The Office of Undergraduate Research Presents

4TH ANNUAL

Texas STEM Conference 2016

Transforming Undergraduate Education in STEM

Saturday, October 29, 2016

Lamar University, Beaumont, Texas
We would like to acknowledge and thank everyone for their participation in making this 4th Annual Texas STEM conference, a success.

Individuals listed have provided invaluable guidance and support throughout the development of this conference. We sincerely appreciate their time and expertise.

The Office of the Provost and Vice President for Academic Affairs

Theresa L. Ener
Azadeh Semien & Chatwell’s Catering, Cardinal Catering
Susan Baertl, Convention & Visitor’s Bureau
Patti Owens & Holiday Inn Beaumont Plaza
Doug Mullins, Kirksey Sprint Printing

Enjoy the Conference!
Thanks,

Dr. Kumer P. Das, Director
The Office of Undergraduate Research

Dr. Catalina T. Castillon, Assistant Director
The Office of Undergraduate Research

Antoinette A. Henry
Administrative Associate

Dr. Kendrick Aung
College of Engineering

Dr. Cristian Bahrim
College of Arts and Sciences

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College of Education and Human Development

Dr. Dorothy Sisk
College of Education and Human Development

Mr. Juan J. Zabala
University Advancement

Dr. Weihang Zhu
College of Engineering

CONTACT US:
CHEMISTRY, ROOM 115A
P: 409-880-8430
E: antoinette.henry@lamar.edu
Joanie Kleypas is a marine scientist at the National Center for Atmospheric Research, who investigates how rising atmospheric carbon dioxide is affecting marine ecosystems, including both climate change and ocean acidification. She is currently using high-resolution oceanographic modeling to help identify refugia based on the expected impacts of climate change on adult populations and how their larvae are transported to other reefs. She is also working on a coral reef restoration pilot project in Costa Rica, to speed up the recovery of degraded reefs by propagating corals in underwater nurseries and then transplanting them to degraded reefs.

She is the Chair-elect of AAAS Section W (Atmospheric and Hydrospheric Sciences), has organized many scientific workshops worldwide. She is recipient of many national and international awards including:

- USGS Shoemaker Award for Communication Excellence, with Lisa Robbins, Mark Hansen and Stephan Meylan for development of CO2calc App and Software, 2013
- Heinz Foundation Award for the Environment, 2011
- AGU Rachel Carson Lecture Award, 2009
- Aldo Leopold Leadership Fellow, 2008
- Best Publication, Coral Reefs, 2003
- Advanced Study Program Fellowship, NCAR, 1993–95
- Fulbright Scholarships, 1987, 1988
- Getty Oil Co. Scholarship, 1984

Joanie is a proud graduate of Lamar University (“Go Big Red”). She also received a Master’s degree from the University of South Carolina, and a PhD from James Cook University in Australia.
2016 TEXAS STEM CONFERENCE AGENDA

SATURDAY, OCTOBER 29TH

All events will take place in Galloway Business Building

REGISTRATION

8:15 AM – 8:55 AM Registration (Continental Breakfast will be served)

WELCOME

Landes Auditorium

Dr. James Marquart, Provost and Vice President, Lamar University

9:00 AM – 9:30 AM

Dr. Kumer P. Das, Director, The Office of Undergraduate Research

Mr. Nick Vidonic, Technical Manager, ExxonMobil Chemical Company

KEYNOTE SPEECH

Landes Auditorium

9:30 AM – 9:35 AM Introduction of Speaker

Dr. Catalina T. Castillon, Assistant Director

The Office of Undergraduate Research

9:35 AM – 10:20 AM Keynote Speaker

Dr. Joanie Kleypas

Scientist

National Center of Atmospheric Research

10:20 AM – 10:25 AM BREAK
SESSION 1A-Oral Presentation

10:25 AM – 11:10 AM  Chair: Dr. Cristian Bahrim, Department of Physics
Room 122, Galloway Business Building

10:25 AM-10:40 AM  
**Active Flow Control and Solving the Ongoing Challenge in Aircraft Fuel Consumption Efficiency**  
*Carlos Caballero* | Physics & Mechanical Engineering | Mentor: Dr. Cristian Bahrim, Lamar University

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10:40 AM-10:55 AM  
**Thor Sequences as a Platform for Interaction Between Relations and Their Components**  
*Aaron Phillips* | Mathematics & Physics | Mentor: Dr. P.J Couch, Lamar University

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10:55 AM-11:10 AM  
**Using Statistical Approaches to Model Crude Oil Data**  
*Audrene Edwards* | Mathematics | Mentor: Dr. Kumer Das, Lamar University

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SESSION 2A-Oral Presentation

10:25 AM – 11:10 AM  Chair: Dr. Ozge Gunaydin-Sen, Department of Chemistry and Biochemistry
Room 124, Galloway Business Building

10:25 AM-10:40 AM  
**Structural Properties of Ammonia Borane/Polyvinylpyrrolidone Composites**  
*Ramanjaneyulu Seemaladinne Sahithya Pati and Adarsh Bafana* | Chemistry | Mentor: Dr. Ozge Gunaydin-Sen, Lamar University

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10:40 AM-10:55 AM  
**Fabrication and analysis of Super hydrophobic metal surfaces**  
*Divine Sebastian, Kirby Clayton & Mehrdad Mohsenizadeh* | Mechanical Engineering | Mentor: Dr. Chun-Wei Yao, Lamar University

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10:55 AM-11:10 AM  
**An Introduction to the S-STEM Program and Highlights of Student Progress and Success**  
*Fariba Ansari and Grecia Acosta* | Physics & Biology | Mentors: Dr. Jose Pacheco & Dr. Rebecca Escamilla, El Paso Community College

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11:10 AM – 12:00 PM  LUNCH BREAK

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12:00 PM – 1:15 PM  POSTER PRESENTATIONS
SESSION 1B – Oral Presentation

1:15 PM – 2:00 PM  Chair: Dr. Matthew P. Hoch, Department of Biology
Room 122, Galloway Business Building

1:15 PM-1:30 PM  
**Novel Catalysts for the Photocatalytic Conversion of Waste Carbon Dioxide and Water to Syngas**  
*Karishma Piler* | Chemical Engineering | Mentor: Dr. Tracy Benson, Lamar University

1:30 PM-1:45 PM  
**Dehydrogenation Properties of NH₃BH₃ Composites via Thermal Kinetic and Vibrational Studies in Bulk and Nanofiber forms Supported by Polyacrylamide**  
*Krishna Kharel, Radhika Gangineni, Lauren Ware and and Lu Yang* | Chemistry | Mentor: Dr. Ozge Gunaydin-Sen, Lamar University

1:45 PM-2:00 PM  
**A Comparative study on MIP, CP, and Heuristic Optimization on NP-Hard Terminal Allocation Problem**  
*Burak Cankaya* | Industrial Engineering | Mentor: Dr. Berna Eren Tokgoz, Lamar University

SESSION 2B – Oral Presentation

1:15 PM – 2:00 PM  Chair: Dr. Brian Craig, Department of Industrial Engineering
Room 124, Galloway Business Building

1:15 PM–1:30 PM  
**Mitigation of Temperature Induced Single Event Crosstalk Noise by Applying Adaptive Body Bias**  
*Pankaj Bhowmik* | Electrical Engineering | Mentor: Dr. Selahattin Sayil, Lamar University

1:30 PM–1:45 PM  
**Spartina Patens planet microbial fuel cell with Stainless Steel porous current collectors**  
*Deep Narula* | Mechanical Engineering | Mentor: Dr. Ramesh K. Guduru, Lamar University

1:45 PM–2:00 PM  
**Finite difference scheme for large-deflection analysis of non-prismatic Cantilever Beam subjected to transverse concentrated load and non-uniform distributed load**  
*Adnan Shahriar* | Aerospace Engineering | Military Institute of Science and Technology

AWARD CEREMONY & CLOSING REMARKS

2:10 PM – 2:40 PM  
*Dr. Joe Nordgren, Interim Dean,*  
*College of Arts & Sciences, Lamar University*

*Dr. Srinivas Palanki, Dean*  
*College of Engineering, Lamar University*
An Investigation on Chemical Absorbents for the Effective Removal of Hydrogen Sulfide from Crude Oils
Obakore Agbroko and Karishma Piler
Department of Chemical Engineering
Mentor: Dr. Tracy J. Benson

Growth and Magnetic Studies of Bacteria from the Marquez Crater
Manish Baviskar
Department of Chemistry and Biochemistry
Mentor: Dr. T. Thuy Minh Nguyen

The Impact of the Salt Water Barrier on Rangia cuneata Clam Size and Distribution in the Lower Neches River
Jami Brown
Department of Biology
Mentor: Dr. Ana Christensen

Port Disaster Risk Prioritization
Burak Cankaya
Department of Industrial Engineering
Mentor: Dr. Berna Eren Tokgoz

Influence of Titanium (II) Oxide on the Structural and Thermal Behavior of Polyethylene Films
Abhaysingh Deshmukh
Department of Chemistry and Biochemistry
Mentor: Dr. Paul Bernazzani

Design and Synthesis of para-Dichlorobenzene-Based Herbicides
Hannah Donnelly
Department of Chemistry and Biochemistry
Mentor: Dr. Xiangyang Lei

Analyzing Fuel Economy of Automobiles using Statistical Approaches
Chris Hagner
Department of Mathematics
Mentor: Dr. Kumer Das
Robot for Automated Benthic Survey of Pterois volitans Infestation
Tristen Harris
Department of Electrical Engineering
Mentor: Dr. Harley R. Myler

Regression Methods Being Applied to University Retention
Cameron Henry, A’Quisha Morgan and Marcus Trent
Department of Mathematics
Mentor: Dr. Kumer P. Das

Modified Power Plant Solid Waste Fly Ash for Absorption of CO₂
Justin Ho
Department of Mechanical Engineering
Mentor: Dr. Ramesh K. Guduru

Model of Hepatitis C Viral Dynamics through Deterministic and Stochastic Methods
P. Griggs Hutaff, Jr., Maria P. Kochugaeva and Anatoly K. Kolomeisky
Department of Chemistry

New Nickel-Based Catalytic Systems with Nitrogen-Containing Pincer Ligands for Suzuki Cross-Coupling Reactions
Jimmy Huynh, Zhifo Guo and Kenny Huynh
Department of Chemistry and Biochemistry
Mentor: Dr. Xiangyang Lei

MoO₃ Based Hybrid Supercapacitors: The Effect of Current on Capacitance and Cyclability in Multivalent Aqueous Electrolytes
Juan Icaza and Ketan Solanki
Department of Mechanical Engineering
Mentor: Dr. Ramesh K. Guduru

PDMS/CNT Nanocomposites Membranes: Preparation and Characterization
Dilruba Islam
Department of Chemistry and Biochemistry
Mentor: Dr. