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ERGP Disclaimer

The ERGP staff has compiled this abstract booklet with information provided by the undergraduate students. We have reprinted it with their permission exactly as they submitted it.
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APHID COUNTER
Japsh Vincent Aberejo, Staton Eichman, Jacob Pruitt, Dr. Brian McCornack
Department of Computing Information & Sciences

Aphid infestations on plants are a big concern for crop growers. It is necessary for the grower to know how many aphids are on the plant, in order to determine whether or not to use sprays to clear the infestation. In order to prevent having to count the aphid insects by hand, an image processing algorithm was developed for the purpose of taking an image of an aphid-covered leaf, processing it with the algorithm, and having it estimate the number of aphids in the photo. The goal for our project is to use this algorithm in a mobile application that can be used to take photos of aphid-covered leaves and determine the aphid count on the spot.

The result our team came up with is an Android application that allows the user to take a series of photos and then allow the user to convert the photos and determine the average insect count from all the photos in the set. The most significant task we had to deal with was converting the algorithm from MATLAB code to Java. Another issue that posed a problem was the amount of time it takes to convert the image. Currently, using an 8 megapixel image which is roughly 3000 x 2000 pixels in size, it takes around 25-30 seconds to convert and generate a bug count from a single image on an HTC Droid Incredible 2 cell phone.

Poster 2
HERO
Jessica Aschenbrenner, Dr. Jessica Heier Stamm
Department of Industrial & Manufacturing Systems Engineering

Throughout the United States there is increasing emphasis on the importance of science, technology, engineering, and mathematics (STEM). Numerous in-class and extracurricular activities have been developed for pre-college students to introduce them to STEM careers and build students’ related skills. Students may find that they are gaining strong STEM skillsets but may not follow this career path because they do not find it interesting. One way to pique interest in STEM majors and careers is to show students that engineers make a difference in their communities and in the world. Past research has shown that students, especially those from historically underrepresented groups, are drawn to messages that emphasize the real-world impact of engineering.

In this study, we designed an interactive game for middle and high school students that demonstrates how industrial engineers can make a difference in the lives of those directly impacted by disasters. Industrial engineers use optimization to design and improve supply chain systems. Choosing the best routes to deliver supplies following a disaster is an important and challenging problem. In the game, students manage their own supply chains as they attempt to deliver goods with varying obstacles affecting their paths. The game was played with a total of about 105 middle and high school participants in the KSU BNSF Outreach program. We report on results of pre- and post-surveys of participants, including what students think engineers do and students’ reported likelihood of choosing an engineering career.
Poster 3

BETA TYPE STIRLING ENGINE REGENERATION
Theodore Augustine, Dr. Amy Betz
Department of Mechanical & Nuclear Engineering

Robert Stirling filed a patent for his external heat engine in 1816 successfully creating the first practical closed system gas engine. A Stirling engine, with perfect regeneration and no dead volume losses could theoretically reach Carnot efficiency. The Carnot efficiency is the highest efficiency possible according to the second law of thermodynamics. However, unlike the Carnot cycle, the Stirling cycle can be made into a functioning external combustion engine. Perfect regeneration and zero dead volume losses are both impossible for a real system, but 98% effective regeneration has been achieved and dead volume losses can be minimized; thus, actual Stirling engines have reached up to 50% thermal efficiency. Recently, there has been significant research on utilizing the Stirling cycle’s high thermal efficiency for power production from natural gas combustion and focused solar heat. Industrial beta type Stirling engines rely on annulus regenerators that surround the outside of the hot cylinder. The annulus design creates an effective regenerator, but significantly increases the total system dead volume. The purpose of this research is to explore alternative regenerator designs and materials for beta type Stirling engines, and utilize K-State’s small (1 kW) beta type engine to test their effectiveness. All Stirling engines utilize a displacer piston to shuttle air between the hot and cold ends of the system, and in a beta type engine the power and displacer pistons are stacked and concentric within a single cylinder. The focus of this research is to design and manufacture a regenerative displacer piston to minimize dead volume, radial conduction, and fluid flow losses.

Poster 4

SHEAR LOADING IN A SEVEN-STORY MULTI-BAY CONCRETE FRAME
Caitlin Beaty, Emily Garrison, Dr. Donald Phillippi
Department of Architectural Engineering & Construction Science

The concept of concrete special-moment frames is relatively new in building design. Their use was optional, until 1973 when the Uniform Building Code required implementation in areas with high seismic activity. Further analysis of these frames has come from preexisting structures that have undergone seismic activity, resulting in more stringent code requirements. Typically, the Equivalent Lateral Force Procedure, along with the “strong-column, weak-beam” concept, is used when designing concrete frames in seismic conditions. When designing a concrete frame, current analysis methods look at the concrete components that have constant stiffness. Use of this assumption in the design process yields results that work for capacity, but not for stiffness and distribution of lateral loading. In this study, existing calculations on a seven-story concrete frame were used along with a Portal Frame analysis and results obtained from SAP2000, a finite element analysis (FEA) program, to provide the current basis for design. The shear and axial forces and moments for the individual columns from the IBC Manual, Portal Frame method, and SAP2000 were all similar. The above findings were then compared to results from LS-DYNA (a three-dimensional dynamic FEA program), which was used to solve the complex problem associated with the non-linear behavior of concrete. When the forces and moments were compared, the LS-DYNA shear results for the columns were considerably different than those obtained from the other methods. Thus, assuming the non-linear analysis is more accurate, further study is needed to provide more accurate ways of calculating shear forces in concrete frames.
At Kansas State University, a group of students are developing a simulated controls environment via Matlab Simulink software for the Segbot, EEVA, supervised by Dr. Warren White. EEVA is a two wheel robot which has an underactuated, nonlinear, nonholonomic dynamic system. It is controlled by a myRIO microcontroller from National Instruments. This robot is currently being operated remotely with a WiFi signal on a private local area network with supervisory and autonomous commands. However, they are working to modify the LabView-based operating system to include more abilities for the Segbot and make the computer processing more efficient. In order to create this environment they need to understand the LabView and Matlab code written for the Segbot’s current tasks, create a model in Matlab that can simulate what the LabView code feeds, modify the Matlab code to fit into their new model with simulated inputs given to it, and create simulated outputs for accurate readings to test updates to the Segbot system. If the team can develop this simulated controls environment, they will be able to test the Segbot’s code before programming it onto the physical system. This will make experimentation of code safer and easier to improve the system. The team’s research has applications to the automated manufacturing and testing industry. As equipment becomes larger and more expensive, companies having the ability to test out new codes in a simulated environment becomes beneficial.

Quantum mechanical methods, such as Density Functional Theory (DFT), have emerged as an important computational tool for advanced science exploration and education. In this project, we developed a compact, open-source, and extensible python-based package (VaspCAT) that can be used to facilitate and streamline DFT calculations. As a result, the preparation of DFT calculations, in particular for engineering catalyst materials with complex structures, has become more efficient and user-friendly. Currently, VaspCAT is able to: (i) generate output files directly to meet VASP format standards, (ii) allow users to modify the data contained in the program output, and (iii) be used on most Linux high performance computing platforms. To the best of our knowledge, open-source packages achieving the above goals scarce.

