



# **Book of Abstracts**

**The CUNY Research Scholars Program**

**Fall 2017**

*Supported by The City University of New York*

<b>Student Researchers</b>	<b>Faculty Mentors</b>	<b>Department</b>	<b>Project Title</b>	<b>Page</b>
Eudelia Alderete	Prof. Marcos Pinto	Computer Systems Technology	A Patient-Centric Electronic Medical Records (EMR) System	4
Guichang Chen	Prof. Janet Liou-Mark	Applied Math	Exploring the Gender Effects of a Mathematics Preparatory Workshop on Student Learning	4
Lev Chesnov Demba Diop	Prof. Daeho Kang	Civil Engineering	Measurement of Airflows Through Entrance Doors	5
Courtney Choy	Prof. Marcos Pinto	Computer Systems	A Mobile Chatbot for Learning	5
Lynese Edwards	Prof. Marcos Pinto	Civil Engineering	Internet of Things (IoT): Into the Jetsons Era	5
Astrid Frank	Prof. Xin-Zhou Wei	Mechanical Engineer Technology	Public Data Visualization Scheme for Smart City	6
Harpreet Gaur	Prof. Viviana Acquaviva	Computer Information Systems	Computerized Homework Education SyStem (C.H.E.S.S)	6
Jannat Hoque	Prof. Ohbong Kwon	Computer Engineering Technology	Hardware Implementation of an Assistive Technology Mobile Robot	7
Kwokching Hui	Prof. Urmi Gosh-Dastidar	Applied Math	Gender Differences, Socio-Economic Status and Cardiovascular Disease	7
Afolabi Ibotoye Elena Zimareca	Prof. Alexander Aptekar	Computer Systems Technology	Solar and Rain Catching Canopies	7
Faith Kakshak	Prof. Anne Leonhardt	Architectural Technology	Algorithms and Architecture: The Impact of Emerging Digital Media on Design	8
Raidan Kaseem	Prof. Ozlem Yasar	Mechanical Engineering Technology	Drug Delivery Tests for the PDMS Based Scaffolds	9
Zhengdao Li	Prof. Anty Lam	Applied Chemistry	The Correlation Between Periodontal Disease and Kidney Disease	9
Joycephine Li Jannatul Mahdi	Prof. Farrukh Zia	Computer Engineering Technology	Implementation of an Assistive Technology Mobile Robot	9

<b>Student Researchers</b>	<b>Faculty Mentors</b>	<b>Department</b>	<b>Project Title</b>	<b>Page</b>
Richard Lin	Prof. Muhammad Ali Umy	Electrical Engineering Technology	Continuous Tunable Terahertz Wave Generation Via a Novel CW Optical Beat Laser Source	10
Wen Jie Long Farid Rodriguez	Prof. Muhammad Ali Umy	Electrical Engineering Technologies	Developing Lab Exercises Using a Super Mechatronics Trainer	10
Waseem Mohammed	Prof. Marcos Pinto	Computer Systems Technology	A Mobile Chatbot for Learning	10
Tin Oo	Prof. Akm Rahman	Mechanical Engineering Technology	Structural Composites for High-Temperature Applications	11
Brian Parra	Prof. Ozlem Yasar	Mechanical Engineering Technology	Scaffold Fabrication for Cell Viability Analysis	12
Quadel Phillips	Prof. Ozlem Yasar	Mechanical Engineering Technology	Design and Fabrication of UV Light Holder for Photolithography	12
Shaun Pollard	Prof. Douglas Moody	Civil Engineering	Assessment of Learning Strategies for Computer Programming Pedagogy	12
Brittney Roberts	Prof. Angran Xiao	Mechanical Engineering Technology	Design and Manufacturing a Robot Arm with 4 Degrees of Freedom	13
Scipio Sargeant	Prof. Marcos Pinto	Computer Engineering Technology	Web Application: Choosing a Major	13
Navjot Singh	Prof. Ozlem Yasar	Mechanical Engineering Technology	Design and Fabrication of PDMS Samples and UV Light Holder	13
Jean-Hus Theodore	Prof. Aida Egues	Biomedical Informatics	Water Race and Class	14
Cheryl Thomas	Prof. Masato Nakamura	Paralegal Studies	Environmental Policy and Poor Families: Melting Snow, Rising Sea Levels, Gentrification	14
Brian Yellis	Prof. Masato Nakamura	Mechanical Engineering Technology	Forward Acting Grate: Data Analysis for Municipal Solid Waste Mixing	14
Yuping Zhang	Prof. Navid Allahverdi	Civil Engineering	Fiber Reinforced Concrete Bowling Ball – Design & Fabrication	15

