SAGINAW VALLEY STATE UNIVERSITY

Science and Engineering Symposium

Pioneer Hall
Friday, April 27, 2018
8:30 a.m. - 4:30 p.m.

SVSU Science and Engineering Symposium

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SVSU Science and Engineering Symposium

Program

8:00 a.m.	**Registration**	Pioneer First Floor
9:00 a.m.	**Opening Remarks** Dr. Frank Hall Dean, College of SE&T	Marble Lecture Hall (Wickes 115)
9:05 a.m.	**Keynote Lecture** Dr. Joanie Kleypas, Research Scientist National Center for Atmospheric Research	Marble Lecture Hall (Wickes 115)
10:00 a.m.	**Poster Session**	Pioneer First Floor
	Biology Posters Chemistry Posters Computer Information Systems Poster Mathematical Sciences Poster Physics Poster Mechanical Engineering Research Posters Electrical Engineering Senior Design Posters Mechanical Engineering Senior Design Posters	
12:00 p.m.	**Lunch**	Pioneer First Floor
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Keynote Lecture

Can the collapse of coral reef ecosystems be avoided?

Speaker: Dr. Joanie Kleypas, Research Scientist
National Center for Atmospheric Research, Boulder, CO

The coral reef ecosystem has changed so significantly over the past three decades that many reef scientists now feel it will be one of the first ecosystems to suffer catastrophic collapse. Until recently, the causes of reef degradation have been attributed more to direct causes, such as overfishing and pollution, rather than to climate change. The approach to reef conservation was largely one of simultaneously encouraging reductions in CO_2 emissions, while reducing the land-based threats through the establishment of marine protected areas. The third global coral bleaching event of 2014-2017, which was the most severe and long-lasting of any on record, has shifted this more passive approach to one of intervention, including reef restoration, assisted evolution, and assisted migration. Oceanographic modeling has been a key element in the projections of coral reef bleaching, and in some cases, identifying regions where coral reefs can survive. Now the challenges of ocean modeling are to identify those regions where interventions can be successful. This talk will cover the history of how ocean modeling has been applied to reef conservation, and how it can be used to help avoid coral reef collapse.

Dr. Kelypas is a Scientist Level III at NCAR in the Climate & Global Dynamics Laboratory. She received her Ph.D. in Tropical Marine Studies from the prestigious James Cook University, Australia. As a marine ecologist, she has studied coral reef communities around the world, and is a leader and pioneer in research on ocean acidification.

Dr. Kleypas has received several awards for her research, including:

- The 2009 recipient of American Geophysical Union's Rachel Carson Award of the Audubon Society (http://www.audubon.org/about/rachel-carson-award)
- The 2011 recipient of the prestigious Heinz Award given for extraordinary achievements of individuals in the areas of greatest importance

She recently organized and led the First Ocean Acidification Workshop for Principal Investigators, sponsored by National Science Foundation, which pulled together researchers from many different agencies and institutions, and provides Congressional Testimony on issues of ecosystem dynamics.

Dr. Kleypas was featured in the documentary Chasing Coral. This documentary was produced by Netflix and brings out issues of coral reef die offs that are permeating the global consciousness.

Biology Posters

B01. Developing high-sensitivity western blotting to study sensorimotor signaling pathways in embryonic chick models

Taylor Brooks, Cole Pero, and Julie Learst
(Advisor: Dr. Sylvia Fromherz, Co-advisor: Dr. Andy Sharp, Southern Illinois University)

Animal proprioception, the ability to sense movements and positioning of the body, is established during embryonic development. A variety of neuropathies and muscle disorders in humans involve disruptions in proprioception. Complex neuro-muscular circuitry underlies proprioception and includes sensory input to proprioceptive neurons from associated muscle fibers in the body periphery and conveyance of that information directly to spinal motor neurons. Peripheral, muscle-produced, neurotrophin-3 (NT-3) is required for proprioceptive neuron survival in vertebrates. To better understand the role of the NT-3 signaling pathway in proprioception, we wish to establish a protein profile of NT-3 in early to mid-stage chicken embryos. We first undertook sequence analysis to identify several candidate antibodies generated against human or mouse NT-3 that should cross-react with chicken NT-3. Next, we developed a high-sensitivity (chemiluminescence-based) Western blotting approach because NT-3 levels are expected to be extremely low (picogram quantities). To establish and optimize the methodology, we are using an antibody directed at the high-abundance tubulin protein on total protein solubilized from embryonic day 9 (E9) chicken embryos. Once the technique is optimized, we will begin an analysis of the NT-3 profile from E5 to E13, starting at E9 when proprioception is known to be functional.