In this study, we demonstrate the utility of VaspCAT by engineering a zeolite-based catalyst for methane-to-methanol conversions. The catalyst consists of a modified ZSM5 framework and nickel oxo complex. Initial structures were constructed from Materials Studio Visualizer. The atomic coordinates were then exported as *cif format, which were then converted and set up for VASP calculations. During this process, the user intervention was kept at a minimal, as both the structure input and computational parameters were prepared internally by VaspCAT. VaspCAT also has the capability to process multiple structures and set up individual jobs. Overall, VaspCAT has shown great value in reducing workload and facilitating students to learn quantum mechanical methods in their research and education.
Poster 7
A COMPARATIVE INVESTIGATION ON BUTANEDIOL DEHYDRATION PROCESS ON ZRO₂, THO₂ AND CEO₂
Lucas Ramon Carneiro Thomaz, Jiayi Xu, Dr. Bin Liu
Department of Chemical Engineering

The production of industrially important chemical precursors from renewable resources is an appealing strategy, also with significant societal benefits. In this study, we selected 2,3-butanediol, which can be obtained from fermentation of biomassic materials, as a model compound for our investigation of selective dehydration process on different catalyst materials, to produce butadiene and butene, both of which are important polymer precursors. Previous study showed that acidic catalysts, such as Al₂O₃, favor the formation of methyl ethyl ketone and can lower butadiene/butene selectivity as oppose to the formation of 3-buten-2-ol. To further understand the influence and trend of butanediol dehydration on catalyst materials of different acidic properties, ZrO₂, ThO₂, and CeO₂ will be used as model catalysts. Molecular modeling based on Density Functional Theory (DFT) was used as the computational tool to gain atomic-level insights for this reaction. This study focuses on the relative stability of reactant (2,3-butanediol) and primary dehydration intermediate species (methyl ethyl ketone, and 3-buten-2-ol) and final products (butadiene) on different oxide surfaces. The DFT modeling enables us to establish a relationship between the selectivity of competing dehydration pathways and reaction energetics. The less acidic oxide, i.e. ThO₂, which binds methyl ethyl ketone weaker, will preferentially favor the other dehydration path forming 3-buten-2-ol, and thus improve the butadiene formation.

Poster 8
MIA SOLÉ THIN-FILM PHOTOVOLTAIC ARRAY PERFORMANCE AT VARIOUS TEMPERATURES AND SUBSTRATES.
Alan T. Caro, Dr. Ruth Douglas Miller
Department of Electrical & Computer Engineering

The purpose of this research is to collect data from copper-indium-gallium-selenide (CIGS) panels to validate current information and compare performance of suspended CIGS panels vs those installed directly on a roof, and vs polycrystalline silicon panels installed at an angle. Mia Solé Flex Series CIGS thin-film solar panels are a new technology produced starting in late 2012. Our objective is to test these panels on different substrates and under different temperature variations. Thin-film solar panels are less efficient than typical monocrystalline/polycrystalline solar panels and more economical to install; however they are more costly up front. They are designed to be adhered directly to a roof, with no racking. Installation of 14 panels on the engineering building roof was completed during the 2014 summer; however we were prohibited from mounting them directly to the roof, and they are instead on a platform suspended above the roof. My specific role in the research is to engineer an experiment/apparatus to record data off a single panel resting on various substrates. The suspended panels are connected in series sharing a single Sunny Boy 2000 inverter. The single panel is connected in series with a load (potentiometer to control the resistance), and a microcontroller called an Arduino Uno to collect voltages and currents. Using this data we will make IV (current to voltage) curves to find Vmpp, Impp and Pmpp. We will compare panel energy production with respect to temperature. This data will help determine the economic payback of CIGS vs the more common silicon.
Poster 9
EFFECTS OF NATURAL HAZARDS ON STRUCTURES
Michael Cesena, Dr. Bill Zhang
Department of Architectural Engineering & Construction Science

Natural hazards affect hundreds of thousands of buildings in the United States every year. The most damaging hazards are earthquakes, hurricanes, and tornados. The purpose of this research was to investigate how much damage natural hazards are doing to buildings, how natural hazards destroy buildings, and if there are recent construction methods and building technology that will limit the damage that natural hazards cause on buildings. My research consisted of analyzing numerous journals on natural hazards. Many of them were reports of building damage and resistance to certain hazards such as the Joplin, Missouri tornados and the Northridge Earthquake of 1994. After analyzing the journals on natural hazards and their effects on buildings we found that the damage done to buildings by natural hazards stems from the connections of different parts of the building, and one connection malfunction generally led to the failure of the building or caused major damage to it. Comparing statistics of recently used construction and building engineering technology to those used a few decades ago, my mentor and I concluded that special moment frames, reduced beam sections (RBS), and multiple hurricane fasteners are improvements in building engineering and construction that would greatly reduce the amount of damage caused by natural hazards.

Poster 10
COLD-FORMED STEEL (CFS) AND PLYWOOD SHEATHING SLIP MODULUS
Austin Curnutt, Jonathan Faringthon, Prof. Kimberly Kramer, Dr. Bill Zhang
Department of Architectural Engineering & Construction Science

The purpose of this experimental study is to determine the slip modulus between cold-formed steel members and plywood sheathing, in order to examine the composite action between two materials. Currently, a floor, wall, or roof system of cold-formed steel is designed based on the capacity of steel members only. This approach doesn’t accurately reflect the actual stiffness and strength of the system. By considering the composite action the steel member sizing and spacing can be modified. This may result in savings on material and labor. Establishing the slip modulus is the key step towards a more accurate design approach.

Test specimens will be constructed using 1/2” plywood fastened to one side of the cold-formed steel member by screws. The fastener spacing will be varied in order to investigate the effect of fastener spacing. Specimens will be tested in tension with one grip attached to the steel member and another grip attached to the plywood. Testing specimens in tension can prevent buckling and crushing of the plywood that occurred during previous compression tests.
Poster 11
SCALABLE SECURITY FOR MILLIONS OF APPS: UTILIZING TIERED-MACHINE LEARNING TO SCALE TO MARKET-WIDE SOLUTIONS
Jordan DeLoach, Dr. Ou Xinming, Dr. Doina Caragea
Department of Computing & Information Sciences

The Android ecosphere is unlike any other phone app repository in its openness or in its size. This size and openness has contributed to a litany of security-related problems. For this large of an ecosphere, extensive examination to detect the potential maliciousness of each app, using a combination of computational and manual analyses, is not feasible. For these reasons, current research has hypothesized that machine learning can have extensive applications in the realm of Android security, particularly as a “cheap” way for predictive analysis into potential security concerns for an app.

With these concerns, current research has explored how machine learning can be applicable at a litany of depths of analysis. Lightweight analyses tout the benefits of being scalable to the millions of real-world apps, but suffer from high false positive rates and inconclusive results. On the opposite end of the spectrum, heavy, semantics-rich analyses tout sophisticated approaches that are slow, complicated, and not scalable when considering more than a few hundred apps. The overarching goal of the team researching Android security at Kansas State is to develop a multi-tiered approach that knows when and how to apply multiple levels of analysis. A solution such as this provides for the ability to be light and quick, while still being able to provide full and rich analysis, when necessary.