1. A Patient-Centric Electronic Medical Records (EMR) System

Eudelia Alderete  
Prof. Marcos Pinto

This research looks at Patient Centric EMR system's that would allow the Patient to have control and access to their Medical records via mobile devices. Statistically according to the CDC 86.9% of office based physician offices use EMR, however, only 53.9% have basic systems to support this upward trend. The shift in technologies to get this information in the patient's hands is on the forefront of research at schools, government agencies and companies, such as Harvard, the CDC, Healthit, Amazon, Google, and Microsoft. There is consumer-centric approaches to EMR data with resources available. This is lacking in the industry with competitive environments hospitals don't want to share data. The focus to use their analytics to increase the profit margin is collectively creating communication blocks from one cluster of information to the other, however, with creative solutions we will bridge the gap. The current strides to increase mobility in Patient Centric EMR lacks diversity in communications. Not one system is created in a different language. They are open sourced in order to collaborate a fix to a healthier future for everyone inclusively creating access for all communities.

2. Exploring the Gender Effects of a Mathematics Preparatory Workshop on Student Learning

Guichang Chen  
Prof. Janet Liou-Mark

Undergraduates interested in majoring in a Science, Technology, Engineering, and Mathematics (STEM) discipline are sometimes challenged by the mathematics requirements. To assist in supporting these students, New York City College of Technology has been offering three-day mathematics preparatory workshops during the winter and summer intersessions. Students are enrolled in a free workshop that allows them to pre-learn selected topics prior to taking the required mathematics course. These preparatory workshops are offered in the following classes: Intermediate Algebra/Trigonometry (MAT 1275), Precalculus (MAT 1375), Calculus I (MAT 1475), and Calculus II (MAT 1575). The primary focus of this study was to examine if there are gender differences in final mathematics grades and their responses to a satisfaction survey. Results showed that males who enrolled in the Calculus I preparatory workshop showed statistically significant higher mean grade differences than females, but not in the other mathematics courses. For the Intermediate Algebra/Trigonometry, Precalculus, and Calculus II workshops, females found the course materials and workbook statistically significantly more helpful than the males. Moreover, for females taking the Precalculus workshop, they would recommend the workshop to other friends more so than their males counterparts. For the Calculus II workshop, the mean response for females is statistically significantly higher than the males for the statement "learning mathematics make me nervous."

3. Measurement of Airflows Through Entrance Doors  
Lev Chesnov, Demba Diop, Jelani Barro, Haoxiang Cui  
Prof. Daeho Kang

There have been many studies on the impact of infiltration through the building envelope, not many studies have focused on the air flow through the entrance doors of buildings. This research will show the quantification of air flow rates and the implication of the effects on energy flows. This research is an ongoing process throughout the course of a year, of which measurements of the: temperature, relative humidity, CO2 levels, the frequency of door openings, and differential pressure and air velocity over the doors are recorded. The data is primarily focused on the indoor thermal environment, within 10-20 ft. of the entrances. The research is to present the results of the measurements taken. Research findings so far have proven that the indoor thermal environment in the lobby areas through the entrance doors, significantly varies during cold and windy outdoor weather. With future studies, the results of this research will enable us to identify the implication of the impact of the energy flow through entrance doors.