B02. Are Plastic Microbeads an Environmental Threat? A Model Study in Microbial Ecology

Amanda K. Siemen (Advisor: Dr. Sylvia Fromherz)

The goal of my research is to help determine how microbeads impact microbial communities, by using a single-celled toxicology model, *Tetrahymena thermophila*. Microbeads are microscopic (0.1μm-5mm) plastic beads routinely manufactured in cosmetics, toothpaste, hand soap, and other common household products. Microbeads are released in large quantities into the environment where they accumulate. Microbeads have recently been in the news due to growing concerns about their unknown potential negative impacts on aquatic and marine environments, including the Great Lakes. *Tetrahymena* uses the process of phagocytosis, evolutionarily conserved from microbes to humans, to engulf bacteria or other particles. For my research, I want to determine how phagocytosis is affected by the presence of non-nutritive microbeads, with the idea that these microbeads might inappropriately compete with *Tetrahymena*'s consumption of a natural food source such as bacteria. So far, I have tested blue-colored polystyrene beads of various sizes and have obtained evidence to suggest that *Tetrahymena* cells consume 1 μm but not 3 μm-diameter beads. I have developed a visual assay to monitor bead uptake as a measure of phagocytosis and have determined the rate of phagocytosis by *Tetrahymena* using 1 μm-diameter blue-colored beads.

B03. Screening for Herbicide Resistance in populations of *Phragmites australis*
Samantha Turner (Advisor: Dr. Dennis Gray)

Phragmites australis is an invasive common reed that has been classified by the Michigan Department of Natural Resources as a medium to high threat. With no natural predators, it proliferates rapidly, crowding out native flora in wetland ecosystems. The DNR suggests treating all established stands with glyphosate followed by mechanical removal. This threat would be amplified, however, if herbicides become ineffective due to the appearance and spread of resistant individuals. The goal of this project is look for evidence of herbicide resistance within treated populations of *Phragmites australis*. I have identified an ideal location in which to sample, or an area that has been treated for more than two years, and have obtained permissions to do so. During the summer months of 2018, I will travel to Charity island to sample coastline populations and propagate them in a greenhouse setting. After propagation, I will screen for resistance by submitting samples to increasing concentrations of the herbicide glyphosate to observe which survive. I will then try to uncover the mechanism behind resistance. First, by extracting and sequencing the gene for the enzyme EPSP synthase that is affected by glyphosate to search for genetic markers known to confer resistance, and then testing for increased transcription of the enzyme. Both tests will be explored to either explain or rule out that method of resistance. This study will provide valuable information that will benefit those trying to control the spread of the invasive reed and enhance the knowledge of herbicide resistance in general.

Chemistry Posters

C01. Synthesis, characterization, and electrochemical investigation of d8-metal hydroxamate complexes

Andrea Nikolai (Advisor: Dr. Adam Warhausen)

The aim of this project is study the interactions of hydroxamic acids with biologically relevant molecules. Hydroxamic acids are known donors of nitric oxide, an important diatomic molecule. Our research investigates the possible modes of coordination of the hydroxamate to the metal. Upon synthesis of the new complexes, their redox behavior has been investigated. In addition to elucidating the coordination mode of the hydroxamate to the metal, our goal is to investigate the electrochemical and spectroelectrochemical properties of these complexes and their analogues. Cyclic voltammetry (CV) and IR-spectroelectrochemical techniques are employed to examine the redox behavior of the complexes. The results obtained from this investigation will be presented.

C02. Synthesis, characterization, electrochemical, and spectroelectrochemical investigation of group 8 metal-hydroxamate complexes

Brad Ross (Advisor: Dr. Adam Warhausen)

Interactions between nitric oxide and biologically available materials have been widely studied in the field of chemistry. Fortunately, there is much more to learn and to study about organic molecules that are capable of producing nitric oxide within living organisms. The nitric oxide donating molecules utilized in this research are hydroxamic acids. This project aims to study the interactions of these hydroxamic acids with iron and ruthenium- containing bimolecular models. The emphasis of this work focuses on understanding their redox behavior using electrochemical and spectroelectrochemical methods.

Characterization of the complexes included nuclear magnetic resonance (NMR), ultraviolet-visible spectrophotometry (UV-Vis), and Fourier transform infrared spectroscopy (FTIR) has been done. The redox properties of these complexes and of their analogues have been examined utilizing cyclic voltammetry (CV) and IR-spec echem techniques. The extensive CV experimentation includes the utilization of platinum disk electrodes. The results of these afore mentioned studies will be discussed in this poster.

