Book of Abstracts

The Emerging Scholars Research Program

Fall 2016

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1. Adaptive and Autonomous Tensegrity System

Starky Acevedo, Alyssa Ayow, Andres Espinal, Asli Oney, Cyntia Persaud, Adel Yaseen
Prof. Phillip Anzalone

The Adaptive and Autonomous Tensegrity System (AATS) is a project for incorporating a computation driven design-to-installation workflow into building components, enabling the efficient automated design and deployment of differential-geometry active structure with potential uses as part of an active façade system. The system employs parametric and solid-modeling methods with production by streamlining computer numerically controlled (CNC) manufacturing through novel detailing and production techniques to develop an efficient manufacturing and assembly system. The AATS system focuses on computationally produced full-scale performative building systems and their innovative uses in the building and construction industry.

The basis for the structure of the system is the use of tensegrity, an advanced structural concept that looks to the future in an innovative system where a continuous network of efficient axially loaded high-tension cables are configured with isolated structural compression members in such a way as to delineate the system spatially and provide a highly efficient, dynamic and exciting form. Tensegrity has been discovered as the structural composition of many natural biomechanical systems, such as the relationship between muscles, bones and tendons in the human body. In constructed form, tensegrity is a relatively new invention, first developed only 50 years ago by Buckminster Fuller and Kenneth Snelson, who's potentials are only now being realized through computational capability of advanced hardware and software.

The system is engineered to take advantage of the forces developed in building components through computational sizing and configuration of the elements and the tensegrity form. The structure self-tunes in geometric form-finding, reducing internal stress, develops counter-vibration properties to dampening movement and reduces vibrations by dispersing the forces in the naturally resilient tensegrity system. The lightness of the structure reduces the need for extensive support to external structures, providing a less invasive attachment condition to new and existing buildings.

The Emerging Scholars researchers for Fall 2016 used Professor Anzalone's computational form-finding software module to design tensegrity mast for full-scale prototyping. The researchers modified the design of the node of the structure to be appropriate for 3D printing on a steriolitography (STL) printer. These modifications were studied through finite element analysis (FEA) to assure that imposed loads would not exceed design allowances. Initial prototypes of the nodes were iterated in photopolymer acrylic resin, and the final nodes for assembly were produced in an

engineering resin specifically designed for higher toughness and flexibility. Struts were produced from alloy 6061 aluminum stock tubes and tension members from 7x7 galvanized steel rope, with connection points specifically designed to integrate with the 3D printed nodes. The structure was assembled to validate the 3D printed node design, study the properties of assembling a networked system that is geometrically unstable until complete, confirm through loading that the analysis was accurate, and to prepare for future work on active systems for building envelope components.

2. Development of the Peer-Led Team Learning Handbook
   Carlos Alvarez
   Prof. Janet Liou-Mark

   Peer Leader Training has become a widespread tool in mathematics education. By training undergraduate students – who have excelled in certain mathematics courses –in a manner where learning theories and facilitation techniques are learned and prioritized, these students then become peer leaders, who's sole purpose is to guide students towards achieving successful grades in their classes. These peer leaders are obligated to take the MEDU2901 course offered at The New York City College of Technology, which is a semester long, one credit course, which emphasizes on the understanding of fundamental learning theories and assists peer leaders in learning how to tackle a situation that is not ideal. This method of teaching is effective, but through the use of a handbook which would explain an effective and proper way to introduce how to peer lead, the peer leaders will gain a vast amount of knowledge and will always be able to refer back to the handbook if they need more guidance. Through the development of the Peer-Led Team Learning Handbook, we are creating a support system that goes beyond the Mentee-Mentor relationship. The handbook will contain plenty of examples, possible solutions to issues, references if students would like to gain more information about a certain learning theory and possible questions and techniques that students can adopt to be a successful peer leader.

3. Examining the Role of Calpain1 in Oxidative Stress
   Jean-Luc M. Antonie
   Prof. Ralph Alcendor

   We studied the Bose-Einstein condensation (BEC) and superfluidity of photons in a micorcavity. The interaction between photons is achieved by coupling of the photons to a dye molecule. The photons are trapped due to the curved shape of the mirrors, forming the microcavity. The curved shape of the microcavity results in the coordinate-dependent photon effective mass and photon-photon interaction. The temperature and coordinate dependence of the superfuid density for photons in a microcavity is analyzed. The possible experiments to observe the BEC and superfluidity of microcavity photons are discussed.