4. Using AI in Developing Web Sites and Applications  
Courtney Choy  
Prof. Marcos Pinto

Mimicking the way we think and react to real-world situations are the objectives of the field of Artificial Intelligence (AI). The theory behind AI is machine-learning by repetition or induction. Intelligent Web sites/applications which make use of AI would be on the lookout to serve us on the spur of the moment, however, we should have the first word of allowing such service or not. This research proposes a Web application that uses AI in order to assist the computer systems technology department in assigning course sections depending on the apparent preference of incoming students (freshman level) demonstrated through a survey that may be included during the class registration process.

5. Internet of Things (IoT): Into the Jetsons Era  
Lynese Edwards  
Prof. Marcos Pinto

Inform the reader of what the Internet of Things is in the computer world. Have them to understand the significance it has to technology. They will know how it became to exist and how

it has grown. It will inform them on the unlimited amount of things it is used for each day that one might take for granted.

6. Public Data Visualization Scheme for Smart City

Astrid Frank

Prof. Xin-Zhou Wei

A Wireless Sensor Network is commonly used to improve the quality of life, such as public transportation, products, and even consumptions. The data that this device collects and the different sensors it uses can be used to monitor the energy occupied in an office space, store, subways, and factors. Unfortunately, the wireless network, which needs internet, cannot always be connected to the internet. This can be very costly and ineffective, when trying to acquire data from inhabited or remote areas, like a mountains. However, with the use of ZigBee, a low cost data transmission device, data is able to travel to any environment and monitor the devices in real time, despite the wireless connection. ZigBee uses both open source hardware and software to collect and transmit the data wirelessly to network gateway or web-based cloud servers. This concept has already been successfully researched in a small scale, but as a group we plan to expand the research by adding more wireless connections and adding GPS location in hopes of displaying them both.

7. Computerized Homework Education SyStem (C.H.E.S.S)

Harpreet Gaur

Prof. Viviana Acquaviva

Debt-ridden college students often find it prohibitive to afford software for online homework that can cost up to \$150 per class. We at C.H.E.S.S. (Computerized Homework Exercise SyStem) have created an economical, secure and user-friendly online homework system. Through C.H.E.S.S., students login and take personalized homework assignments for their classes. If they answer incorrectly, the system displays a hint to assist them and affords them one extra attempt. Students can access assignments' descriptions, open submission dates, grading policy, and current grade through a "hub" page. C.H.E.S.S. also provides an intuitive management system for instructors, who can easily create and customize the assignments. We are currently working on creating a larger set of questions and hints in the database, on testing performance and stability, and on making the application go live. We have presented C.H.E.S.S. at the CUNY-wide IT conference, and requested feedback from faculty in different disciplines to determine which features would make C.H.E.S.S. more likely to be widely adopted. Our long-term plan for C.H.E.S.S. is to have a system that is flexible and secure and can be tailored to the needs of college and high-school instructors.

8. Navigation System for a Mobil Robot

Jannat Hoque

Prof. Ohbong Kwon

In this research I will be upgrading the two different sensors in the 1990 robot Heath kit Education Robot (HERO). The two most common techniques for mobile robot obstacle detection and navigation are based on ultrasonic sensor using sound waves and infrared sensor using light waves. In this research project we compared the pros and cons as well as technical specifications of the two techniques and implement them on a mobile robot to test their effectiveness in real world situations. I used Arduino programming to upgrade the light wave sensors. And to upgrade the sound wave sensor I used raspberry pi programming. Upgrading the sensors of the robot can help the robot to sense if there is something in front of it and react to it, and upgrading the sound sensor can help the robot to react to any sound. This research can be further improved by connecting the robot to a mobile device through Bluetooth.