C03. Electrochemical Investigation of ruthenium complexes utilizing cyclic voltammetry
Vincent Flores and Hayley Lillo (Advisor: Dr. Adam Warhausen)

The complexes benzylidene-bis(tricyclohexylphosphine)-dichlororuthenium, and [1,3-bis-(2,4,6-trimethylphenyl)-2-imidazolidinylidene]dichloro(phenylmethylene)(tricyclohexylphosphine)ruthenium are well-known and extensively studied complexes. They are known for the wide range of reactions that they can be involved in. An area of interest that lacks in current literature is the redox properties of these complexes and their analogues. Our focus is to expand the knowledge of these complexes, more specifically, with respect to their first oxidation potential. Our group set out to investigate the electrochemical and spectroelectrochemical properties of these complexes as well as their analogues. The redox properties of these complexes have been examined utilizing cyclic voltammetry (CV) techniques using various solvents and electrolytes. The two different supporting electrolytes used in the CV experiments are tetrabutylammonium hexafluorophosphate and tetrabutylammonium tetrakis[3,5-bis(perfluorohexyl)phenyl]borate. The extensive CV experimentation includes the utilization of screen printed platinum and glassy carbon disk electrodes, as well as varying temperatures.

C04. Effects of Adding a Biguanide to Carbohydrates on Blood Glucose
Chelsea Harmon (Advisor: Dr. Jennifer Chaytor)

Diabetes is a disease that affects millions of people worldwide. Various health complications can occur as a result of this disease, especially with poor management of it. There are two types of diabetes, which are type I and type II diabetes. Type II diabetes comprises the majority of those with this disease. People with this type tend to be more prone to complications of diabetes. The reason for this is that elevated blood glucose levels is more common in those with type II diabetes. Treatments can include diet, exercise, and the use of medications. However, these treatments are not always sufficient to prevent complications. Current drug treatments include α-glucosidase and gluconeogenesis inhibitors, both of which will be explored in this research. This thesis will explore a class a compounds called the carbohydrate biguanides. These compounds may have the potential to act as both α-glucosidase and gluconeogenesis inhibitors. Methods of synthesis will be examined for various carbohydrate biguanides. The carbohydrate of interest was glucose. The biguanides that were coupled with glucose included; 1-(o-tolyl)biguanide, Phenformin, Proguanil, guanidine, and 1-(3-chlorophenyl)biguanide. Literature precedence suggests that carbohydrate biguanides with protected carbohydrates, can decrease blood glucose levels, so synthesis of biguanides coupled with glucose pentaacetate will also be examined. Mass spectral characterization was completed for each compound that was synthesized and revealed that the target compounds were not formed. Purification of the target compounds with high pressure liquid chromatography was also explored. Development of an α-glucosidase assay was examined to test potential α-glucosidase inhibitors.

C05. Synthesis of C-Glycosides as Potential Type II Diabetes Treatments
Katie Kwiatkowski (Advisor: Dr. Jennifer Chaytor)

Type II diabetes mellitus is described as an increase in blood glucose levels and is becoming a growing problem in the world. It is projected that 380 million people worldwide will have type II diabetes in 2025. Medication is often required to fully manage the disease because an improved diet and exercise don't reduce glucose amounts to the recommended levels. Cardiovascular disease, kidney failure, and neuropathy are a few of the many complications associated with type II diabetes. Medications exist to eliminate excess blood glucose, but can result in unfavorable side effects. Sodium dependent glucose cotransporters (SGLTs) are responsible for glucose reabsorption in the body. Reabsorption in the kidneys is facilitated through SGLT2 and is attributed to 90% of all reabsorption. This research focusses on the synthesis of aryl-C-glycosides that will be made to have SGLT2 inhibition and anti-hyperglycemic activity. The synthetic products are purified using techniques such as washes, recrystallization, and column chromatography. Nuclear Magnetic Resonance Spectroscopy is used to analyze products to ensure reaction completion and accuracy. The target compounds will be evaluated using an enzymatic assay.

C06. Synthesis of Dianthin G, a Peptide that Promotes the Formation of Osteoblasts
Kathlyn Underwood, Nicholas Toupin, and Patrick Fryfogle
(Advisor: Dr. Jennifer Chaytor)

Osteoporosis is a common disease that occurs in the bones of both men and women. The disease is more prominent in adults over the age of 60 as it commonly affects 1 in 2 women and 1 in 4 men in this age bracket. While many people have osteoporosis, there are still millions of people who are at risk of developing the disease or have low bone mass levels that may lead to an increased susceptibility of fractures, especially in the hip, wrist, and spinal areas. Recently, there has been a discovery of a plant (*Dianthin superbus*) that has been tested for osteoblastic proliferative activity. A peptide from *D. superbus*, known as Dianthin G, has been shown to activate the production of osteoblasts to increase bone mass. Dianthin G is a cyclic hexapeptide that is extracted from *Dianthin superbus* and was initially taken from a northern province in China, known as Shandong, and is used in traditional Chinese medicine. Furthermore, amino acids arginine and lysine have been shown to promote the growth of bones as lone residues, and will also be analyzed when incorporated into an analog of Dianthin G. This study has examined the chemical synthesis of Dianthin G and its structural analogs. The proliferative activity of these compounds on rat osteoblast cells will later be tested to see if they have the ability to prevent the formation and endurance of osteoporosis. The chemical synthesis and purification of these cyclic peptides will be discussed in this presentation.