4. Discovering Mechatronics by Connecting the Software and the Hardware Together
   Atif Bacchus
   Prof. Muhammad Ummy

   Mechatronics, which is the combination of mechanisms and electronics, teaches us how to acquire theoretical knowledge of different types of sensors and actuators and to apply it in LabVIEW (Laboratory Virtual Instrument Engineering Workbench). The purpose of this project is to create a lab manual for the Mechatronics class by providing experiments so students can learn how to design and create a simple system using the contemporaneous equipment manufactured by National Instruments (NI).

   LabVIEW is a program that uses a graphical notation to connect functional nodes, which produces output data and passes the data to the next node in the dataflow path. It can be utilized to take measurements, analyze data, and present results to the user. Students will enhance their design and programing skills by creating platforms for controlling various systems. This project is primarily focused on learning more about digital and analog modules and LabVIEW software. By using LabVIEW as the motor controller, students can control a DC motor for multiple purposes. With the push of a button in LabVIEW, students will be able to start, stop, and change desired direction of the motor. LabVIEW will be the main controller and processor, NI DAQ as the interface, and an H-bridge as the sub-controller.

5. Alzheimer's Disease and Related Disorders
   Ilhom Bakiyev
   Prof. Niloufar Haque

   Dementia is a progressive, neurodegenerative, fatal condition characterized by deterioration in cognition and memory loss. The patient experiences progressive impairment in the ability to carry out activities of daily living, and develops a number of neuropsychiatric symptoms. There are about 80 to 90 kinds of dementia, All types of dementia are chronic, progressive and fatal. Physician can recognize these dementing illnesses in patients by using existing criteria. Repetitive measurement with neuroimaging techniques could be useful instruments permitting to differentiate between types of dementia. This Differential diagnosis has an important bearing on patient management and prognosis, due to the fact that different types of dementia has different cause and effects therefore the medical treatment may vary. (NINCDS-ADRDA). Alzheimer's disease accounts for 60-80% of cases. Vascular dementia, which occurs after a stroke, is the second most common type of dementia. Frontotemporal dementia neurodegenerative disorder, which has three cardinal features: behavioral and personality changes, cognitive impairment, and motor symptoms. It is a rare condition. physicians should be familiar with the clinical difference between AD and other diseases.

6. Elevator Staging System for Maskless Photolithography
   Chad Boodoo
   Prof. Ozlem Yasar

   In recent years, Tissue Engineering is utilized as an alternative approach for the organ transplantation. Success rate of tissue regeneration influenced by the biomaterials, cell sources, growth factors and scaffold fabrication. Design and precise fabrication of scaffolds are required to support cells to expand and migrate to 3D environment. At the SET Research Laboratory at City Tech, maskless pholithograpy is used to fabricate the scaffolds. Main components of the maskless pholithography are “digital micro-mirror device” (DMD), “photo-curable material” and an “elevator system”. In current scaffold fabrication set-up at SET, only 2D scaffolds are generated due to the lack of an elevator stage. In this research, to carry the scaffold fabrication from 2D to 3D, elevator stage is designed and fabricated.

7. User-Centered Design for Multimedia Health Literacy
   Ellen Chan
   Prof. David Lee

   Information technologies have heavily impacted society and health care is no exception. Computer screens are a major hub of health care interactions, from computerized provider order entry (CPOE), to consumer-facing health information websites and mobile apps. These technologies are intended to improve health literacy, giving consumers more ways to keep track of their health records and communicate with providers. Critics of health care IT note problems and unintended consequences, such as keystroke error, HIPPA concerns and the digital divide. The evidence base for what makes these new apps, platforms and interventions effective is still being established. In this exploratory research project, we investigate the literature of health care IT and the role of design thinking in improving health communication. The result is a survey instrument aimed at identifying challenges with health communication technologies from the end-user perspective.

8. EESL Combustion Chamber Physical Modeling Group
   Jackie Chan, Justin Colon
   Prof. Masato Nakamura

   As a part of the Physical Modeling Group, we are constructing part of a combustion chamber. A combustion chamber converts organic matter into energy. We responsible for constructing amount for the motor which will move a metal bar horizontally. The mount was cut out of metal brackets. Tracers will be thrown in with the garbage. They are made of foam and have different sizes, densities, and shapes. Their job will be to track the mixture of organic material. Overall, in the end, we will create a MATLAB simulation chart which will show the mixture of organic material.

9. The Link Between Oral and Systemic Health: The Nursing Connection
   Maricel Charles, Judith Diyarza, Akilah Pascall
   Prof. Aida Egues

   Evidence-based practice speaks to a critical link between oral and systemic health, but this topic is scant in its investigation across life spans, and more so in the nursing literature. To research peer-reviewed multidisciplinary articles addressing the state-of-the science regarding the link between oral and systemic health in patient populations.