9. Study and Analysis of Communicable and Non-Communicable Diseases

Kwokching Hui

Prof. Urmi Gosh-Dastidar

With the increase of cardiovascular risk factors in India, the prevalence of coronary heart disease (CHD) is expected to rise. From 2001-2003, approximately 17% of the overall deaths and 26% of adult deaths in India were caused by CHD. A decade later, the percentages have risen to 23% of the total deaths and 32% of adult deaths (Gupta, Mohan, and Narula 2016 <https://www.ncbi.nlm.nih.gov/pubmed/27372534>). In this project, we studied relationships between cardiovascular disease, socio-economic status, and cardiovascular disease in United States based on available data. Chi-squared contingency tables are used for comparisons. This is a preparation work for a follow up project that will be carried out at Baruipur, a semi-rural area, located about twenty miles away from Kolkata, West Bengal, India during January 2018.

10. Solar and Rain Canopies for a Greener planet

Afolabi Ibitoye , Elena Zimareca, Langston Clark, Evan Banks

Prof. Alexander Aptekar

Our research project is focused on developing a prototype model that collects rainwater for plants watering in NYC “Pocket Parks” and uses solar panels to charge park visitors phones by harnessing nature's resources with today's technology in an effort to beautify, educate, and promote good health and growth of communities and local businesses. During rainstorms in NYC, the grey water overfills sewage systems of NYC pushing Treatment Plants to release water

untreated. NYC Department of Environmental Protection encourages people to plant small gardens and instead of asphalt or concrete to absorb rainfall and collect rainwater rather than letting it go to the combined sewer system. For this project, we are collaborating with NYC "Pocket Parks" that are installed throughout Manhattan during spring, summer and fall seasons. A focus of the research is to create a design for the canopy that fits in a park's layout and can collect the power solar rainwater and distribute it to the separate storage clay pots that are located in earth on different levels of the "Pocket Parks". We research the best balance between the demands of water collation and solar energy. The team determined the best angle and size for solar panels to produce enough of power to satisfy the demand of phone charging; calculated the average volume of rainwater to be collected by the canopy from spring through the fall. We created a 3D model of the canopy. Our goal is to use environmentally friendly materials that is why we will mostly use natural materials such as wood and cotton canvas. Since the objective is to create a design that is both affordable and easily duplicable, the features that we considered were: collapsibility, energy output, water catching method, and flexible solar systems. The next part of the project is the creation of a prototype that will be installed in one of the "Pocket Parks." Another big part of the research will be monitoring how well it performs over time and possibly modifying the canopy. The development includes, the 3D physical model of the solar and rain catching canopy as it integrates into the design of the "Pocket Parks." A prototype designs were developed and one was selected for prototyping. At this stage of the project, we are in the early stage of assembling the prototype model that we called "Urban Oasis".

## 11. Algorithms and Architecture: The Impact of Emerging Digital Media on Design

Faith Kakshak

Prof. Anne Leonhardt

From an architectural design perspective, after a design concept is arrived at, a designer needs to analyze potential weaknesses in supporting load capacities and material usage.

This project explores the foundations of the topology behind computer aided generation of gyroids, and other complex forms, utilizing the tools of Wolfram Mathematica and Robert McNeel's Grasshopper and Kangaroo. Models were generated from parametrized mathematical inputs and analyzed for form-optimization and then 3D printed to visualize their final shape. Some of the simulations were based on the study of the klein bottle and the mobius strip. This process will allow designers and engineers to take advantage of optimization techniques of pure forms to becoming something more tangible and efficient when designing a physical object such as a pavilion or a structure

## 12. Drug Delivery Tests for the PDMS Based Scaffolds

Raidan Kassem

Prof. Ozlem Yasar

Drug delivery plays an important role in cell growth within the engineered scaffolds to do tissue regeneration. In this project, PDMS based scaffolds will be designed and fabricated by micro-printing at SET Research Laboratory at the Department of Mechanical Engineering Technology. Then, the engineered scaffolds with different internal architecture designs will be sandwiched between two glass slides to do drug delivery tests

## 13. Fluoride in Dental Products: Over the Counter Versus Prescription

Zhengdao Li

Prof. Anty Lam

Fluoride has been one of the common ingredients used in dental products due to its recognized effect as beneficial in prevention of tooth decay as well as detrimental on the other hand as excess fluoride can lead to dental fluorosis in young age population. Different kinds of fluoride have known to be added in commercial toothpaste such as stannous fluoride, sodium fluoride and sodium monofluorophosphate (MFP). Analyzation of fluoride in toothpaste by applying different sample preparation protocols based on the fluoride source, in this case commercial over-the-counter (OCT) toothpaste. Proposed experiment employing ion chromatography provided direct determination of concentration of fluoride through dilution, centrifuge, filtration and lastly solid phase extraction. Standard samples with varying concentrations were made for construction of calibration curve. Concentration of fluoride is determined as relatively uniform bands in different brands of toothpastes.

