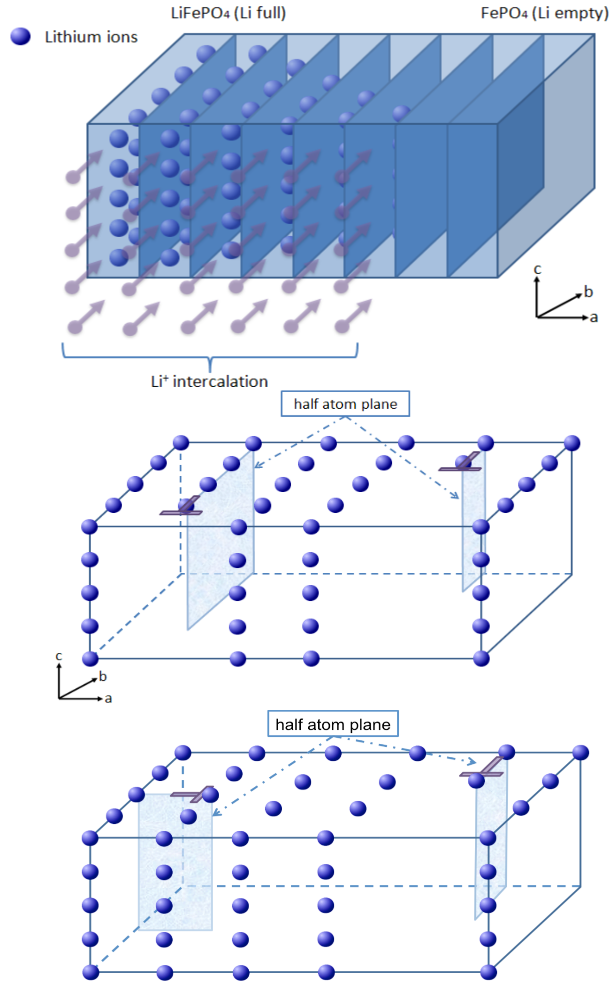


Fig. 3. Diffusion induced dislocations.

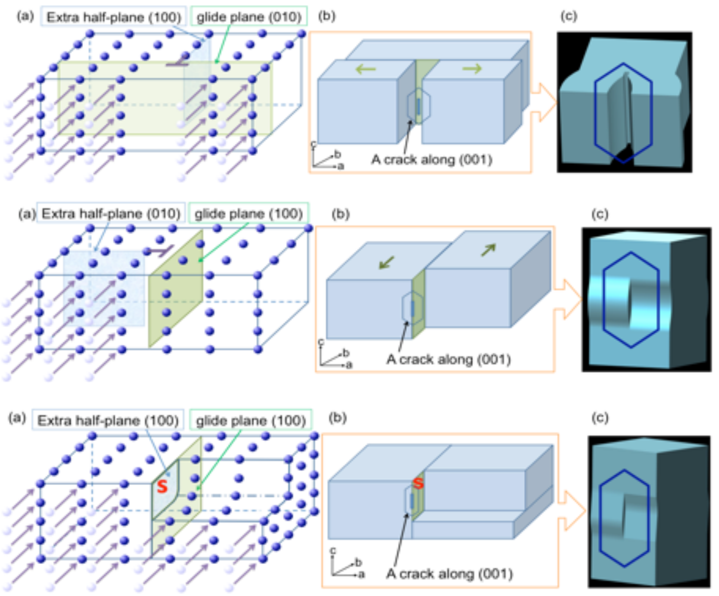


Fig. 2. Kinetics of the dislocation formation due to Li-diffusion, and mode I/II/III fractures caused by the accumulated dislocations.