Poster 12
SPACE GAME ENGINE
Chris Delpire, Max Erdwien, Robert Lafferty, James Tyson, Ondrej Kuzela, Mr. Nathan Bean
Department of Computing & Information Sciences

Our class group is in the process of creating a C++ game engine from the ground up using DirectX. We want to show what we have achieved in a little under a semester. We plan to talk about how we have used DirectX to communicate with the gpu in order to render models to the screen. Along with rendering models, we can also rotate, translate, and scale these models. Models can be transformed individually or with respect to a parent model. In addition to talking about rendering, we will discuss other aspects of the game engine we have begun creating. This includes playing sound, moving a camera around the screen, asset management, and more. Finally we will conclude by discussing the future plans for the engine. Texturing, lighting, and basic physics are some of the features we hope to touch on before the end of the semester.
Poster 13
SELECTOMUTATIVE RECURISVE GENETIC PROGRAMMING
Jacob Ehrlich, Dr. William Hsu
Department of Computing & Information Sciences

Genetic programming (GP) has been a very successful technique in the last 30 years for finding approximate but novel solutions for many problems. At first, GP had a very simple type system. Then Montana introduced strongly typed GP but his system did not yield a very powerful type system. Stronger type systems like Hindley-Milner were tried with some success compared to Montana, namely Tina Yu. Apart from these issues is the issue of recursion and iteration in GP. Most GP has no means of recursion or iteration due to the complexity of allowing such a feature. Some have tried to produce systems which incorporate iteration along with arbitrary cutoffs based on running time. It would be nice if there were an elegant way to allow for recursion that did not have such an arbitrary cutoff. I present a basic first system that unifies the powerful type systems like that of Tina Yu with such a recursive system. The type system is used as part of the tool that ensures we do not run into the aforementioned complexities.

Poster 14
THE PERIODIC PROJECT
Karen Fang, Alex Lesperance, David Maas, Mr. Nathan Bean, Dr. Dan Andresen
Department of Computing & Information Sciences

The Periodic Project is an interactive learning tool for K12 students to learn and understand chemical reactions through the interactive Sifteo Cube platform. Students are presented with a set of small touchscreen cubes that display different elements from the periodic table. They can arrange the cubes into different arrangements to see how the elements react to form different compounds. This provides an engaging, interactive experience as the students don’t have to simply memorize a long list of reactions but can experiment and see things for themselves.
Next generation Li-ion batteries (LIBs) require higher energy and power densities. The use of 3D nanostructured electrodes can significantly increase the rate of Li insertion and removal due to the short transport distances for Li ion within the 3D nanostructure. Further, the higher surface area associated with 3D nanostructured electrodes permits a high contact area with the electrolyte and consequently increases the Li-ion flux, while the improved porosity decreases volumetric stresses during cycling. Ni nanofoams are the state-of-the-art current collectors in LIBs due to their high stability, mechanical robustness, porosity, and the highly conductive 3-D framework that can be coated with high capacity active materials such as SnO₂. However, their extremely high porosities (> 99%) and limited specific surface areas (< 5 m²/g) limits the amount of active electrode material that can be deposited, consequently reducing the maximum achievable areal energy density. Here, we show, for the first time, a scalable gas-phase liquid injection chemical vapor deposition (LI-CVD) process for the infiltration of arrays of high-quality CNTs in Ni nanofoam. Importantly, the new process allows for the improvement of the BET specific surface area of Ni nanofoam by a factor of over 20 without compromising the structural integrity of the foam. Upon deposition of SnO₂ on CNT-infiltrated Ni nanofoams by atomic layer deposition, the new nanocomposites show improved areal capacity and excellent rate capability as well as high capacity retention.

Carbon Nanotubes (CNTs) have potential for application in the energy field due to their outstanding electrical, thermal, and mechanical properties. Application possibilities include use as current collectors or active materials in lithium-ion batteries, or support materials for catalysts in reaction engineering. In batteries, higher levels of energy and power densities are required to improve functionality. The textural properties of CNT foams affect the specific surface area and the rate of insertion and extraction of lithium ions, thus limiting the areal energy capacity and rate capability. The inverse relationship between the porosity and tortuosity poses a challenge for creating an optimized CNT 3D matrix that maximizes both power and energy densities. To potentially balance these two factors in CNT foams, this study is focused on establishing connections between the 3D morphology and the lithium ion diffusion and storage properties. Highly porous 3D foam materials have been fabricated using CNTs and sodium carboxymethyl cellulose (CMC) as a dispersing agent in aqueous solution. The CNT-based foams are formed via phase separation by thermal phase transition. The solid-liquid phase separation process is accomplished by freeze-drying the CNTs, resulting in a porous nanomaterial with pores that are replicas of the ice crystals. The pores of a freeze-dried material are dependent on the thermal flow during the freezing process, thus future work will focus on using the thermal flow and different CNT morphologies to tailor the microstructure of the foams.
The Nemaha County Historical Society in partnership with Kansas State University and the Kansas Preservation Alliance would like to restore a 1917 Masonic Temple in Seneca, Kansas as a military museum and community gathering space.

As an interdisciplinary service learning project, Seneca community leaders asked students and faculty of K-State to provide guidance and background information for grant proposals, using the skills we have been learning at K-State. The following poster outlines the analysis and upgrade recommendations for the mechanical and electrical systems in the project.

In the final submittal to the Nemaha County Historical Society examination of the landscape work, structural concerns, interior design needs, mechanical systems, electrical systems, lighting configuration, fire protection, and construction feasibility was assessed. A student and professor for each discipline worked on a final narrative and set of plans for the Historical Society. This coordination made the Seneca job a unique opportunity because it closely parallels a professionally operated job.

For this forum, an in-depth focus was taken on the electrical and mechanical systems needed to restore the lower level space, while closely coordinating with other disciplines. To simulate the construction documents a consulting firm would provide, a mechanical and electrical floor plan was created with special considerations for kitchen equipment, elevator, projectors, and ductwork in a low ceilinged basement space considered. This research could be used to help the Historical Society communicate to a professional firm the goals they hope to achieve with the Seneca Temple Transformation Project.

Response to public health emergencies, such as an influenza pandemic, involves coordinated activities at the state and local levels between public health departments, hospitals, and emergency medical service providers. Responders in each of these categories are expected to need protective equipment that will be scarce at the time of the response. Thus, pre-positioning strategies are an essential component of preparedness planning. The deployment of pre-positioned supplies is affected by uncertainty about how quickly different demand centers will consume supplies. The prepositioning of supplies is difficult because of the uncertainty in the demand. The central question addressed by this research is: How can non-uniform, stochastic demand patterns be integrated into an optimization model to determine the locations of preparedness stockpiles and the assignment of demand centers to open stockpile locations? To address this question, we adopt a scenario-based approach where each scenario represents a different demand pattern that could occur. We introduce a robust optimization model that identifies a stockpiling strategy that performs well regardless of the specific demand scenario that occurs. The method is illustrated using data from the state of Kansas.
Poster 19
BIOLOGICAL INTERACTIONS OF SILVER NANOPARTICLES IN HUMAN CELLS
Patrick Guvele, Dr. Abhilash Sasidharan, Dr. Nancy A. Monteiro-Riviere
Department of Biological & Agricultural Engineering,
Department of Anatomy and Physiology

Nanotechnology is science, engineering, and technology conducted at the nanoscale, from about 1 to 100 nanometers. Nanomaterials (NM) have come to the forefront due to their unique physicochemical properties such as high reactivity, large surface to volume ratio, exceptional electronic characteristics, chemical composition (purity, crystallinity, electronic properties, etc.), surface structure (surface reactivity, surface groups, inorganic or organic surface coatings), solubility, shape, aggregation etc. Its wide array of applications in various fields as diverse as agriculture, electronics, and the military is a testament to this exponential growth. NM may be used to deliver drugs in a more effective way, with less side effects than traditional drugs by targeting specific areas of the body allowing for faster recovery and treatment for diseases such as tissue and bone repair and even cancer. Silver nanoparticles (Ag NPs) have found numerous applications in the biomedical field owing to its anti-microbial properties, and are currently used in various consumer products, which have led to considerable human exposure. In this study, we have investigated the role of size, surface chemistry and surface charge of silver NP on the interaction with human umbilical vein endothelial cells (HUVEC). AgNP were characterized for their average hydrodynamic diameter using a dynamic light scattering (DLS) and size using transmission electron microscopy (TEM). Surface charge was measured using zeta potential analysis. Negatively charged lipoic acid coated and positively charged branched polyethylene imine coated (BPEI) 40 nm and 80 nm Ag NPs were exposed to HUVEC cells at various concentrations for 24 h. Our finding shows that NP physiochemical properties play a significant role in the NP-cells interaction and toxicity.