Computer Information Systems Poster

Crescendo: A Sheet Music Management System
CIS 424 Senior Capstone Class (Advisor: Dr. Scott James)

This year's CIS capstone class designed and built a self-contained sheet music management software system. The system can scan sheet music into a PDF format and then recall the sheet music for live performance playback. Furthermore, the system allows sheet music to be grouped and managed by playlists of the performer's choosing. The sheet music playback is controlled by a USB foot pedal allowing complete navigation of the sheet music system without touching the computer's physical keyboard. The system was designed using Microsoft Visual Basic.NET and SQL Server.

Mathematical Sciences Poster

Optimization of Student Loans using Euler-Lagrange Equation
Reecha Upadhyay (Advisor: Dr. Arundhati Bagchi Misra)

The researchers work on an application of Euler-Lagrange equation on dynamic optimization problems and mainly replicate The Career Decisions of Young Men and The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment published by Keane and Wolpin in 1997 and 2001 respectively. In the papers, Keane and Wolpin solved the optimization problems of student loans using the Bellman principle of optimization and, the researchers plan to do so by applying Euler-Lagrange equation using MATLAB. The Bellman Principle of Optimality by Ioanid Rosu links Euler-Lagrange principle to the Bellman principle and the researcher's work is informed by Rosu's paper. While Wolpin's papers comprised of numerous parameters, the researchers seek to obtain the same solutions with fewer parameters, initially. The researchers follow the solution method described in the paper The Solution and Estimation of Discrete Choice Dynamic Programming Models by Simulation and Interpolation: Monte Carlo Evidence by Keane Wolpin in 1994.

Physics Poster

Symmetries and degeneracy in quantum harmonic oscillators
Autumn Zender (Advisor: Dr. Rajan Murgan)

We revisit the energy eigenvalues of the two-dimensional and three-dimensional quantum harmonic oscillators by exploiting their underlying symmetries defined by the SU(2) and SU(3) Lie groups respectively. Moreover, these larger symmetries of their Hamiltonians also imply degeneracy of the energy levels which we also explain. In particular, the Casimir operators of the SU(2) and SU(3) groups are utilized for this purpose. This is done by expressing them in terms of the Hamiltonians and determining their eigenvalues that are the same in any representation. The various degrees of degeneracy of the energy levels are demonstrated to be equal to the dimensions of irreducible representations of these Lie groups.

Mechanical Engineering Research Posters

ME01. Optimizing Mechanical Efficiency of Conical Coil Heat Exchanger Using Thermoelectric Generation

Daniel Newton (Advisor: Dr. Aneesha Gogineni)

Coiled tubes are designed to improve heat transfer performance of compact heat exchangers. Heat loss is most common in heat exchangers and this heat is not often used. In the present study, the heat energy that would normally be wasted in a heat exchanger is allowed to run through a thermoelectric generator prior to being introduced in the heat exchanger. This design allows the waste heat energy to be recovered by the thermoelectric generator, and the power generated is measured. A conical coil heat exchanger was built and the test set up is used to conduct experimental analysis at varying temperatures and flow rates. A conical coil was used to maximize heat transfer coefficient, and minimize pressure drop. In addition, the theoretical analysis is conducted using MATLAB to determine heat transfer coefficient of fluid with change in temperature and flow rates. The obtained results are validated by comparing them to experimental results. It is observed that with increase in flow rates, heat transfer coefficient and Nusselt number increases. As the difference in fluid temperature increases, the thermoelectric generator produces more power.

ME02. Research on Robotic Vision Monitoring System

Kyle W. Bruce (Advisor: Dr. Andy Pandian)

The goal of this project is to design and develop quality control parts for robotic vision research and fabricate 3D printed colored components for experiment. Student will learn and use the robotic vision In-Sight software and hardware to set-up the vision computer/robotic system and teach the robot to make quality control decisions. The most important aspect of the vison system is the “lighting” arrangements. The camera must be calibrated using the gird calibration 10 x 10 mm calibration sheet. This calibration procedure adjusts (accommodate) for the lighting and the camera focus on the part. The calibration sheet placed on the table will be illuminated using the backup light source and a picture of the sheet is taken using Cognex camera (640 x 480/800 x 600 resolution). Now, the set-up is ready to measure the part color and the part dimensions. After camera calibration, place the part on the illuminated table and take a picture of the part using the In-Sight software. The part static picture is analyzed for part color accuracy using gray scale values. Using vision tools, the part geometry dimensions are evaluated. This information is fed to the robot memory to pick the accurate part from collection of bad parts.