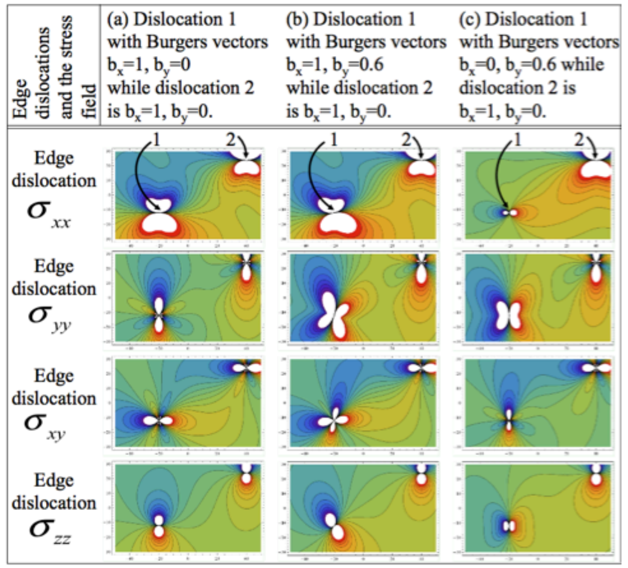


Fig. 4. Stress distribution inside electrode materials.

faculty Dr. Fuh-Gwo Yuan

ENERGY HARVESTING FROM AMBIENT VIBRATIONS

Wireless sensor networks are increasingly used in inaccessible locations or hostile environments to transmit data without the cost and inconvenience of wiring. In most of these applications, a long lifetime and non-maintenance power source is the best choice. However, traditional solutions such as conventional batteries, solar energy, and wind energy cannot meet the need because of their limited lifetime, or high maintenance cost.

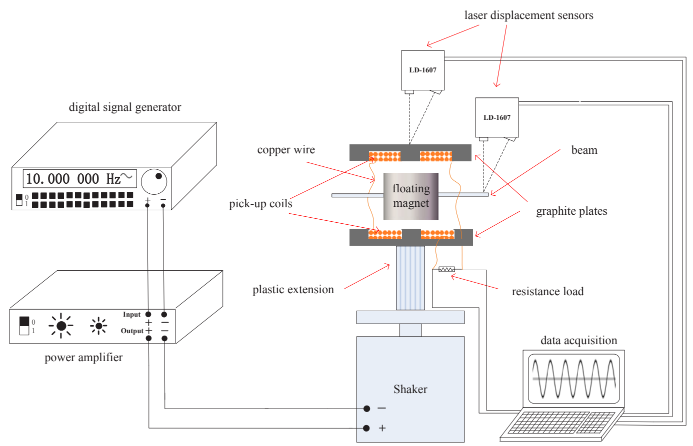
This has given rise to the development of energy harvesting techniques which aim at powering the wireless sensors by scavenging ambient energy from the environment, supplementing and even entirely replacing the battery energy. Such self-powered wireless sensors could be employed potentially in hostile or inaccessible areas with little or no maintenance.

Much of the literature today leans heavily on optimally tuned linear resonant systems for energy extraction. Although resonance yields markedly increased response in a linear system, efficient operation demands an excitation source that is well characterized by a single harmonic. In recent years it has become apparent that continued success demands enhanced capability to draw energy from more complex and realistic multi-frequency and stochastic environments. Since linear devices exhibit resonance within a very narrow frequency range, they are ill-suited to answer this challenge. Along with this problem, there are always undesired internal frictions from mechanical suspensions which are generally unavoidable and energy transferred from the environment is adversely dissipated in the form of heat.

Present research explores a novel magnetic levitation system using diamagnetic material (pyrolytic graphite) which aims at solving the above mentioned problems. The proposed design consists of two cylindrical magnets–a lifting magnet and a floating magnet. The floating magnet is located between two parallel pyrolytic graphite plates. The pyrolytic graphite plate serves the two purposes of providing a restoring force and balancing the floating magnet in the vertical direction. Additionally, a groove is made in the pyrolytic graphite plate to incorporate the coils which are required to harvest the energy.

Unlike energy harvesting devices that operate at a high frequency range, this energy harvester works primarily at a low frequency range (0.1 Hz-10 Hz). This low working frequency range is much more suited to large structures whose natural frequency is lower than 10 Hz. Also because there is no energy dissipation in the device due to mechanical friction, the energy harvester can operate with good efficiency at this low excitation level.