Poster 20
DEFECT SELECTIVE ETCHING OF BULK HEXAGONAL BORON NITRITE (HBN)
Yichao Zhang, Mr. Tim Hoffman, Dr. J.H. Edgar
Department of Chemical Engineering

Hexagonal boron nitride (hBN) is a wide-bandgap semiconductor material with potential applications in neutron detection, ultraviolet light emission, and nanophotonics. In this study, defect selective etching (DSE) was developed to measure the density of dislocations in hBN single crystals grown using a high temperature Ni-Cr flux method. DSE is a simple, rapid, and effective method for determining dislocation types and density. The objective of this research project is to evaluate the quality of the hBN crystal by determining the dislocation density with DSE and to calculate activation energy of etch rate. Bulk hBN crystals mechanically extracted from the Ni-Cr surface were etched in a molten KOH/NaOH eutectic mixture between 425°C and 525°C. With etching, hexagonal etch pits formed where dislocations intersect the crystal surface. Four types of etch pits were observed and categorized: inversed hexagon pyramid pits, inversed truncated hexagonal pits, a combination of the above, and shallow hexagon prism pits. The typical etch pit density is $4.8 \times 10^7$ cm$^2$, and the optimal etching condition was 450°C for 1 minute to produce separated etch pits that could be easily seen by scanning electron microscope. From an Arrhenius plot of the log of the etch rate (as measured from the pit sizes) versus the inverse temperature, the activation energy was estimated to be 17 kJ/mol, which is typical of a kinetically controlled reaction.
Poster 21
LIGHTING ANALYSIS FOR FIEDLER ATRIUM
Parker Hall, Breanna Robertson, Margaret Waggoner, Collin Wheeler, Tucker Rayl, Jenna Shaw, Prof. Fred Hasler, Prof. Russ Murdock
Department of Architectural Engineering & Construction Science

Fiedler Atrium in the Engineering Building at Kansas State University has four pendants mounted with four metal halide luminaires each for a total of sixteen luminaires, illuminating the majority of the atrium space. The luminaires are mounted in an indirect manner in addition to the use of natural light from a glass wall with a south orientation. During Phase IV construction, the south glass façade was fireproofed, thus eliminating all daylight from the space. As a result, the atrium had too little light so the College of Engineering asked the K-State IES chapter to analyze the space. The group observed the atrium, took illumination measurements, and produced solutions for a greater amount of light in the space. This report explores the process that used to analyze the existing conditions, produce a lighting design, payback period, preliminary controls schematic, and ultimately, a recommendation to the owner.

Poster 22
CONTROLLED GROWTH OF CARBON NANOTUBE CARPETS ON CONDUCTIVE SUBSTRATES
Tyler Harris, Mr. Xu Li, Dr. Placidus Amama
Department of Chemical Engineering

The properties of carbon nanotubes (CNTs) have been vastly explored due to their unique electrical, mechanical, optical, and thermal properties. CNTs exhibit high thermal conductivity and electrical conductivity making them desirable materials in thermal management, energy storage, and electronic devices. For these applications, it is imperative that CNTs are grown directly on conductive substrates to prevent high contact resistance. However, the CVD process, which is the preferred growth process for producing CNT carpets, involves the use of insulators (SiO₂ and Al₂O₃) as catalyst supports. Applications of CNT carpets require an efficient method of growing CNTs on conductive substrates. Numerous problems emerge when exploring the growth on metal substrates such as poor catalyst stability, and activity resulting from the weak catalyst-substrate interactions. The study shows the growth of CNT carpets on a stainless steel substrate by using Fe catalyst deposited on an alumina barrier. Interestingly, by systematically decreasing the thickness of the barrier, we have successfully determined the optimum thickness that supports high-quality growth of CNTs. The results of the study are expected to benefit the efforts aimed at rational design of metal-supported catalysts for CNT carpet growth.
Poster 23
KONZA PRAIRIE PEDESTRIAN BRIDGE REPLACEMENT
Jordan Heinen, Sean Mitchell, Rebecca Woodard, Prof. Ray Buyle
Department of Architectural Engineering & Construction Science

AGC (Associated General Contractors) have been working on designing a wooden pedestrian bridge for the Konza Prairie. The existing bridge was constructed of a telephone pole abutted by 2x8 boards. The bridge deflects under current loading conditions, but the new bridge has been engineered with the help of the Kansas State Student Chapter of Structural Engineers Association of Kansas & Missouri (SEAKM) to reduce deflection and bending. AGC has designed the bridge from footing to walkway using AutoCAD and SketchUp. They have also dug footings, cut and bent rebar, formed and poured concrete, and built a deck atop the concrete walls. The bridge spans thirty feet between the banks of the ravine with a pier in the center. The bridge will be a more permanent and asset for the Konza Prairie.

Poster 24
ARCHITECTURAL ENGINEERING STUDENT DESIGN COMPETITION
Tyler Henley, Alex Pint, Sean Reed, Jarrod Zaborac, Prof. Chris Ahern, Prof. Russ Murdock
Department of Architectural Engineering & Construction Science

The Architectural Engineering Institute (AEI) Student Design Competition is an annual competition organized by AEI of the American Society of Civil Engineers. The competition gives students in Architectural Engineering and related programs, such as Architecture or Construction Science and Management, an opportunity to prepare and submit a building systems integration package. This package includes a fifteen page design narrative, supplemental calculations and documents, and drawings. Teams can also submit to the following categories: structural, mechanical, and electrical systems design and construction management and methods. The Kansas State University (KSU) AEI Team submitted to all five categories. The submission was selected for the finals and the team presented the design solutions at the 2015 AEI Professional Conference. This year’s competition was to design a “vertical greenhouse” for Growing Power’s headquarters in Milwaukee, Wisconsin. The building is intended to be a prototype so that Growing Power could expand to alternate locations in the future. The students were challenged with designing a building that promotes sustainable urban farming as well as community education on sustainability topics. The KSU AEI Team came up with engineering design solutions that were innovative, functional, and sustainable.
Data Explorer and Assessment Resources for Faculty (DEAR-Faculty) is a government funded research program. The purpose is to increase the use of research-based assessment in physics classes, and to support physics faculty in using research-based teaching methods through online resources on PhysPort.org. Towards that purpose, we are developing a Data Explorer to help faculty analyze the results of their assessments for Physics Education Research (PER). PER is a research field focused on understanding how students think about physics and ways to improve students' learning.

The Data Explorer is a website that will allow faculty to upload and analyze their students' assessment scores. Methods used to study these data are data mining, information visualization, and statistical machine learning. These methods help faculty analyze raw data to improve teaching technique for introductory physics. The focus for summer of 2014 is to build a user interface, uploader and statistical graphing/charting tools.