## 14. Hardware Implementation of an Assisted Technology Mobile Robot

Joycephine Li, Jannatul Mahdi

Prof. Farrukh Zia

This is a two-part research project in which Heathkit Education Robot (HERO) hardware circuits and features will be upgraded. Modern hardware devices and sensors will be added to implement assistive technologies that will help people with disabilities. A small historical background of old hardware devices will be explained along with the new hardware devices. In the old HERO robot, some of the old hardware devices were light, sound, and motion detectors with a sonar sensor. There was also a Motorola microcontroller that was programmed in Assembly. As for the modern hardware, an ultrasonic sensor was tested with Arduino, a modern hardware device that is used for running code programs in C++, and Raspberry Pi, another modern hardware that runs with an SD card and it is used for voice synthesis and recognition. A script was installed for Raspberry Pi and was tested with distance sensor with no mistakes. This

part of experiment was tested for people who need help with vision by producing speech output.

15. Continuous Tunable Terahertz Wave Generation Via a Novel CW Optical Beat Laser Source

Richard Lin

Prof. Muhammad Ali Ummy

The purpose is to design a fiber compound-ring resonator that will generate two different kinds of wavelengths simultaneously. This laser source has the potential of generating widely tunable CW-THz radiation via photomixing, which will be used for detecting cancerous cells. This unique source uses semiconductor optical amplifier (SOA) as a gain media, two fiber Bragg grating filters (FBGs) and tunable filter for wavelength selectivity and two Sagnac loop mirror for controlling output power.

16. Developing Lab Exercises Using a Super Mechatronics Trainer

Wen Jie Long, Farid Rodriguez

Prof. Muhammad Ali Ummy

This research looks at the operation of the Super Mechatronics Trainer and the implementation of Programmable Language Code in a classroom environment. Mechatronics is often used to improve efficiency and address problems we cannot solve due to physical limitations. Applications include automation, robotics, and industry. The goal is to create a readily-understandable lab manual that applies all of the aspects of the programming language (PLC) for use in a mechatronics course. To achieve this we must learn to operate the system and alter its programming. Then, it is to be applied in LabVIEW, a language that is already taught in the mechatronics class.

17. A Mobile Chatbot for Learning

Waseem Mohammed

Prof. Marcos Pinto

A mobile application that uses artificial intelligence and helps students to learn. The knowledge domain is initially in computer systems programming, more specifically, an introduction to an object-oriented programming language such as Java. The application employs a rule-based reasoning to teach students how to program in Java by maintaining a "conversation" with the student who can type in questions about programming in Java and the system will answer with an explanation that might contains snippets of Java coding. The application presents the user with an initial list of learning subjects: data types, classes, and methods, and the student can ask

questions on these subjects. The objective is to extend the app to cover more subjects on Java programming so the student will have a complete learning experience using this mobile application.

## 18. Structural Composites for High-Temperature Applications

Tin Oo

Prof. Akm Rahman

Composite materials are generally designed in certain combinations with more than one constituents in order to meet a specific goal as defined in terms of chemical, physical or mechanical properties. Ceramic matrix composites (CMC) are one of the fastest growing material in the field of materials science. The current Research aims at developing eco-friendly ceramic matrix composites for Bio medical and high temperature applications.