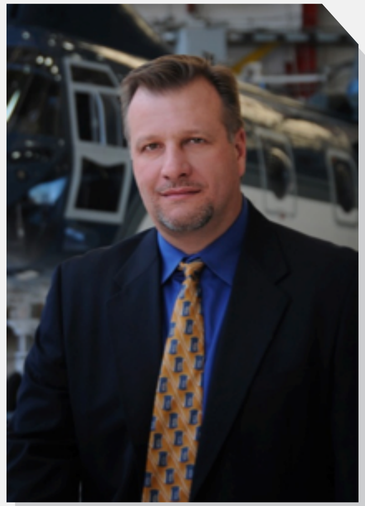
Restoring forces from the diamagnetic plate and the damping force from the coils were calculated, respectively. It was seen that the forces were weakly non-linear for the present low level excitations and would become significantly non-linear for higher excitations. Hence, this system explores the concept of non-linearity along with removing the undesired mechanical friction on moving masses which dissipate the useful mechanical energy. A schematic figure of the system is shown below.



Experimental setup for energy harvesting using the concept of diamagnetic levitation.

FEATURED ALUMNI

Chris Holder: Technical Conscience



Naval Air Systems Command (NAVAIR) has a term "technical conscience" that serves as the foundation of this organization's work in support of Navy and Marine Corps aviation. In short, it means you always do what is right technically in the execution of your duties – the Fleet depends on it. In an engineering application, it means always seeking the correct answer and understanding what that answer means to the person who asked, even if the answer is "I don't know, but I will find it!" Saying "I don't know" is the only professional and ethical answer, you must never guess or risk giving the wrong answer in the name of keeping production, the research, or a project moving, or to look smart.

I had no idea that back in the late 1980s when I started my engineering courses within the MAE Department that I was being taught the foundational building blocks needed to ethically execute the "technical conscience". At that time, I was mostly worried about passing all of my classes, staying clear of certain professors (to remain nameless), and making enough money to eat. However, looking back, I must say that NC State and especially the MAE Department taught me the importance of finding the correct answer, understanding what the answer meant, and knowing how to say "I don't know" and how to use all of the resources available to find the best answer.

After I graduated with an Aerospace Engineering Degree from NC State in 1990 and started working for NAVAIR at the Aviation Depot Cherry Point, NC, I started to realize that I had a unique experience within the MAE Department. There are many examples, but the senior project of designing and then building a flyable airplane was a challenging and rewarding experience that turned out to be unique with many practical lessons. Finding the correct answers within limits and then ensuring the answer could actually be used in the successful fabrication of something was not an obvious outcome, but I soon learned the importance of these lessons in my new career. Determining the cause of a component or system failure, developing a fix, and realizing that your efforts could save a pilot's life or enhance the support to our country's service men is rewarding and requires the use of those skills at every turn. As an aircraft platform working level engineer, lead engineer, team lead, and integrated product team lead, I was able to make a difference every day.

As I moved into senior level management as a Structures Division Head, Air Vehicle Department Head, and into my current position as NAVAIR's Head of Research and Engineering at Fleet Readiness Center East, I was able to realize the positive impact that NC State and the MAE Department had on me and the Aerospace Industry in different ways. As a senior leader, I always passed on the "technical conscience" and the ethical lessons to the newly hired engineers and the 500 plus engineers, scientists, and technicians at Cherry Point. In fact, it always amazes me as I work with people from all over the world that not everyone has heard of the State of North Carolina, but most of them have heard of and has obvious respect for NC State Engineering.

AT A GLANCE: CHRIS HOLDER

> "You must never guess or risk giving the wrong answer in the name of keeping production, the research, or a project moving, or to look smart."
>
> —Chris Holder