10. A Feasibility Study of an Energy Recovery System
    Liza Chiu, Rose-Claire E. Pyram, Runtao You
    Prof. Masato Nakamura

    As the technology for personal electronic devices develops rapidly, the demand for a reliable energy source to power those devices is increasing. Rather than focus on extending the battery life, which would be limited by the physical attributes of the energy storage device, the Energy & Environmental Simulation Lab Feasibility Study Group (EESL FSG) focused on developing an alternative sustainable solution that will convert the kinetic energy from regular physical activity, including walking and exercising.
    The proposed system design will launch a magnetized projectile through a solenoid-type device with springs at either end. By Farraday's Law, a current will be induced through a change in magnetic field, and will continue to create energy with the oscillating motion produced by the springs at either end. By altering the different factors in Farraday's Law, we can determine the cost effectiveness of such a design by changing the wire gauge (and thus the number of coils) and the size and strength of the magnet.
    The success in both the feasibility and cost-effectiveness of this experiment will provide practical applications to a self-generating alternative energy source, and be a reminder to consumers that a self-sufficient life is preferable to an expendable one.

11. Modeling the Interaction of Multi-Target Compounds with the BACE 1 Enzyme: Implications in the Treatment of Alzheimer's Disease
    Coreen Cooper
    Prof. Mai Zahran & Prof. Alberto Martinez

    Dementia a neurogenerative disease that affects over 48 million people worldwide. Alzheimer's disease (AD) the most common form of dementia is the cause of over 60% of cases and is the 6th leading cause of death. Neither a cure or adequate treatment have been discovered. One contributing component of AD is the presence of Beta Amyloid plaque in the brain. Beta Amyloid plaque is caused by the accumulation of Beta Amyloid peptides that are the by-product of Amyloid Precursor Protein (APP). In AD, the enzyme Beta-site APP Cleaving Protein (BACE1) irregularly snips APP, which creates Beta Amyloid peptides. Targeting the inhibition of BACE1 is practical strategy for synthesizing a drug treatment. Antagonist compounds have been designed

experimentally that have the potential to inhibit the function of BACE1. This experiment will focus on the use of computational tools to simulate the interaction between the compound and BACE1 complex and determine the most favorable conformation. Molecular modeling tools are used to create a three-dimensional image of the compound. Binding sites are predicted by docking compound into BACE1, using SwissDock online molecular docking tool. Molecular Dynamics (MD) is then performed using NAMD to sample the possible conformations of the complex and observe the interaction. MD is a time-consuming process that will be preform in the coming months. Computationally, the research is still in the preparatory stage. After MD is preform longer, the next step with be to evaluate the results and compare to the experimental data.

12. Spectroscopic Studies on the Interaction of Porphyrin, Chlorin, and Isobacteriochlorin with Human Serum Albumin
    Alexandra DePasquale
    Prof. Diana Samaroo

    The interaction of photosensitizer dyes such as porphyrins (PGlu4), chlorins (CGlu4) and isobacteriochlorins (IGlu4) to human serum albumin (HSA) was investigated using ultraviolet-visible (UV-VIS) and fluorescence spectroscopies at pH 7.4 in a tris hydrochloride buffer. Analytic methods such as Stern-Volmer plots and double logarithmic plots were used to identify static or dynamic quenching, binding sites, and binding constants for the HSA- photosensitizer complex. Preliminary data will be presented, showing strong binding between the photosensitizer and protein during fluorescence titrations. These dyes have potential to be used in photodynamic therapy as anti-cancer agents as well as pre-malignant conditions.

13. Significance of Entrance Door Infiltration to Building Environment
    Sean Eckelmann, Lev Chesnov, Javonne Senior
    Prof. Daeho Kang

    The unwanted infiltration of air through doorways contributes to building energy consumption. Air infiltration through doorways depends upon many factors. They include types of doors, frequency of door use, outdoor climate, and indoor environment. Based on the literature studies of air infiltration through various entrance doors, we gained a better knowledge of energy loss. We measured various factors to quantify infiltration or exfiltration rates through doorways and also monitor the variation of indoor thermal environment due to door infiltration. Throughout the fall semester we conducted measurements such as relative humidity and temperature through the double swinging entrance doors and the entrance lobby of the Environmental Building. Our results will help us to show the importance of air infiltration through the entrance doors of buildings and make recommendations to improve energy savings as well as indoor climate.