My participation in this project over eight weeks was to learn coding languages (HTML, JavaScript) and utilized these to develop codes that will allow the user to find the Fibonacci sequence, and find the maximum and minimum. In addition, I also designed a sample webpage and the structure of a visitor statistic page for the PER's site that can be modified as the project continues.

The PER is funded for four years that is presenting open for user testing. Our long-term goals are to eliminating errors, expand the website for an improve of users experience.

Agricultural water use over the last sixty years has led to a decreasing saturated thickness of the Ogallala Aquifer in western Kansas by up to 250 feet in the regions of highest depletion. Landsat and evapotranspiration images of the Arkansas River valley are examined to study hydrological surface differences over periods with varying climatic conditions. Data from eight USGS Arkansas River gaging stations, ranging from Coolidge to Garden City, illustrates the change in flowrate of the river over this transect, with flow in the Arkansas River decreasing from Coolidge to Garden City. Landsat and ET images confirm the diminishing flow in the Arkansas River as the water travels east, and the images show periods of no flow in the river near Garden City. This study of decreased flow and its relation to groundwater depletion and land use in Landsat imagery contributed towards understanding change in hydrologic function.
**Poster 27**

MYFIELDS MOBILE ABSTRACT

Daniel Kennedy, Brett Merriam, Kyle Murphy, Mr. Nathan Bean, Dr. Dan Andresen

Department of Computing & Information Sciences

The MyFields Mobile app for Android and iOS is designed to provide a solution for farmers to manage their fields on the go. Most farmers currently use paper and pen to keep track of information related to their crops and fields; this app will provide a mobile interface for a farmer to bring that management into the digital age. The app includes functionality for creating a field, displaying and editing an existing field’s information, and providing a working list of fields for the user. It also provides functionality for synchronizing that user’s field information with a web server that will store that data securely in the cloud.

Beyond field management, the app also includes functionality for farmers to take pest samples from their fields. This provides an easy way for farmers to associate a particular pest with their field to keep track of it; beyond that, however, the app will also provide a determination of whether a field’s population of a particular pest is above acceptable levels. At the end of taking a sample, based on the data collected by the farmer, the app will output a determination to treat the field for that particular type of pest (usually by spraying insecticide). These samples are associated with a particular field and will therefore track not only the current pest levels of the field, but also the field’s history of pests.

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**Poster 28**

NATURAL-BASED SYSTEMS FOR INDOOR HUMIDIFICATION

Eric Kerschen, Dr. Melanie Derby

Department of Mechanical & Nuclear Engineering

Buildings account for nearly 40% of energy consumed in the US, and the majority of energy usage in public buildings is attributed to HVAC systems. As such, these systems make up a large portion of total energy consumption in the US today; any effects of improvements on the system will be seen on a large scale. HVAC systems control temperature and humidity for occupant comfort. Natural, plant-based systems can improve indoor comfort with minimal energy addition. Plants, which transpire water as part of their photosynthetic process, are evaluated as a passive system to increase relative humidity, especially during winter.

Experiments were conducted in an environmental chamber at IER at 20°C and at 25% and 60% relative humidity, for two different plant species and a soil control. At low humidity, the results show that the amount of water evaporated is significant enough to affect humidity of smaller rooms, such as residences in nursing home facilities. These results also show significant differences in evaporation rates for different plant species and under different relative humidity conditions. This leads to the possibility of using different types of plants for different seasons or locations according to the specific need. These results show that in addition to improved indoor air quality and general health and happiness of people when placing plants in rooms, plants can also passively raise the relative humidity and alleviate energy consumption.
Poster 29

SUSTAINABLE AMMONIA PRODUCTION USING A THERMOCHEMICAL REACTION CYCLE

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Department of Chemical Engineering

The production of ammonia (NH₃) is essential because of its use as a nitrogen source for fertilizer. As the global population increases, so does the demand for fertilizer and consequently, ammonia. Currently, annual ammonia production world-wide is on the scale of 100 million metric tons. Every year, 2% of global energy consumption is by the ammonia synthesizing Haber-Bosch process. Per ton of ammonia produced, the Haber-Bosch method uses 0.5 tons of natural gas for its hydrogen content as well as for combustion energy and produces approximately 1.5 tons of carbon dioxide. We have successfully synthesized ammonia at atmospheric pressure using a three-step thermochemical reaction cycle. In the first reaction, manganese powder is heated to 800°C in a quartz tubular furnace and reacted with nitrogen gas to produce Mn₆N₂.₅₈ and Mn₄N. In the second reaction, the nitrides are heated to 500°C in the presence of steam, producing ammonia and manganese oxide. The final step of the reaction is the reduction of the manganese oxide at 1150°C in a 4% methane by volume in nitrogen gas stream. Ammonia synthesis has been tracked with an ammonia ion-selective electrode (ISE) and solid products have been characterized with powder x-ray diffraction (XRD). The first step produces 89.2 wt% manganese nitrides containing 32.7 wt% Mn₆N₂.₅₈ and 56.5 wt%. The second step shows that approximately 43-50% of the lattice nitrogen in the manganese nitrides is converted to ammonia. The rest of the nitrogen reforms to N₂ and all of the manganese forms MnO. The third step has shown a MnO conversion of 30 to 37 mol% with a 20 to 27 mol% nitride yield. This nitride yield has effectively combined the first and third step, simplifying the reaction process. These results show that this thermochemical cycle is a promising alternative to the Haber-Bosch process for ammonia production.

Poster 30

CROPYIELD: SORGHUM ANALYSIS TOOL FOR MOBILE DEVICES

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Department of Computing & Information Sciences

The estimation of sorghum yields is a rigorous process which requires precision and time or expensive machinery. To get an accurate yield estimate, a count of multiple heads worth of seeds is necessary, with each head having up to 5,000 seeds. An alternate solution to physically counting seeds, either via machine or human, is to use computer vision. While this is a less accurate method of obtaining a seed count, it is neither expensive nor time consuming. To fulfill the requirements of the computer vision solution to the problem, CropYield was created. It is an Android based application which works on both tablets and phones, and utilizes the devices camera and processing capabilities to perform a computer vision analysis in the field. Preliminary results from this past season’s harvest resulted in an R value of 0.56. Overall, our CropYield application for Android is an excellent way for farmers to save time and still receive a relatively accurate estimate of their field’s yield. While it is not as accurate as a hand count of seeds, the R values associated with the image analysis are excellent for the sheer amount of time saved. As years go by and more data is collected, the yield formula may be refined towards the computer vision style of analysis, giving more accurate results.
Poster 31
DEVELOPING SIMPLIFIED EQUATIONS TO CHARACTERIZE THE EFFECTS ON
FULL ASSEMBLY PHYSICS
Max Langston, Daniel Nichols, Dr. Jeremy Roberts
Department of Mechanical & Nuclear Engineering

Modern reactor analysis relies on quickly and accurately calculating the dependence of fuel properties on state variables including temperature, boron concentration, and burnup. Theses dependencies are very complex and difficult to model for parametric scoping studies. The goal of this research was to utilize existing software to compile data based on the aforementioned parameters and to produce simple models for use in MATLAB. Specifically, a two-dimensional lattice physics tool was used to tabulate assembly-averaged parameters (e.g. cross sections and pin powers) as functions of the state variables for three different fuel designs. Symbolic and polynomial regression were then used to fit the tabulated data to simple functions. The resulting data model will be used in an extremely fast, two-dimensional reactor model suitable for parametric scoping studies of new fuel designs.