- Chris Holder, NAVAIR Research and Engineering Group Head, In-Service Support Center at Fleet Readiness Center East, Cherry Point, NC.
- Naval Air Systems Command provides full life-cycle support of naval aviation aircraft, weapons and systems operated by Sailors and Marines. This support includes research, design, development, and systems engineering; acquisition; test and evaluation; training facilities and equipment; repair and modification; and in-service engineering and logistics support. The support is provided from nine different global sites with approximately 8,000 engineers within its approximate 24,000 total workforce.
- Mr. Holder started his career in 1990 at the then named Naval Aviation Depot, Cherry Point NC, as an AV-8B Harrier Platform Engineer primarily focused on structures, sub-systems and flight controls. In 1995, he was selected as the AV-8B Flight Control System Team Lead and then in 1996 he was selected as the AV-8B Flight Control System Program Manager. He also served as the Integrated Program Team (IPT) Leader for the AV-8B Digital Flap Controller Redesign and Retrofit Program and the IPT Leader for the TAV-8B Upgrade Program. In 1999, he was selected as the Fixed Wing Structures / Aeromechanics Division Head and then in 2000, he was selected as the Air Vehicle Department Head. In 2005, Mr. Holder was selected for his current position as the Research and Engineering Group Head, Fleet Readiness Center East.
- Mr. Holder completed his undergraduate education at North Carolina State University with a degree in Aerospace Engineering in 1990.
- Mr. Holder is a charter member of the NCSU Mechanical and Aerospace Department External Advisory Group and has Chaired the Group for the past six years.
- Mr. Holder is the Co-Founder and Chair of the Eastern North Carolina Science and Engineering Forum.
- Mr. Holder is a 2004 graduate of the Naval Air Systems Command Senior Executive Leadership Development Program.
- Mr. Holder received a United States Marine Corps Certificate of Commendation in 1992 for superior performance of duties during a Naval Class A, Loss of Life, Aircraft Mishap Investigation.
- Mr. Holder received the Department of the Navy's Meritorious Civilian Service Award in 2010, which is the third highest award issued to civilian employees. In part, he was recognized for his work with public schools, community colleges, and universities on the advancement of STEM efforts.
- Mr. Holder is married with two daughters. He was born and raised in the Sandhills of North Carolina and is a graduate of Pinecrest High School, Class of 1985. He currently resides in Beaufort, NC.

MAE ENERGY SOLUTIONS

SAVING ENERGY AND TRAINING THE NEXT GENERATION OF ENERGY ENGINEERS

State Energy Intern Program (SEIP) Grant

PROGRAM HISTORY

A partnership between NC State University's Department of Mechanical and Aerospace Engineering and the State Energy Office (SEO) began during the energy crises of the 1970s. Industry was closing its doors because natural gas was being diverted to the residential sector. North Carolina and the nation were in a state of shock. In an effort to address this situation, the SEO asked the Mechanical and Aerospace Engineering Department to develop a program for assisting industry through this difficult period. What evolved was Dr. Eckerlin's "Energy Walk-Thru Program," a program designed to assist industry in improving its energy efficiency by assessing facility processes and mechanical systems (boilers, lighting, compressed air, motors, chillers, HVAC, etc.). Thus began a partnership that continues today as the MAE Energy Solutions program.

Drs. Herb Eckerlin and Stephen Terry direct the MAE Energy Solutions team, which runs two energy engineering programs: the Industrial Assessment Center (IAC) and the Energy Management Program (EMP). Energy Solutions works with medium and large industrial, commercial, governmental and institutional facilities with two main goals:

1. *Save Energy.* To have an immediate impact on businesses by conducting energy assessments to identify energy and cost-saving opportunities, thus helping to improve the energy efficiency and increase profitability.

2. *Train the Next Generation of Energy Engineers.* To have a long-term impact on the nation's economic and environmental well-being by educating students in the principles of energy engineering and stimulating their interest in energy efficiency/conservation, manufacturing, and waste management.

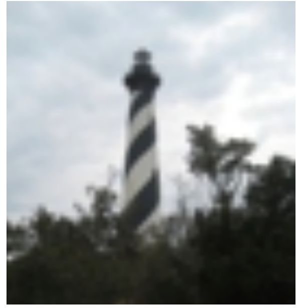
PROGRAM TODAY

In recent years MAE Energy Solutions has been assisting the State Energy Office (SEO) with grant funded energy projects across North Carolina as one of 38 approved technical service providers for the State. In addition, the program has been working with the Department of Natural and Environmental Resources (DENR) through its Division of Air Quality to assess boiler operations and assist the boiler operators at manufacturing plants in the state in anticipation of boiler MACT and GACT regulations. Partnering on campus, Energy Solutions has teamed up with the Industrial Extension Service to help them with technical energy surveys for their E3 grant program. Through these collaborations over the past 1 ½ years, the MAE Energy Solutions team has assisted approximately 200 facilities across North Carolina.

In 2010, MAE Energy Solutions was awarded a $464,000 grant as part of the State Energy Intern Program to train students about energy engineering. Through this grant, the Energy Solutions team has been able to give more than 50 NC State students the opportunity to intern in the energy engineering field with regional operations such as IBM Fluor, Red Wolf Associates, Stantec Engineering, RTI, Power Secure, Brady Trane, Electricities, Southern Energy Management, Holocene, John J. Kirlin Mechanical Contractors, Morris & Associates, NC School of Science & Math, UNC-Chapel Hill, UNC-TV, City of Raleigh, and Towns of Cary and Clayton. Through the internships, the students were given the opportunity to apply the engineering knowledge and concepts learned at NC State in real world applications.