14. Neuroprotection and regeneration of neurons and oligodendrocytes in Multiple Sclerosis
    Aspil Estime
    Prof. Andleeb Zameer

    Multiple Sclerosis (MS) is an autoimmune inflammatory illness of the central nervous system. Demyelination is the consequence of losing the protective layer (myelin sheath) that surrounds nerve fibers in the brain and spinal cord. Demyelination is a result of oligodendrocytes, cells that synthesize myelin sheath, loss in MS. Research will be conducted to examine the role of oligodendrocytes in Multiple Sclerosis pathology. Literature survey will be done to examine factors that have been shown to be neuroprotective and regenerative for oligodendrocytes and neurons that are damaged in MS. We will also conduct a survey of the recent therapies for MS.

15. Examining the Effect of Oxidative Stress on Tetrahymena thermophile Sirtuins, THD_190
    Edrouine Gabriel
    Prof. Ralph Alcendor

    Tetrahymena thermophila, a ciliated protozoan, has been a reliable research model for many years. Studies on *T. thermophile* have made significant contributions to biology such as the discovery of ribozymes and telomere function. *T. thermophile* are ideal research models because of the minimum facility required for growth, maintenance and manipulations. Additionally, the complete T. thermophile genome has been sequenced, making it an appropriate model for bioinformatics studies. Overall, the volume of research conducted with these organisms is extensive. However, in the area of stress resistance and aging, *T. thermophila's* biology has not been exploited. These cells have proficient anti-stress mechanisms. They can survive in sublethal temperature, in extremely low oxygen environment, and starved or poor nutrient conditions. If the condition is conducive, T. thermophile can divide indefinitely without showing classic signs of aging such as senescence. The aim of this project is to investigate the role of sirtuins in *T. thermophile* ability to survive high oxidative stress (OS) conditions induced by copper. Cells were exposed to varying amount of copper and incubated for 24 h–48 h. Cell death analysis showed increase cell death with increasing amount of copper. Only 40% of cells survived after 24 hours in the presence of 1.0mM of copper. mRNA expression of sirtuins decreased in the presence of 0.1–0.5mM of copper but increased in the presence of 0.8–1.0mM of copper. Similar pattern was seen in the mRNA expression levels of antioxidantgenes. These results suggest that sirtuins may be involved in OS induced by high rather than low amount of copper.

16. Development of a Peer-Led Protein Structure Activity for Undergraduate Biochemistry
    Johnny Guevar, Josue Kersaint
    Prof. Mai Zahran & Prof. Nathan Astrof

    Undergraduate biochemistry lab courses often do not provide students with enough exposure to protein structure visualization to allow them to understand the implication of 3D protein

structure on their function. The goal of this study is to develop a computer lab activity wherein students examine, via computation, the function of a
protein of known 3D structure. This activity challenges students to find key properties in protein structure studied over the semester. We further designed and mutated a known protein structure to incorporate errors that students would have to find during their lab activity. We also created a questionnaire to access the efficacy of this approach on students understanding of protein structure.

17. Endocrine Disrupting Chemicals and its Effect on Reproductive and Mental Health
    Devya Gurung, Khosiyatkhon Sayfulloeva
    Prof. Sanjoy Chakraborty

    An extensive body of literature shows that writing about traumatic or emotional experiences results in improved physical health and emotional well-being. In Pennebaker's (1997) expressive writing paradigm, participants are instructed to write about either traumatic emotional events or neutral topics over several sessions. Those assigned to the expressive writing condition typically display physical and psychological health improvements over time compared to the control condition. This study extends pilot work we did in our lab which found that when participants engaged in cognitive restructuring (subjects were asked to reframe an emotional experience in positive terms i.e., meaning-making), vagal tone and heart rate improved. A second major difference in our study versus previous published work is that our study assessed the effects of expressive writing on autonomic nervous system responses (e.g., vagal tone, cardiac impedance) over time. Fifty subjects (25 male), ranging in age from 18 to 44 years (M=24.64; SD=6.18 yrs.), participated. Each was randomly assigned to the standard expressive (n=24) or the meaning-making (n=26) condition. Subjects wrote for at least two sessions and most wrote for three while physiological measures were recorded. Heart rate ($F(1,45) = 8.16$, $p = .006$) and to a lesser degree, vagal tone ($F(1,45) = 3.43$, $p = .071$), improved over time in both conditions but vagal tone ($F(1, 45) = 2.874$, $p = .097$) and respiration changes ($F(1, 45) = 6.229$, $p = .016$) were moderated by gender. It appears that women may benefit more from a meaning-making expressive writing paradigm compared to the standard whereas the opposite may be true for men and they may benefit more from a standard expressive writing format.