In this research initiative, two types of polymer driven ceramics will be evaluated to develop the matrix materials with superior performance. These systems are generally recognized as Geopolymer and Magnesium- Potassium-Phosphate (MAKP). Geopolymer based materials are developed from recyclable earth's crust including Fly ashes and kaolin. These materials will be treated and processed under eco-friendly processing method in order to obtain valuable alternatives to conventional ceramic materials for high temperature composites. Selecting proper activators and activator-to-precursor ratio are crucial for optimum geopolymer properties. Combining with pozzolanic material like coal ash or Rice husk Ash help binding the aggregates and provide solid hardened and strong materials. Nano materials are considered as the filler and toughening agent of the geopolymer systems. Nano reinforcement will be performed using several nanomaterials including Fumed Silica, Silicon Carbide whiskers and Rice husk ash based Silica. Magnesium oxide and Mono Potassium Phosphate (MKP) will be considered for MAKP based ceramic.

In this study, the molds will be prepared for the fabrication of samples for a variety of characterizations. Starting from mold designing to 3D printing and using silicone liquid rubber, metals and plastics as the mold materials, this study support understanding a complete mold making process in an industry setting. Several characterization techniques were utilized to recognize the underlying chemical, physical and mechanical behavior of ceramic materials. The techniques include Compression, Flexural and Tensile test. In addition, Optical microscopy, Scanning Electron microscopy (SEM) and Energy Dispersive Spectroscopy (EDS) technique will be used to understand the structural properties of CMC. Ultimately, the goal of this research is to develop alternative matrix materials for fiber-reinforced composites with superior mechanical and thermal properties and associated cost-effective manufacturing process.

#### 19. Scaffold Fabrication for Cell Viability Analysis

Brian Parra

Prof. Ozlem Yasar

One of the principle challenges in Tissue Engineering, especially with the production of large tissue constructs, is the cell survivability within the scaffolds. Cells can show healthy growth within the scaffolds if biocompatible materials are used to generate the scaffolds.

In this project, collaborative work will be done between the SET Research Laboratory at the Department of Mechanical Engineering Technology and Biomedical Engineering/Biology departments at City College and City Tech to fabricate the scaffolds and to do the cell viability tests. Our preliminary results show that cells can survive within the PEGDA based scaffolds if 20% of PEGDA is used to fabricate scaffolds.

#### 20. Design and Fabrication of UV Light Holder for Photolithography

Quadel Phillips

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, photolithography is used to fabricate the scaffolds. Main components of the photolithography are “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. Our preliminary research showcased that scaffolds can be successfully fabricated with the use of elevator system.

#### 21. Assessment of Learning Strategies for Computer Programming Pedagogy

Shaun Pollard

Prof. Douglas Moody

As the world progresses more and more technological advancements are being made thus the demand for learning how to code heightens. Quickbooks.intuit.com notes that learning to program can help improve your work life making you more productive, efficient and effective. Students in nearly all age groups are looking to understand coding, and particularly the computational thinking aspect of the discipline. A new learning platform, Pathway2Code, looks to help students learn computational thinking and ease them into the art of coding literacy. These two skills will develop a student into a computer programmer. In this project we look to

compare Pathway2Code with other well-known approaches and explore next steps in the Pathway2Code platform growth.

22. Design and Manufacturing a 4 Degree of Freedom Robot Arm

Brittney Roberts

Prof. Angran Xiao

In this project, the professor and a student in Department of Mechanical Engineering Technology will design and build small a robot arm using 3D printing technology. The robot arm will be able to move with 4 degree of freedom, and will be used in a flexible production line.

23. Web Application: Choosing a Major

Scipio Sargeant

Prof. Marcos Pinto

A web application that helps the students to choose which department he/she would like to enroll to. It would be a complement of the usual open house offered by the college. The app will show the best of each department and will provide students an easier way to decide which school department and major he or she would like to enroll in from the three divisions: School of Technology and Design, School of Professional Studies, and School of Arts & Sciences. . After completion students or transfers will have a fundamental experience and clear view of what each school offers and their majors of interest.