In February, several top interns accompanied the Energy Solutions team on three separate assessments for the NC Department of Cultural Resources. The facilities visited were the Museum of the Albemarle, The Graveyard of the Atlantic, and the USS North Carolina Battleship. These assessments will not only result in direct energy savings for the State operations, some of the team's findings will also help protect treasured state artifacts for years to come. A simple example demonstrating energy and maintenance savings, as well as protection for many artifacts is through the use of special LED lighting that doesn't emit harmful UV that can degrade many artifacts over time. Other recommendations being researched for feasibility, financial savings and energy efficiency gains are water cooled heat pumps for the USS North Carolina, water softening systems for the Museum of the Albemarle, use of onsite backup generators for peak load shaving, optimization of operating parameters for the existing Building Automation Systems (BAS), and integrating thermal storage to improve operating capabilities of climate control systems. Findings at the Graveyard of the Atlantic will result in 25% savings on facility energy costs with a 3 year payback achieved by optimizing the boiler operation, upgrading lighting and controls, and utilizing a solar thermal hot water system for HVAC reheat loads.

The optimization of the mechanical systems and the financial savings for the facilities are important positive outcomes of the Energy Solutions assessments, but the experience gained by our MAE students is invaluable. After working with Energy Solutions, our students are comfortable in a world of boilers, chillers, cooling towers, and other facility mechanical systems. These opportunities have allowed the students to see these devices in operation and analyze actual data. We're proud of our students and their work, and we look forward to them carrying these experiences with them into their future engineering careers.



FACULTY, STAFF AND STUDENT HONORS

MAE students Kyle Thompson and Michael Habersetzer earn first place in Disney competition
"The Mind of Molly Mouse," a theme park proposal set on the moon in the year 3011 by MAE students Kyle Thompson and Michael Habersetzer and other two NCSU students, won first place in the rigorous Disney ImagiNations design competition.

Scott Ferguson won Outstanding Teacher Award (college wide)

Jeffrey Eischen won the 2012 George H. Blessis Outstanding Undergraduate Advisor Award (college wide)

Kara Peters named as one of the Super Science People in Triangle Business Journal

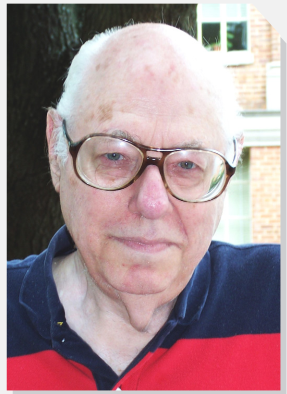
Dr. Fuh-Gwo Yuan named NC State Langley Professor at NIA
North Carolina State University has named Dr. Fuh-Gwo Yuan as Samuel P. Langley Professor in the NCSU Department of Mechanical and Aerospace Engineering at the National Institute of Aerospace (NIA), in Hampton, Va. The Samuel P. Langley professorships were conceived and implemented by NIA's member universities to serve as the foundation for its unique academic research program that directly supports NASA Langley Research Center.

MAE graduate student Saurabh Bakshi won a student paper competition award in the IEEE International Ultrasonics Symposium 2011, October 18-21, 2011, Caribe Royale, Orlando, Florida.

MAE Students Win Awards at AIAA

- First place in the Regional Design Competition: "Team Atlas: Design of a Biologically-Inspired, Long-Endurance UAS"
- Second place in the Regional Design Competition: "Inflated Fabric Habitat for Martian Surface and Nanoscale Lift Support Catalysis" Instructors: Mazzoleni (MAE) and Warren Jasper (Textiles)
- Third place in the Team Division (requires a paper and presentation): "Design of a Dual Configuration Canard Pusher-Propeller UAS" Instructor: Dr. Hall
- Second place in the Community Outreach Competition: "AIAA at North Carolina State University" Whitney Lohmeyer

MAE Remembers
Dr. Frederick O. Smetana



Dr. Frederick O. Smetana, a former MAE faculty member who helped develop NC State's aerospace engineering program, passed away on May 27, 2011.