18. Blending Wine Education and General Education: Preparing Tomorrow's Wine Professionals for Continual Growth
    Malika Ikramova
    Prof. Karen Goodlad

    An in depth wine education is important for all hospitality students. This course of study helps students better understand the wine industry but also helps build critical thinking and communication skills. The study of wine and beverage can be challenging; especially due to the lack of prior knowledge some college students have with the subject. The study of wine and beverage demands conscientious attention to detail, academic diligence and a passion for

exploring ones' senses. This research will help students be more aware of the value of their wine and beverage.

19. Mamakating Master Plan and Visitor Center Vision Study
    Christine Nicole Jayco
    Prof. Paul King

    The Town of Mamakating located in Wurstboro, NY was once a thriving city due to the use of the D&H Canal and later the Railroad. From the context from the history and analyzation of the land and its historical maps, we are proposing new routes and mapping context by directing vehicular traffic, and routes and paths used for bikes, hiking trails, and walking. We are also proposing positions for signage on highways and roadways, and locations trailheads to help direct visitors and locals as well. Through observations and iterations of diagrams, we propose our maps to help the town and people become aware of their rich history and context of land.

20. Health Promotion and Self-care: Impact of Micro Aggressions, Intersectional Identities, and Self-compassion
    Ricardi Jean Gilles, Jamel Phillips, Stefanie Rimpel, Yulduz Saidinova
    Prof. Amanda Almond

    This research project focuses on constructing an inventory to measure self-care of men/women that are graduate students or ECPs (Early Career Professionals) combined with Promoting Well-Being and Empowerment for (Women) Professional Psychologists. My colleagues and I will distinguish the impact of micro aggression, intersectional identities, and self -compassion and correlate them with their lifestyle habits, social desirability, Physical and Mental health, Professional Organization Involvement, and flourishing.

21. NYC Max: Mapping the Maximum Allowable Density
    Xiaojing Jiang, Xiaoneng Tang
    Prof. Ting Chin

    This research is developing to a further project that will use New York City's existing building regulations to map the maximum allowable existing building envelope of Manhattan. Based on the existing building envelope we build and the zoning information, we can get how many area of different use of each building. Getting the zoning information for the buildings in the city can provide us with a metric, which determining how many people can live and work on the island. This data answers to the question of how many people can be fit on the infrastructure of Manhattan. Since this project is still developing, this semester was focused on writing a computer script that will use the data in the existing building regulations to automate the development of a 3-dimensional digital massing model that will ultimately reflect the maximum existing building envelope of Manhattan.

22. Big Data in Cloud Robotics Using Neuromorphic Computing
    Alisa Kalegina
    Prof. Ashwin Satyanarayana

    Understanding the brain is perhaps the greatest challenge facing twenty-first century science. Currently, there exists a tangible gap between the intelligence of computer systems and that of human beings. While a traditional von Neumann computer excels in precision and unbiased logic, its pattern recognition abilities lag far behind those of biological neural systems. However, exciting new technologies have emerged that possess high potential to bridge this gap. Furthermore, the fields of neuromorphic and brain-based robotics hold enormous promise for furthering our own understanding of the brain. Cloud robotics is a new paradigm in which robots take advantage of the Internet as a resource for massively parallel computation and real-time sharing of big data. A neuromorphic cloud infrastructure and its extensive set of internet-accessible resources has potential to provide significant benefits in myriad areas. In our research we survey several current approaches to these technologies and propose a potential architecture for neuromorphic cloud robotics.

23. Molecular characterization of Telopathes cf. magna from deep waters around New Zealand, Antarctica (Ross & Somov Seas), & Hawai'i
    Sheila Moaleman
    Prof. Mercer R. Brugler

    Black corals are a predominantly deep-water group of anthozoans (living as deep as 8,600m) and thus have historically been understudied. Currently, 7 families, 42 genera, and 247 species have been described. The most recent genus to be described within the Order Antipatharia is Telopathes MacIsaac & Best, 2013, and is currently only known from the western North Atlantic (1,073-1,983 m depth). The original description of Telopathes magna was unique in that it provided molecular data and in-situ images from individuals representing multiple life stages, from juvenile (which resembles an adult colony of the genus Bathypathes) to adult (which resembles a large, densely branched Bathypathes). Recently, an expedition to the continental margin off the northeastern United States captured in-situ images of large colonies resembling T. magna (from Block Canyon to Nygren Canyon). In June 2015, while leading a deep-sea black coral identification workshop at NIWA (Greta Point, Wellington), we examined the NIWA Invertebrate Collection for specimens resembling T. magna and found thirteen colonies collected from deep waters (250-1,520m) surrounding New Zealand and Antarctica (Ross Sea & Somov Sea). More recently, we received a subsample of Telopathes cf. magna that was collected by the NOAA ship Okeanos Explorer (2015 Hohonu Moana Expedition) while exploring deep waters off the Hawaiian Islands (specimen collected south of O'ahu at 359m depth). We have amplified three mitochondrial intergenic regions (igrN, igrW, igrC) and two nuclear genes (ITS2 and SRP54) for all specimens. A full morphological examination of all colonies is also in progress.