Electrical Engineering Senior Design Posters

E01. NASA Mining Robot

Connor Peil, Clayton Gould, Erik King, and Mohsen Abusaq
(Advisor: Dr. Rajani Muraleedharan)

Having the ability to mine on Mars is a vital part to potential Mars tourism or even colonization. Mining on Mars presents many challenges that are not faced on Earth, which is why NASA has started the Robotic Mining Competition. We have entered believing we can bring forth interesting ideas. The mining robot will consist of a general chassis that will be the base of a belt-mining method to be placed on. The robot will have situational-awareness sensors at its disposal to allow easy navigation through a simulated Mars environment. Through this system configuration and iterative testing, SVSU will be able to make an impressive debut at the NASA Robotic Mining Competition.

E02. Amigo Battery Health Monitor

Josiah Ward, Nathan Scharich, John Kovalick, and Komail Alabbas
(Advisor: Dr. Rajani Muraleedharan)

Batteries are one of the largest expenses with Power Operated Vehicles (POV) and are susceptible to user abuse. A batteries state of health decreases significantly when subject to a deep discharge or incomplete discharge and charge cycles. A proposed solution to this problem is to develop a system that will monitor the depth of the discharge and determine the batteries state of health at all times. The system being introduced will determine the state of health by using the batteries internal resistance. Once the internal resistance begins to exponentially increase, the battery will be deemed a failure. The system will need to be able to handle a 50A current and it must log incomplete recharge cycles and how deep a discharge cycle is. It must also have a visual indicator that will tell the user when the battery is no longer usable along with a reset functionality for when the battery is replaced. The product must have a unit cost of eight dollars per ten thousand units and a compact size of 2.2 inches by 3.2 inches.

E03. Air Quality Monitoring System

Jared Leonard, Aaron Boshaw, Joshua Bower, and Noah Conner
(Advisors: Dr. Rajani Muraleedharan and Dr. Aneesha Gogineni)

Aging buildings and infrastructure presents a growing concern about indoor air quality and the risk of "Sick Building Syndrome," or the tendency of facilities with poor air circulation to spread sickness. The project goals include designing a low cost, modular system for monitoring air quality, while promoting understanding of STEM concepts with high school students. Primarily, the AQMS is designed to monitor room temperature, the levels of harmful gases in the air such as carbon monoxide and carbon dioxide, and the presence of volatile organic compounds (VOCs). The AQMS is capable of monitoring multiple rooms and communicating to a cloud server for data analysis purposes and comparison with the American Society of Heating, Refrigerating, and Air Conditioning Engineers' (ASHRAE) indoor air quality standards. A simple design is utilized so that students can fully understand the components of the AQMS and perform their own mathematical statistics that increase interest in science and engineering. Ultimately, this project will provide air quality monitoring, be cost effective to implement, and be easily operated and understood by high school level students.

E04. SVSU Go-Baby-Go Making Lives Better: Modifying Ride-On Toys to Provide Mobility to Children with Cognitive or Physical Disabilities

Anthony Hebert, Kevin Horn, Donald Horner, and Joshua White
(Advisor: Dr. Rajani Muraleedharan)

SVSU Go Baby Go project aims to provide mobility to special needs' children with limited mobility. An existing battery-operated children's toy ride-on electric car will be adapted to conform to the child's special needs circumstances. The car will be chosen by the child's parent(s) and adapted according to the child's medical condition. The adaptations may include safety harnesses, remote (radio) communication for control and emergency stops, and sensors for crash prevention. The customized car will be gifted to the child's family as a token of SVSU's outreach contribution of making lives better for special needs children.

E05. Rear-Steer Mechanism for Cardinal Racing Team

Zachary O'Brien, Nicholas Armstrong, and Mohammad Albannawi
(Advisors: Dr. Sandun Kuruppu and Dr. Rajani Muraleedharan)

The project aims to analyze and design a rear steering system for a Formula SAE racecar to improve performance while maintain SAE guidelines. In general, at low speeds a rear steering system can turn the rear wheels in the opposite direction as the front to whatever degree seems fit. But, to adhere to the SAE guidelines the rear wheels will be limited to a maximum of six degrees articulation. Due to the high-power output, size, and weight electric linear actuators are used for articulation of the rear wheels. The linear actuators can be programed using an Arduino to have a better turn radius in response to the racecars front wheels using their position and speed. Hence, a data transmitter, such as ZigBee, with high data transmission at a low cost is preferred. The ZigBee enabled rear steer design will be implemented on formula SAE racecar in 2019 in hopes of improving rank of cardinal race cars in Formula SAE Collegiate Competition Series.