Poster 32
PIPE LINE DRAINAGE
Rene Le, Prof. Tom Logan
Department of Architectural Engineering & Construction Science

The purpose of this research is to analyze how less water in low flow fixtures affect drainage in a four inch diameter pipe with varying slope. Old water closets consume between five to six gallons of water per flush while low flow fixtures can consume as little as 0.8 gallons per flush. This research uses a 1.6 gallon per flush Kohler water closet with 100 feet of four inch diameter pipe with two bends to resemble a building application. Typical building sanitary lines are sloped at 1/8” per foot to prevent separation of liquids from the solids, and to analyze if less water would affect separation, data is collected for 1/8” and 1/4” slopes.

This research references previous research published in periodicals and proceedings. Focus is placed on test results from research presented by the Plumbing Efficiency Research Coalition (PERC). The PERC research was conducted with ideal conditions without the use of a water closet. Two case studies of citywide replacements of older water closets are presented to discuss the viability of citywide mandates in relations to water conservation and monetary savings using low flow fixtures.
Poster 33  
NEXTGEN AIR TRAFFIC CONTROL  
Marco Loma, Rian Browne, Kyle Coates, Brandon Reigel, Dr. J. Garth Thompson  
Department of Mechanical & Nuclear Engineering  

It is predicted that in the not too distant future the number of military and commercial UAVs (Unmanned Aerial Vehicles) will increase due to their potential for economic growth. In order for the aircraft to efficiently use and navigate safely through the airspace with no incursions we must develop new methods for air traffic control. A variety of studies such as integrated flight control algorithms and flight path models have been performed to address this problem. The method of this study addresses the issue of air traffic management. The purpose of this research is to create an automated method that can efficiently detect and mitigate incursions between multiple aircraft. Fifth order polynomial segments are used to create 4D flight path models. The model uses a number of waypoints to construct a flight path for the aircraft. The waypoints give the desired position, velocity, acceleration, and time of the aircraft’s current state. A program has been developed which uses flight path models to detect and mitigate incursions between multiple aircraft. To mitigate incursions we must take into consideration the “right-of-way rules”. A program written in C++ is used to simulate the flight paths and to detect and mitigate incursions. It determines whether mitigation is required to avoid an incursion. If so, it creates a new flight path for the aircraft by adding or moving waypoints. This C++ program will run in a device called a Pixhawk Autopilot. We plan to simulate different scenarios of air traffic management to test the code. After testing the code, we will run the code on a number of different UAVs such as fixed winged and rotary winged. We hope that this method will help permit UAVs to be used safely in the airspace.

Poster 34  
SOLUBILITY AND DIFFUSIVITY OF ALCOHOLS AND WATER IN THIN MATRIMID FILMS  
Anne Maier, Mr. John Stanford, Dr. Mary Rezac  
Department of Chemical Engineering  

The eventual decreasing availability of fossil fuels has presented the need for biofuel conversion efficiency to provide economically viable solutions. This research investigates the application of polymeric membrane reactors for three-phase hydrogenation reactions, specifically interactions between reaction solvents and polymer, including penetrant sorption and diffusion. Typically, these types of studies are performed on thick polymer films on the order of 1 to 100µm. However, we are investigating the dense, thin layer of asymmetric polymer membranes on the order of 0.1 to 1 µm with a quartz crystal microbalance (QCM), which acts as a piezoelectric transducer providing frequency data of a quartz crystal due to the applied alternating current. For this research, the QCM is used to determine sorption and diffusion properties of short-chain alcohols on Matrimid polymer films. Additionally, it determines optimal spin parameters and how the polymer solution’s weight percent affects the mass deposited on the crystal as the thin polymer coatings on the quartz crystals are obtained using spin-coating techniques. The sorption data gathered used 1 and 2 wt% Matrimid in dichloromethane (DCM). Spin parameters were analyzed for both 1 and 2 wt% solutions with spin velocities ranging from 1500 to 3000 rpm and accelerations ranging from 250 to 750 rpm/s. The results showed that acceleration affected the polymer thickness more than changing the velocity in both cases. The thickness of the deposited Matrimid increased from 0.0665 µm to 1.217 µm as the weight percent of Matrimid in DCM increased from 0.5 wt% to 4 wt%.
CHEMICALLY CROSS-LINKING MATRIMID MEMBRANES WITH ETHYLENEDIAMINE VAPORS
Lauren McDonald, Mr. John Stanford, Dr. Mary Rezac
Department of Chemical Engineering

This research involves investigating a novel or non-traditional approach for chemically cross-linking Matrimid membranes. The films used in the experiments are made from Matrimid and dichloromethane at a 2wt% solution. The integrally-skinned asymmetric membranes used are cast from a 16wt% solution of Matrimid in tetrahydrofuran, gamma-butyrolactone, and butanol. The dense surface of the membrane is exposed to ethylenediamine (EDA) vapors for a specified amount of time ranging from 0 to 60min. This non-traditional approach avoids the use of membrane swelling solvents such as methanol. The purpose of this approach is to increase the chemical stability of the dense top-layer surface without adversely affecting the porous substructure of the Matrimid membranes, which allows our research group to use them in potentially harsh solvent environments encountered in three-phase membrane reactor applications. Multiple tests are done to measure gas transport properties in the modified membranes/films, measuring the gel-fraction of cross-linked films, and using FTIR-ATR to measure the extent of chemical cross-linking as a function of EDA exposure time. Also, a quartz crystal monitor is used to measure the total mass uptake of EDA in thin Matrimid films.

PLASTIC MASONRY UNITS – MATERIAL INVESTIGATIONS
Daniel Minks, Daniel Preut, Laura Trickett, Prof. Shannon Casebeer
Department of Architectural Engineering & Construction Science

Some of the most common building materials used in construction, such as concrete masonry units and lumber, are produced through extraction and manufacturing processes that are essentially destructive to the natural environment. As human populations continue to grow worldwide, the volume of trash produced by consumers increases as well. The objective of this research project was to investigate potential opportunities to utilize post-consumer plastic waste to replace concrete masonry units and wood studs in certain construction applications. Specifically, this research looked at creating Plastic Masonry Units (PMU) from recycled plastic. In addition to reducing harmful extraction processes, an increased demand for recycled plastic would decrease the amount of post-consumer plastic waste products going into landfills. A review was conducted of the various types of plastics, commonly found in post-consumer waste, to understand their available quantities and properties in an effort to examine their suitability. Among the different types of recycled plastics that are available in significant quantities, High Density Polyethylene (HDPE) exhibits suitable mechanical properties that merit further research into its use in producing PMU. Other research efforts have analyzed the mechanical properties of recycled plastics for structural applications. Although further research will be necessary to determine the specific properties of PMU and explore its commercial uses, the other research indicates that PMU made from recycled HDPE have the potential to replace some conventionally used building materials in certain applications in a more environmentally-friendly manner.
Poster 37

ESTABLISHING BIOMASS GROWTH, PROTEIN, AND LIPID PRODUCTIVITIES FOR CHLAMYDOMONAS REINHARDTII

Noe Nunez, Ms. Chelsea Dixon, Ms. Laura Soto Sierra, Dr. Lisa R. Wilken
Department of Biological and Agricultural Engineering

Petroleum resources have become increasingly scarce over the last century. As the world continues to rely on a nearly depleted source of energy, great concerns over next source of energy have arisen. Of the new energy sources proposed, biofuel energy has been considered as the top candidate to solve the oil crisis. Recent studies indicate that microalgae can effectively produce lipids in the form of triacylglycerol (TAG). Microalgae can accumulate up to 50% lipids and as a result, their potential within the biofuel industry is immense. However, energy efficient methods are needed for lipid recovery. In addition, recovery of other valuable constituents such as protein can greatly impact process economics. Aqueous enzymatic oil extraction (AEOE), or the use of enzymes to disrupt cell walls and release lipid bodies, is one potential technique for lipid and protein recovery. Having protein and oil productivities established for C. reinhardtii provides crucial information regarding the optimal harvest time. The protein and lipid productivities for C. reinhardtii were established through sample collection and assaying at various stages of the growth cycle. Both Bligh and Dyer procedures for lipid content determination and bicinchoninic acid (BCA) assays for protein content determination were performed on collected samples. The establishment of lipid and protein productivities over time is only the first step in assessing the potential of microalgae as a biofuel feedstock, but serves to guide optimization of growth conditions and extraction procedures that ultimately determine commercial feasibility.