24. Cultural Competence Amongst Undergraduate Healthcare Students
    Linalee Moreira, Fauziya Sani
    Prof. Zoya Vinokur & Prof. Elaine Leinung

    The United States is a country of many culturally diverse populations. By 2050, minority populations will increase to 48 percent of the U.S. population and Hispanics will represent 24.4 percent of the total population (U.S. Census, 2010). Due to this demographic shift, cultural competence which is defined as the ability of providers and organizations to effectively deliver health care that meet the social, cultural, and linguistic needs of patients is crucial in the curriculum of undergraduate healthcare students. This study looks to analyze cultural competence amongst undergraduate healthcare students by utilizing surveys and questionnaires of over 200 undergraduate healthcare students in The Radiologic Technology Program, Nursing Program and Dental Hygiene Program at New York City College of Technology. The study will explore undergraduate healthcare students perceptions of different subcultures such as LBGT and the results gathered through the study will aid in providing meaningful knowledge that impacts facilitating a meaningful cultural competency education that fosters cultural awareness and quality healthcare.

25. Examining the Role of Calpain in Oxidative Stress
    Ribert Morette
    Prof. Ralph Alcendor

    The official symbol for captain 1 is CAPN1, according to Hugo Gene Nomenclature Committee (HGNC). Calpains are a family of calcium–activatednon-lysosomal, intracellular, cysteine proteases which are expressed ubiquitously in cells of many organisms. These enzymes are heterodimers with distinct large subunits that associate with a very small regulatory subunit. Organisms may have several calpains as part of their calpain superfamily. In humans, for example, there about 15 genes encoding for calpains. These calpains are classified as classical, example CAPN1 and CAPN2, or non-classical calpains. Classical calpains contain a C2L and PEF domains, while non-classical calpains exclude C2L and/or PEF domains. Calpains function in a wide variety of cellular processes including preservation of brain function, regulation of the tumor suppressor gene p53, and cell death. One area needing more attention is the role of calpain in oxidative stress.

26. Fabrication of Multi-layer & Multi-material Scaffolds
    Kayla Natal
    Prof. Ozlem Yasar

    In Tissue Engineering, successful tissue regeneration strongly depends on the scaffold fabrication. Scaffolds must be designed and fabricated accurately to help cells to grow in 3D to heal the damaged part of an organ. In today's technology, one of the biggest challenges in scaffold fabrication is to use the multi-materials accurately to generate the thick scaffolds. In

this research photolithography was developed to fabricate the multi-layer and multi-material thick scaffolds. Our preliminary results show that accurately designed and fabricated scaffolds enable the cells to grow in 3D to do scaffold implantation.

27. Exploring the Pollard's Algorithm
    Josiel Nunez, Farjana Shati
    Prof. Ariane Masuda

    The Pollard's algorithm is a method for factoring integers, originally proposed in 1975. It is considered the most efficient method against the (EC)DLP – elliptic curve discrete logarithm problem. The algorithm was applied successfully to factor the ninth Fermat number, F_8 = 22^9 + 1. This research explores the functional graph of the main function underlying the algorithm. We studied the iteration of the function over a finite field and analyze the period, pre-period, rho length, and the number of connected components. We have shown several patterns that we have found in our investigation.

28. Three-Dimensional Scaffold Fabrication with Inverse Photolithography
    Ramesh Prashad
    Prof. Ozlem Yasar

    In recent years, Tissue Engineering is utilized as an alternative approach for the organ transplantation. Success rate of tissue regeneration influenced by the biomaterials, cell sources, growth factors and scaffold fabrication. Design and precise fabrication of scaffolds are required to support cells to expand and migrate to 3D environment. Common scaffold fabrication techniques use heat, adhesives, molds or light. In this research, "inverse-photolithography" which is a light-based fabrication technique was used to generate the scaffolds. In order to control the interior architecture of the scaffold "a single vertical strut" and "a y-shape" were fabricated with the 3D printer by using the dissolvable filament. Then, the strut and the y-shape were immersed into the photo-curable solution which is poly (ethylene glycol) diacrylate (PEGDA) and photo-initiator mixture. UV light with the 365nm wavelength was placed up-side down under the solution. Photo-curable mixture was exposed to the UV light for 3 minutes to cure the entire scaffold. Solidified scaffold with the strut and y-shape inside was kept in the limonene solution. Limonene penetrated through the open-ended strut and y-shape and it dissolved the 3D printed strut and y-shape away leaving the fabricated PEGDA based scaffolds. This preliminary research showcases, the 3D scaffolds with the controlled interior design, can be fabricated with the "inverse-photolithography" technique.