E06. Impact of Parameter Variation in Control Systems

Alexander Shibilski and Huzaifa Muhammad Imam Uddin
(Advisors: Dr. Sandun Kuruppu and Dr. Rajani Muraleedharan)

Real-time mechatronic systems (actuation systems and motor drives) include digital control strategies based on a microprocessor. Mechatronics systems are purposed to perform a task while interacting with the physical world (electric powertrain, robotic systems, surgical equipment) in a safe and reliable manner. Performance of mechatronic system depend on 1.) stable operation of the control system and 2.) the energy conversion system (electric machine drive). Systems are said to be real-time because they generate output signals based on current data/information. Such operation and controller designs rely on the clock signal of the microprocessor to have a known frequency. All data transfer and computation of the processor is executed on the rising and falling edges of the clock signal. Varying the clock frequency from the expected clock frequency injects error into the system. Similarly, sensor error can also be applied to the system. Motor drive systems use rotary encoders to have position feedback, this is how the control system monitors motor position. Any error in position sensing impacts the control system with skewed calculations. In this project, the impact of error on system performance is studied through simulation and experimental hardware. A better understanding of the effects of such system parameter variations enable the development of tight tolerance criterion for future systems.

Mechanical Engineering Senior Design Posters

M01. Duro-Last Automated Uplift Tester

Austin Schroeder, Nick Maestaz, Jimmy Bergmooser, and Hunter Knieper
(Advisor: Dr. Brooks Byam)

Founded in 1978, Duro-Last, Inc. is known for its single ply PVC roofing, of which billions of square feet have been produced. It is used in various climates and needs to be able to survive severe weather conditions. As a result, an uplift test has to been done in accordance with Testing and Application Standard (TAS) 114-95 appendix d. This standard is the testing procedure for roof system assemblies in the high-velocity hurricane zone jurisdiction. Duro-Last, Inc. currently does the test manually, costing the company time and money that can be reduced. The goal of the project is to create an automated test with low operator input that is in accordance with the standard.

M02. Huhtamaki Plastic Cup Stack Dispenser

Wyatt J. Eschenbacher, Earl J. Lewis, Keegan M. Reimus, and Matthew T. Strickler
(Advisor: Dr. Brooks Byam)

The Huhtamaki Group was founded in 1920 in Espoo, Finland, since then it has grown to become a world leader in the manufacturing of packaging for food and drinks. The Huhtamaki plant in Coleman, MI has commissioned a group of students from the SVSU Mechanical Engineering department to design, build, and validate a plastic cup stack dispensary system to aid in increasing the throughput of the Coleman plant. The dispensary system must meet a set of design requirements that were agreed upon by the client and the design team. The design requirements were subdivided into three categories. The chosen categories were safety and ergonomics, functionality, and economics. In terms of safety and ergonomics, the dispensary system must comply to all MIOSHA and FDA requirements for loading and the handling of food-grade products. Functionality wise, the product must be able to dispense multicolor cup stacks that range in height from 25 to 60 cups at a rate of 50 stacks per minute onto a conveyor system horizontally. Economically wise, the entire project must remain in a budget of $4000. Upon completion of the project, the product will be given to the Huhtamaki plant in Coleman, MI to be integrated into it manufacturing process.

M03. MOTIV Bowling Quality Control Automation

Kyle Mazure, Molly Mazzella, Alex Lewandoski, and Kristin Syrowik
(Advisor: Dr. Thomas Mahank)

MOTIV Bowling is a Michigan-based bowling ball manufacturer that is rapidly expanding due to a recognition of their commitment to high quality. As a result, the need arose to decrease the cycle time required for their manufacturing process in an effort to increase production. Currently, the largest bottle neck in the production line is the diameter and out-of-roundness quality checks that are performed manually for every bowling ball manufactured. The measurements required are based on the standards set by the US Bowling Congress. Because this is very time and labor intensive, it was desired that these checks become automated. This fully-automated system will accurately obtain the necessary measurements in the specified cycle time provided by the client and will store the measurement data so it can be accessed by the operations engineer at any time. It is also capable of determining if a ball meets the measurement standards and will output the ball to the appropriate final destination, whether it is to be re-ground or sent to packaging for distribution.

M04. Nexteer Automotive EPS Rack Transportation Cart

John Rye, Dakota Crockford, Mafid Alsadeq, Kyle Malone, and Kevin Gwizdala
(Advisor: Dr. Brooks Byam)

Our team is working to design an ergonomic cart for Nexteer Automotive to be able to transport their EPS Racks around their plants. The cart will be responsible for moving T1XX, K2XX and LWR steering racks. The current need is to create a safer, less strenuous work environment for the operators in order to improve worker productivity and decrease potential injuries. This will be achieved by limiting the loading heights and distances that the operator will be required to reach while loading the cart in order to reduce back and shoulder strain. At the same time our team will be maintaining the most possible racks that can be moved at a time to limit the number of trips needed to move the parts from one area of the plant to another. The cart must be able to move a load of up to 1500lbs while having an initial start push force of no greater than 44lbs and a sustainable push force of no greater than 22lbs. This cart has to be durable enough to have a service life of greater than 5 years while operating in plant conditions that will include being around metal chips and coolant. To complete the project our team has been provided a budget of $5000.