24. Design and Fabrication of UV Light Holder for Photolithography

Navjot Singh

Prof. Ozlem Yasar

In recent years, Tissue Engineering is utilized as an alternative approach for the organ transplantation. The 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 the 3D environment. At the SET Research Laboratory at City Tech, micro-molding process, main fabrication material is PDMS. In this research, toxicity level of PDMS scaffolds was investigated. Our preliminary research showcased that micro-molding solidification temperature plays an important role in the PDMS toxicity levels.

25. The Connection Between Environmental Toxicology and Water Quality on Poor Communities

Jean-Hus Theodore

Prof. Aida Euges

Environmental Racism is an agent of systemic oppression that exposes black and other non-white people of color to harmful waste products at a disproportionate rate by way of their environment. Due to racial-economic bias, there has been a lack of education on the phenomenon in order to absolve responsibility. Through a series of literary reviews, compiled information spanning eight decades on events highlights how environmental safety is regarded as an afterthought when it involves socioeconomically challenged minority individuals, and what measures can be taken to counteract the present and potentially ensuing damage.

26. Environmental Policy and the Law

Cheryl Thomas

Prof. Masato Nakamura

The Clean Power Plan, major regulation meant to benefit poor families promises more than it can deliver. It does significantly cut carbon emissions but the shift from coal, the most affordable energy option may offset the benefits. The Government implements energy programs to minimize the economic downside but poor families already spend four times more than other families. Energy programs such as weatherization and greater use of efficient appliances touted by policy makers may not be as effective as they hope. Poor families tend to concentrate their limited resources in the area of rent and food and may sacrifice the high-end energy efficient appliances. These taxpayer-funded programs operate in diminishing returns. This is not to imply that there is no gain. In the area of increased health, children, the most vulnerable to environmental stressors will have less asthma attacks, close to a 100,000 less. This means that the number of sick days currently taken because of these attacks will be lowered.

27. Forward Acting Grate: Data Analysis for Municipal Solid Waste Mixing

Brian Yellis, Giovanni Campos, Justin Colon

Prof. Masato Nakamura

An early step in the waste-to-energy (WTE) process in the WTE power plant involves municipal solid waste (MSW) to be mixed in a combustion chamber. Various materials of different properties will be mixed in the chamber and because of their various properties, the proper mixing degree is required to keep the combustion process efficient. Various types of moving grates exist to provide various types of motions, some grates could be more efficient depending on the MSW put in. Our project focuses on a forward acting grate. We started this research using coal as a testing material because of its generally uniform properties such as size, shape, density, and heating value. We are in the process of creating a forward acting grate and

preparing it for data recording. Tracers will be mixed in with the coal particles as well as to provide us with a “target” to keep track of during the mixing process. Our tracers were made with approximately the volume and density as coal particles. From the data we gathered we will calibrate a stochastic model to be able to predict the mixing of municipal trash with some element of randomness.

## 28. Fiber Reinforced Concrete Bowling Ball – Design & Fabrication

Yuping Zhang

Prof. Navid Allahverdi

The objective of this research is to design and fabricate bowling balls using fiber reinforced concrete for the purposes of 1) providing opportunity to students to design reinforced concrete objects (structures), and 2) participating in the American Concrete Institute (ACI) bowling competition to be held in spring 2018. The competition draws participants from numerous universities at the national as well as international level. Fabricated concrete bowling balls will be evaluated based on the competition criteria to arrive at the optimal design. The winning ball will be judged based on following categories 1) Weight (mass), 2) Diameter consistency, 3) Final deformation load, 4) Toughness load, and 5) Bowling Performance. The Weight (mass) test weighs the ball to insure it reaches the required mass. Diameter consistency checks if the diameter is within the tolerance of plus/minus 15 mm of the standard 200mm diameter. The bowling performance test scores points while rolling the ball down a V-shaped ramp to knock pins over. The final deformation load, and toughness load measure strength and toughness of the ball. After successful design and fabrication of bowling ball, it is possible to participate in the American Concrete Institute (ACI) bowling ball competition, which draws student from numerous universities at the national as well as international levels. Different designs with varying portion of fiber will be designed and cast.