29. Crash-Free Aerial Vehicle for Assistive Navigation System
    Tenzing Rabgyal
    Prof. Xiaohai Li

    According to World Health Organization, 285 million people are estimated to be visually impaired worldwide. Of these 285 million people, 39 million are blind and 246 million have low vision. Their handicap places severe limitations on many aspects of their life, the most important being personal mobility. With this project, we aim to develop an Assistive Navigation System (ANS) based on the proposed crash-free aerial platform, which will be used to aid visually disable or challenged people to navigate in an indoor environment. In the literature, a few ANSs have been developed to assist blind and handicapped people in indoor or outdoor environments, but aerial ANS has never been proposed. Compared to existing ANSs, an aerial ANS will be easier to deploy, offer wider vision view and have better response capability in emergence. To achieve this target, a unique crash-free spherical design has been proposed for the aerial vehicle by Dr. Li.

    Thus far, we have successfully managed to design and make the customized spherical frame by using 3D Design/3D Printing and advanced dynamics analysis techniques. We have also tested the aerial vehicle to confirm that the propellers are powerful enough to lift the vehicle. The next phase of this student research project is to finalize the circuitry design for the main and steering rotors specially selected for our vehicle, and complete the programming code for a stable PID flight controller. We will also reposition the tail propellers so that the vehicle can execute three axis of movements (pitch, roll, yaw). Then we will integrate sensing components (cameras, lasers, etc.) to the aerial vehicle, getting us closer to our final goal of developing an aerial assistive navigation system.

30. The Start of Becoming an Award Winning Filmmaker
    Leroy Strother
    Prof. John McCullough

    During the beginning of 2016 as we approached the 88th annual Academy Awards I normally have an open forum on Facebook in regards to the categories, the nominees and the perspective winners. This year, because will Smith was not nominated for best actor in the film "Concussion", his Jada Pinkett Smith decided to take a personal petition on the Oscar Award ceremony claiming bias. This changed the outcome of my forum because my patrons decided that she was right, without knowing the total workflow of producing a film. In my writing I incorporate several techniques that if practiced, can help you win awards at film festivals and help you understand how the Oscars nominees are picked and the winners decided. Unfortunately, I wont be able to cover all areas of film work, but I am hoping you can get some understandings from these topics.
    • We will review historical artist and understand their technique
    • You will understand how these early pieces are bonded to great films

- Compare great artworks to great scenes in film
- Discuss the relevance of lighting
- Display artistically motif

31. Multi Material 3D Scaffold Printing with Maskless Photolithography
    Joyce Tam
    Prof. Ozlem Yasar

    In today's technology, organ transplantation is found very challenging as it is not easy to find the right donor organ in a short period of time. In the last several decades, Tissue Engineering was rapidly developed to be used as an alternative approach to the organ transplantation. Tissue Engineering aims to regenerate the tissues and also organs to help patients who waits for the organ transplantation. Recent research showed that in order to regenerate the tissues, cells must be seeded onto the 3D artificial laboratory fabricated matrices called scaffolds. If cells show health growth within the scaffolds, they can be implanted to the injured tissue to do the regeneration. One of the biggest limitation that reduces the success rate of tissue regeneration is the fabrication of accurate thick 3D scaffolds. In this research "maskless photolithography" was used to fabricate the scaffolds. Experiment setup consist of digital micro-mirror devices (DMD), optical lens sets, UV light sources and PEGDA which is a liquid form photo-curable solution. In this method, scaffolds are fabricated in layer-by-layer fashion to control the interior architecture of the scaffolds. Working principles of the maskless photolithography is, first layer shape is designed with AutoCAD and the designed image is uploaded to the DMD as a bitmap file. DMD consists of hundreds of tiny micro-mirrors. When the UV light is turned on and hit to the DMD, depending on the micro-mirrors' angles, UV light is selectively reflected to the low percentage Polyethylene (glycol) Diacrylate (PEGDA) photo-curable solution. When UV light penetrates into the PEGDA, only the illuminated part is solidified and non-illuminated area still remains in the liquid phase. In this research, scaffolds were fabricated in three layers. First layer and the last layer are solid layers and y-shape open structure was sandwiched between these layers. After the first layer is fabricated with DMD, a "y-shape" structure was fabricated with the 3D printer by using the dissolvable filament. Then, it was placed onto the first solid layer and covered with fresh high percentage PEGDA solution. UV light was reflected to the PEGDA solution and solidified to make the second and third layers. After the scaffold was fabricated, it is dipped into the limonene solution to dissolve the y-shape away. Our results show that thick scaffolds can be fabricated in layer-by-layer fashion with "maskless photolithography". Since the UV light is stable and does not move onto the PEGDA, entire scaffold can be fabricated in one single UV shot which makes the process faster than the current fabrication techniques.