M05. B&P Littleford Blown Film Die Development

Amanda Erickson, Mousa Alzaki, Daisy Lund, and Jacob Turanski
(Advisor: Dr. Andy Pandian)

The process of quality testing for highly filled polymers includes a particle distribution and maximum agglomerate size requirement. A blown film die has been used in the past by the engineers at B&P Littleford, however the process needed to use this die is not optimal for in line testing. A new blown film die has been designed and manufactured to run in line with any pilot-scale continuous extrusion process. Objectives such as a heating up to 400 °F in 15 minutes, the ability to withstand an internal pressure of 3000 psi, operate at a mass flow rate of 200 pounds per hour, and the ability to extrude alternate sheet thicknesses were all successfully met. The budget for this project was $3000.00. Six cartridge heaters located in the outer wall of the die deliver 7200 W of power to heat the die body. Prior designs used set screws to locate the outer diameter of the sheet, the new design eliminated all adjustments with a pilot on the upper end of the center cone. A tight runout tolerance was used to ensure concentricity of the main die body and the center cone that determines the sheet thickness. A nitrogen port will be incorporated in the side of the die body to blow the polymer film to its final thickness. Testing of the die proved that the measurable objectives listed above were met and the die operates under desired conditions.

M06. Inspire Outcomes Smart Gait Belt

Hussain Almisbah, Ryan Peruski, Brad Schneider, and Randi Sopczynski
(Advisor: Dr. Brooks Byam)

Inspire Outcomes, LLC. is interested in a force sensing gait belt that would signal the caregiver at the critical limit of 35 lbs and record that data to use at a later date. The final concept chosen includes a smart E-material to be used as a soft pressure sensor on a removable slip for standard gait belts in the healthcare field. The load induced changes the resistance of the smart E-material. Through wiring and programming of two separate sensors to an Arduino board, a force is read and saved onto a SD card. If the critical limit is reached in combination with the sensors, a buzzer will sound.

M07. Kremin Off-Line Dressing Machine

Hassan Almohsin, Jason Messing, Daniel Newton, and Daniel Wolniak
(Advisor: Dr. Brooks Byam)

The existing DRM-001 Dressing Machine offered by Kremin for stone working markets was redesigned to allow for penetration into foreign markets. The existing machine was re-designed to retain all performance while being condensed into an all-in-one enclosure, with added safety features. Due to the redesign, the shipping costs would be cut to ¼ of the current costs, allowing for the machine to enter into new markets. The redesign also allowed for new features to be included at a later date, such as digital readouts and lighted work spaces.

M08. SVSU Greenhouse Automated Vertical Hydroponic System

Gavin Bennett, Ahmed Alfaraj, Joshua Howell, and Shane McClure
(Advisor: Dr. Brooks Byam)

Our project for the SVSU Greenhouse is a vertical hydroponic system that will provide fluid nutrients and adequate exposure to sunlight for over 350 plant plots. The hydroponic system optimizes the client's floor space and height requirements with six six-foot towers, with holes arranged at the optimal angle to prevent overlap of plants as they grow. The system will be fully automated with a continuously-running electric pump and motors timed to turn the six towers during daylight hours. The nutrient fluid mixture is "worm tea", provided by the SVSU Greenhouse.

Oral Session A: Biology **Room: Pioneer-242**

Presentations are 15 minutes each, starting at 1:00 p.m.

B01. DNA Fingerprinting of Charity Island Phragmites and Herbicide Resistance
Kyle Vacca (Advisor: Dr. David Stanton)

Phragmites australis is an invasive reed species that was introduced into the United States over one hundred years ago. It has since spread aggressive throughout the Great Lakes region, displacing native species and destroying wildlife habitat. It has already taken over the eastern shore of Saginaw Bay and is taking over the western coast as well. In addition, it has invaded Charity Island in the middle of Saginaw Bay and is dramatically affecting the tourist trade on the island. In partnership with Huron Pines, an eradication program is underway. Herbicide spraying on the island began in the fall of 2015 and will likely continue to the next several years.

In order to assess genetic variation, population substructure and the genetic effects of eradication efforts, a DNA fingerprinting survey was begun. Samples were taken from Charity Island prior to herbicide treatment and following one and two years of treatment. Genotypes were determined for 217 samples for 10 loci. The data allow for the determination of genetic variation and modes of recruitment in post treatment populations. They also potentially allow for the detection of selection at particular loci. The results have important implications for treatment strategies in this and other localities.