Poster 38

ANXIETY DETECTION THROUGH THE USE OF BRAIN COMPUTER INTERFACES

Ethan Pauls, Dr. David Thompson
Department of Electrical & Computer Engineering

Brains are what allow us to think and process information as well as passively and actively control our bodies. Thus, it would make sense that reading information directly from the brain would be an interesting and exciting look into how we function as human beings. Brain Computer Interfaces (BCI) are how we accomplish such tasks. Research has already been done regarding yes/no responses, motor control and other problems. Another subfield of the BCI movement is affective computing. Rather than extracting command information, the passive state of the BCI user is classified. In this research, EEG data from several participants is being processed in an attempt to find features that might point to anxiety detection. All participants performed sessions of the Balloon Analogue Risk Task and had their brain activity recorded on sixty-four EEG channels. Anxiety detection can be used in a variety of areas in order to help acknowledge and prevent potential hazards.
Poster 39
EXPANSION OF THE DATA MEASUREMENT CAPABILITIES OF THE SOLAR PANELS
Mark Ronning, Eyven Wang, Dr. Ruth Miller
Department of Electrical & Computer Engineering

With carbon emissions growing every year, the demand for renewable energy is becoming more and more prevalent in a world with increasing demands for energy. Consequently, renewable energy options such as those from solar panels are becoming more efficient, and our ability to monitor their energy intake is vital to provide for a society that demands energy around the clock. Currently, the four CS6 series solar panels on the roof of the engineering building are being monitored for their production of power and are capable of producing a total average output power of 800W with voltage of 208 V, and a current of approximately 3.8 A. However, the ability to measure data from the solar panels is limited to periods of at least five minutes. Using a current transformer and a coded Arduino Uno, these solar panels can be monitored over much shorter periods of time. Specifically, the energy intake can be collected every second for a period of thirty seconds and then averaged to see this short-range data. This study was made in an effort to expand the abilities of the data collection capabilities of the CS6 series solar panels. The current transformer (CR9580-10) detects the AC current being produced and converts it to DC voltage approximately .55 times the detected current. By using these values, the solar panels’ energy intake monitoring is expanded to include short-range time intervals, allowing for more detailed analysis of the output power of these renewable energy resources.

Poster 40
DISCREPANCIES BETWEEN PERCEPTION AND REALITY OF THE ENGINEERING INDUSTRY
Anna Salvatorelli, Dr. Julia Keen
Department of Architectural Engineering & Construction Science

Past demographic trends have predicted a shortage of engineers due to the retirements of the baby boomer generation. Due to this shortage, women are being targeted to fill this gap. Significant effort is being put forth to recruiting young girls and women to study the STEM fields. While there has been an increase in the number of women earning degrees in engineering, there has not been an equal increase in the number of women working in the industry, meaning women are leaving the industry after they enter or not entering at all. With the amount of effort and money being put into recruiting women to engineering, it is worthwhile to identify why women are not being retained in the industry. The purpose of this study is to identify what can be done in the education of female engineering students to better prepare them for the engineering workforce reality and culture. The research study focuses on collecting information from current architectural engineering students about their perception of the industry and comparing that information to reality. The goal is to identify areas of discrepancy between perception and reality so that these areas can be addressed before students enter the workforce. The hope is with a better understanding of their career environment, women will be better prepared and equipped to deal with the issues that may be causing them to leave the industry.
Poster 41  
FROST FLOWERS  
Jashuna Shrestha, Dr. Amy Betz  
Department of Mechanical & Nuclear Engineering

The formation of ice crystals occur when water is at a temperature of below 0°C at standard atmospheric pressure or if the pressure. Lowing the pressure will decrease the freezing temperature. A natural ice formation, which can be observed through naked eye, is frost flowers. Frost flowers are formed when there is a high difference of pressure from the insides of a capillary structure, such as a plant, to the surrounding pressure. The pressure difference is caused by the capillary action that occurred in the pores of the plant which transfers the water from the roots of the plant out to the surface of the plant. To analyze frost flowers in more detail a set up was needed. In these experiments, we used different sizes of copper tubes with water. This setup allows us to analyze how far it can extrude and the different shapes the ice form into, when the diameter at the extruding point is changed. Changing the diameter at the extruding point a pressure to extrude the ice. Therefore, the study of frost flower will help us observe nature’s behavior and it can also be applied in many incidents such as frost bites to agricultural applications.

Poster 42  
CORN DRY MILLING AND LABORATORY-SCALE DEGERMING OPTIMIZATION  
Luke Snider, Kevin Hamm, Brad Wehling, Dr. Lisa Wilken  
Department of Biological & Agricultural Engineering

Seed crops (corn, sorghum, etc.) continue to show significant potential as a renewable resource for high-value products from fiber, protein, oil, and starch fractions. The development of an efficient fractionation process at the laboratory-scale that retains the quality of these components while reducing energy inputs and waste products is essential. In the ethanol industry, dry milling is used to separate non-fermentable components (germ, pericarp, etc.) from the endosperm, which contains most of the starch used for ethanol production. Degerming at the laboratory-scale provides the ability to optimize the tempering and milling processes used in larger scale ethanol production and provides recovery of the protein-and oil-rich germ that can then be processed at smaller-scales to recover higher value co-products for food, pharmaceutical, and nutraceutical applications.

This study evaluates a modified dry milling procedure using a Forsberg Impact Huller. The original huller had minimal abrasion to fractionate corn at the desired performance so an impact rotor and stater pin assembly were designed that increased the impact force acting on the corn. Testing of the pin configuration, RPM, and diameter of the huller were conducted to determine the optimum design. The modified huller now represents a scale-down model of an entoleter that provides representative data for industrial-scale fractionation. Optimization of the laboratory-scale degeming process has continued through testing of the tempering parameters including moisture content, water temperature, and residence time.
Graphene is a single sheet of graphite that has individual carbon atoms arranged in the form of a hexagon (similar to a chicken wire). Once graphite gets to the state of graphene, many desirable properties appear. These properties include its extreme mechanical strength, high electrical conductivity, and high surface area (suitable for certain chemical reactions etc.). High mechanical strength and low density of graphene makes it a promising candidate for making polymer matrix composite materials while the high electrical conductivity and surface area opens up applications in electronics and electrochemical energy storage devices. Several techniques are available for making graphene from graphite including mechanical exfoliation (using scotch tape), sonication and shearing with chemicals that break down the bonds between the layers, and ball milling. However, such methods may not be suitable for making grams or kilogram quantities of large area graphene, which is an important requirement for practical engineering applications. Therefore, the purpose of this research is to: (1) utilize microwaving methods in different gas environments to speed up the process of reducing the amount of oxygen in the graphene oxide, and (2) study the effect of this method on the material’s electrical conductivity and mechanical strength versus the conventional heating method.