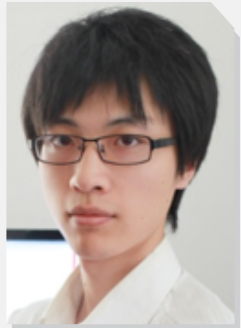
Smetana received his BS in ME at NC State in the early 1950s and also taught AE courses as a graduate student. After receiving his PhD from the University of Southern California, he joined the ME faculty at NC State in 1962. Two years later, he helped develop the BS in aerospace engineering program.

In the 1970s he led an effort to review NACA and NASA research on light aircraft that was supported by the NASA Langley Research Center. In the 1980s he helped develop the MS and PhD degrees in Aerospace Engineering at NC State. He retired as a faculty member in MAE but continued writing textbooks.

Smetana also developed short courses with AIAA, and he was a very strong supporter of NCSU athletics throughout his career.

NEW FACULTY AND STAFF

Dr. Chih-Hao Chang received his B.S. degree in Mechanical Engineering from the Georgia Institute of Technology in 2002. He then received his M.S. and Ph.D. degrees in Mechanical Engineering from the Massachusetts Institute of Technology in 2004 and 2008, respectively. Prior to joining NC State, he was a Postdoctoral Research Associate at MIT. Chang's research interest focuses on the design and fabrication of 2D and 3D nanostructures, and their integration into microscale systems. This work has applications in glass with anti-glare and self-cleaning properties, and energy-efficient hierarchical diffractive solar concentrators. Chang also develops novel nanofabrication techniques, focusing on lithography and self-assembly processes that are scalable for manufacturing.



Dr. Yun Jing received a B.S. in Electronic Science and Engineering from Nanjing University, China, in 2006, and an M.S. from Rensselaer Polytechnic Institute in 2007. He received his Ph.D. in Architectural Acoustics from Rensselaer Polytechnic Institute in 2009. Prior to joining the NC State faculty, he was a research fellow at Brigham and Women's Hospital, Harvard Medical School. Jing's current research interests include the development of ultrasound tomography for biomedical imaging with applications to brain and breast imaging, optimizing numerical algorithms for predicting acoustic wave behavior in various media, and studying the acoustics of meta-materials for sub-wavelength imaging, sensor applications and energy harvesting.

MAE hired seven new administrative staff and faculty in 2010-2011. Dr. Chih-Hao Chang and Dr. Yun Jing joined the department as tenure track assistant professors. Dr. Nancy Moore is a new teaching assistant professor, and Andrew Meyers is a new lecturer.

Andrew Meyers

Dr. Nancy Moore

MAKE AN IMPACT

The State of North Carolina has committed funding for new facilities and infrastructure to support growth and additional faculty for the Mechanical and Aerospace Engineering Department. As an alumnus of our department you have the opportunity to leverage and strengthen these developments by giving. Your gift will help us become a leading department that prepares our students for the work-place, research, and other opportunities that lie ahead. Please join us in transforming the department that helped launch your career.

Giving back benefits you as an NC State engineering graduate. Participation of alumni in giving and in growing our endowments keeps the department competitive with our peer institutions and enhances our reputation as a top rate institution.

MAE BRICK CAMPAIGN

The on-going Brick Campaign recognizes your accomplishments and your support to the MAE department with a personalized brick on the EB III walkway. This supports the department, student clubs, student travel to conferences and student design competitions.

www.mae.ncsu.edu/pdfs/brick.pdf

Alumni giving accounts for the major support provided to many of our educational programs. For example, the success of our student organizations, labs, senior design, professional travel, and our special projects become possible only through alumni giving.

There are numerous ways you can make a gift to support the people and programs in the Department of Mechanical and Aerospace Engineering. From simply writing a check for your annual gift in support of the department's current needs, or the many naming opportunities in our new facility, to providing a major or planned gift for an endowment or a capital project. The options available are divided between ways to give today and ways to give tomorrow. By making your tax deductible gift today you will help the Department of Mechanical and Aerospace Engineering break out from the pack and achieve greatness.

For more information on how to make a gift, how your gift will be effectively used or to arrange a campus tour, please call Dr. Rich Gould, MAE Department Head, 919/515/2368 or gould@ncsu.edu.