B02. DNA Fingerprinting of Walleye (*Sander vitreum*) from Saginaw Bay: Genetic Effects of Stocking
Megan Maitland (Advisor: Dr. David Stanton)

There is a large population of walleye in Saginaw Bay that is both economically and ecologically important. The population is heavily managed and has been stocked extensively in recent years. In order to properly manage this population, genetic information is required. We obtained fin clips from walleye captured in Saginaw Bay for two summers by trolling. With the help of the Department of Natural Resources (DNR), we also obtained fin clips from spawning populations using electroshocking on the Tittabawassee, Shiawassee, Kawkawlin, Rifle River and Flint Rivers. In addition, we obtained fin clips from the Muskegon River through the DNR, since this was the source of the fingerlings stocked in Saginaw Bay. DNA was extracted, using a DNeasy kit. PCR amplification and capillary electrophoresis were performed in order to determine genotypes for ten polymorphic DNA fingerprint loci. The data were analyzed by calculating the number of alleles per population, observed and expected heterozygosities, genetic distances (D) and population substructure (FST). Private alleles were sought that were found in single spawning populations, which would indicative of spawning site fidelity. This information can be used to assess the genetic impact of stocking in Saginaw Bay using fry from the Muskegon River and will aid in making management decisions regarding future stocking programs, as well as decisions regarding damming of rivers and the construction of ladders to be used by spawning walleye.

Oral Session B: Electrical Engineering Senior Design **Room: Pioneer-240**

Presentations are 30 minutes each, starting at 1:00 p.m. (see Pages 11-13 for abstracts)

E01. NASA Mining Robot
Connor Peil, Clayton Gould, Erik King, and Mohsen Abusaq
(Advisor: Dr. Rajani Muraleedharan)

E02. Amigo Battery Health Monitor
Josiah Ward, Nathan Scharich, John Kovalick, and Komail Alabbas
(Advisor: Dr. Rajani Muraleedharan)

E03. Air Quality Monitoring System
Jared Leonard, Aaron Boshaw, Joshua Bower, and Noah Conner
(Advisors: Dr. Rajani Muraleedharan and Dr. Aneesha Gogineni)

E04. SVSU Go-Baby-Go Making Lives Better: Modifying Ride-On Toys to Provide Mobility to Children with Cognitive or Physical Disabilities
Anthony Hebert, Kevin Horn, Donald Horner, and Joshua White
(Advisor: Dr. Rajani Muraleedharan)

E05. Rear-Steer Mechanism for Cardinal Racing Team
Zachary O'Brien, Nicholas Armstrong, and Mohammad Albannawi
(Advisors: Dr. Sandun Kuruppu and Dr. Rajani Muraleedharan)

E06. Impact of Parameter Variation in Control Systems
Alexander Shibilski and Huzaifa Muhammad Imam Uddin
(Advisors: Dr. Sandun Kuruppu and Dr. Rajani Muraleedharan)

Oral Session C: Mechanical Engineering Senior Design I **Room: Pioneer-245**

Presentations are 30 minutes each, starting at 1:00 p.m. (see Pages 14-15 for abstracts)

M01. Duro-Last Automated Uplift Tester
Austin Schroeder, Nick Maestaz, Jimmy Bergmooser, and Hunter Knieper
(Advisor: Dr. Brooks Byam)

M02. Huhtamaki Plastic Cup Stack Dispenser
Wyatt J. Eschenbacher, Earl J. Lewis, Keegan M. Reimus, and Matthew T. Strickler
(Advisor: Dr. Brooks Byam)

M03. MOTIV Bowling Quality Control Automation
Kyle Mazure, Molly Mazzella, Alex Lewandoski, and Kristin Syrowik
(Advisor: Dr. Thomas Mahank)

M04. Nexteer Automotive EPS Rack Transportation Cart
John Rye, Dakota Crockford, Mafid Alsadeq, Kyle Malone, and Kevin Gwizdala
(Advisor: Dr. Brooks Byam)

Oral Session D: Mechanical Engineering Senior Design II **Room: Pioneer-247**

Presentations are 30 minutes each, starting at 1:00 p.m. (see Pages 16-17 for abstracts)

M05. B&P Littleford Blown Film Die Development
Amanda Erickson, Mousa Alzaki, Daisy Lund, and Jacob Turanski
(Advisor: Dr. Andy Pandian)

M06. Inspire Outcomes Smart Gait Belt
Hussain Almisbah, Ryan Peruski, Brad Schneider, and Randi Sopczynski
(Advisor: Dr. Brooks Byam)

M07. Kremin Off-Line Dressing Machine
Hassan Almohsin, Jason Messing, Daniel Newton, and Daniel Wolniak
(Advisor: Dr. Brooks Byam)

M08. SVSU Greenhouse Automated Vertical Hydroponic System
Gavin Bennett, Ahmed Alfaraj, Joshua Howell, and Shane McClure
(Advisor: Dr. Brooks Byam)