32. Structural Health Monitoring of Bridges
    Danielle Telemaque
    Prof. Navid Allahverdi

    Existing steel and concrete bridges in the US are in critical need of repair and upgrade; Active monitoring of structural health of bridges enables engineer to identify and prevent potential bridge collapses. In this research project, focus was spent on identifying and comparing methods to monitor existing structural health condition of bridges. Through thorough research and lab testing, fabricated steel segments were tested for the strengths and limits of strength for steel. Such beams were connected via a hook and clasp method (spring connection), with a weld steel plate at the bottom to join the two for a sturdy connection. Testing of the steel beams were conducted in order to detect the moment curvature and load deflection of the bridge. The objective was to obtain a moment curvature that was rigid in strength, expressing that the beams spring constant was high, which reflects ultimate strength. The results showed a moment curvature higher than what was expected, showing that the design of the connection was somewhat ideal. Results in deflection and moment curvature are able to showcase how strong a structure is, and present opportunity to determine what can be done to make them stronger if they fall below the strengths necessary for safety. Different instrumentation methods to measure strain, deflections, accelerations, and crack growth as parameters for assessing the state of the health of bridges, were also reviewed. Further studies will include creating a mobile app that allows for the results of a wireless sensor on a bridge to determine the deflection and moment curvature of bridge structures.

33. Discrete Structures: Algorithms, Complexity, and Graph Theory
    Byron Ullauri
    Prof. Satyanand Singh

    Complexity analysis is used to measure an algorithm's efficiency relative to the growing values of it's input size (n). However, due to the wide variety of computers, methods used to determine complexity must approach their evaluations using procedures that can be applied across all cases. The objective of this research is to study these methods, covering topics such as time complexity and Big-O notation. This study will involve Kenneth H. Rosen's work in *Exploring Discrete Mathematics Using Maple* alongside Maple 2016 to analyze the complexity of various sorting algorithms through their implementations. In addition to this, we will establish the Big-O relationship of two functions using their graphs and *evalf* ( ). The data obtained will convey methods for comparing algorithms and fundamental concepts in Asymptotic Notation.

34. Effect of Oxidative Stress on THD10, a Sirtuin Found in *Tetrahymena thermophlia*

Masood Usman
Prof. Ralph Alcendor

Sirtuins are a family of proteins that exist in almost all life forms. They are involved in important processes and functions such as lifespan expansion, protection from cell death and regulation of important cellular processes. Although sirtuins have been studied extensively, little is known on their role in oxidative stress in *Tetrahymena thermophila*. *Tetrahymena thermophila*, a ciliate protozoan, has been used as a model for studying the effects of a wide range of factors and stresses. These cells are very easy to work with and they are great models for eukaryotic cells, especially human cells. One of the most popular uses of Tetrahymena is to examine the toxicity of drugs and heavy metals. Oxidative stress is the imbalance between toxic form of oxygen or reactive oxygen species, and antioxidants. High levels of oxidative stress results in cell death, and damage to proteins and nucleic acids. Oxidative stress has also been shown to be involved in diseases such as cancer and Alzheimer's disease. Although oxidative stress has been studied extensively, very little is known on *Tetrahymena thermophila's* response to oxidative stress. Therefore, the goal of this project was to examine the effect of oxidative stress on THD10, one of the several sirtuins found in *T. thermophila*. We hypothesized that THD10 mRNA expression will be affected by different ROS stressors. Cells were incubated under various conditions for 24 – 48 h. Following incubation, mRNA expression was analyzed. THD10 mRNA expression was consistently high under high glucose, but decreased under 1mM of hydrogen, ethanol, and copper. Twenty four hours of starvation lead to an increase in THD10 expression, an effect that was reversed under 48 hours. These results suggest that THD10 may be involved in ROS regulation.