The Pest Control Simulator is a training simulator for pest management companies. Our development team, together with American Pest Management, is working to create a video game that acts as virtual training for new staff members. Our team is using the Unity 3D game engine to create our game. The Unity 3D engine allows player to interact with the environment through the use of game objects and attached scripts. Over the last semester we have been able to expand our environment and add new functionality to our simulation, allowing for a more intractable and user-friendly environment.

We strive to create realistic understanding about the way various types of pests operate within customer’s homes because the software will be used as a training program. We’ve implemented artificial intelligence for pests within the game to replicate the way they move around within a home. For example, cockroaches will migrate towards old food items such as dirty dishes, while bed bugs will migrate towards bedrooms. Creating an accurate simulation is vital to the employee’s training.
Poster 45
ELECTRO-DEPOSITION OF THIN URANIUM AND THORIUM COATINGS FOR MICRO-POCKET FISSION CHAMBER NEUTRON DETECTORS
Sarah R. Stevenson, Daniel M. Nichols Michael A. Reichenberger, Dr. Douglas S. McGregor, Dr. Takashi Ito
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Department of Chemistry
Advancing micro-pocket fission chamber technologies call for a method to reproducibly apply neutron-reactive coatings to small electrodes. Uranium and thorium coatings are deposited onto these devices by electrolysis. Three different electroplating systems were implemented. The first system utilized a wire lead attached to the electrode. The next arrangement consisted of contacting the electrode by pressure between a metal probe tip and plastic backing. Lastly, a setup using a rigid, metal probe and three-dimensional platform under a microscope was used. After electroplating, uranium and thorium deposition was characterized using scanning electron microscopy, x-ray fluorescence, optical microscopy, and alpha decay measurement. The preferred system for depositing micro-pocket fission chamber coatings was found to be the use of a rigid probe and three-dimensional platform under a microscope.

Poster 46
ELECTROCHEMICAL CHARACTERIZATION OF 3D NANOCARBON-BASED ELECTRODES FOR HIGH-PERFORMANCE LITHIUM-ION BATTERIES
Jenae Tate, Marissa Follette, Dr. Placidus B. Amama
Department of Chemical Engineering
Portable electronic devices are negatively impacted by energy and power density limitations of current lithium-ion batteries (LIBs). Architectures or materials for faster ion and electron transport are required. 3D carbon nanotubes (CNTs) or/and graphene are widely used as anode materials in LIBs. However, the optimum morphology and surface chemistry of 3D nanocarbon structures that are required for high ionic diffusion, low irreversible capacity, and stable solid electrolyte interface (SEI) layers are not well understood. In this study, the electrochemical behavior of nanocarbon-based electrodes have been investigated using cyclic voltammetry and impedance analysis. The results have provided new insights into the redox reactions occurring during cycling and in particular, the Li intercalation and SEI formation processes.
Brain-computer interfaces (BCIs) are devices that allow users to interact with their environment by using only their thoughts. This is done by utilizing readings from an electroencephalogram (EEG), which records voltage signals on the scalp. Due to the nature of this device, there are many muscular and ocular artifacts in the readings, which could harm the efficiency of the BCI. To help in removing these artifacts, many methods have been proposed and implemented. This study is to compare two of these state-of-the-art methods, fully online and automated artifact removal (FORCe) and fully automated statistical thresholding (FASTER), and also to see if the implementation of these methods has an adverse effect on the classification of the collected EEG data.

Designing, implementing, and testing digital systems is a time intensive process due to limited methods of troubleshooting. The most common method is using a Logic Probe to measure voltage values at a select node. However, once a flaw in execution is found backtracking to your design in order to implement changes then rewiring your circuit takes a considerable amount of time. To streamline the entire process a Hardware Design Language (HDL) makes the process a programming assignment. This saves time with implementation by allowing changes be a single rewrite of a line with the ability to document your code. The 3 HDL used in the KSU Curriculum (Verilog, VHDL, AHDL) tend to be a learning curve for students while being difficult to troubleshoot. This can lead to students veering from digital design. Likewise programming a microcontroller or an Altera board can take up to 1-2 minutes which impedes frequent revisions. VisiBoole is a KSU HDL that converts a user’s code to color coded expressions that make troubleshooting very easy. Engineers can click expressions to change their boolean values as well as tick to simulate a clock for memory units. It also allows for corrections and compilations to only take seconds. This tool can test a digital design concept before it is ready to be written in an industry ready HDL. Some examples of circuits tested in VisiBoole are: counters, shift registers, and a UART. Currently this project is used by ECE 441 and ECE 643 to practice digital design.
INTERDISCIPLINARY TEAM COMPLETES PRESERVATION-BASED RESEARCH PROJECT ON HISTORIC BUILDING

Daniel Weisenberger, Prof. Ray Yunk

Department of Architectural Engineering & Construction Science

As America ages many buildings that were built at the turn of the previous century or before are finding themselves in various states of disrepair as costs for upkeep and code compliance rise. A group of citizens in Seneca, KS interested in restoring a historic former Masonic lodge approached the Kansas State University Architectural Engineering and Construction Science Department about providing guidance for their restoration. An interdisciplinary team of students, faculty, and a representative of the Kansas Preservation Alliance was assembled to investigate the site and building's existing condition and to make recommendations for its preservation and required improvements. The team presented a package of prioritized recommendations, cost information, and updated floor plans to the Nemaha County Historical Society to aid in project planning and grant request applications.

FLOOR VIBRATION MEASUREMENT AT RATHBONE HALL

Ryan Whelchel, Jarrod Zaborac, Dr. Bill Zhang

Department of Architectural Engineering & Construction Science

In long span and lightweight floor construction structural vibration can become a serviceability issue that needs to be studied. Floor vibrations are typically caused by rhythmic loading from human walking, running, or jumping and the mechanical equipment of a building (HVAC). Traditional serviceability requirements for lightweight, long span floor systems such as deflection limits typically do not guarantee satisfactory vibration performance. For these reasons it is important to measure and study the vibrations to determine if steps should be taken to mitigate the vibrations. Vibrations criteria also depend on the occupancy of the space. The Rathbone Hall, where the College of Engineering is located, was built with long-span steel open web joist floor system. This type of structures is known to be prone to floor vibration. In this study, field measurement is taken in terms of accelerations at various locations of Rathbone Hall. Measured acceleration data is then analyzed and compared to American Institute of Steel Construction (AISC) Design Guide 11 – Floor Vibration Due To Human Activity in order to assess the vibration performance.
Windows™ Dam Analysis Modules (WinDAM) is a set of modular software components that can be used to analyze overtopped earthen embankments and internal erosion of embankment dams. These software components are being developed in stages. The initial computational modules address routing of floods through the reservoir with dam overtopping and evaluation of the potential for vegetation or riprap to delay or prevent failure of the embankment. Subsequent modules incorporate dam breach analysis. Current work is underway to include analysis of internal erosion, non-homogeneous, zoned embankments, and the analysis of various other forms of embankment protection. The focus of this paper is on the overall software architecture and its integration with Sandia National Laboratories’ DAKOTA software suite to perform global sensitivity analysis on a wide range of input parameters.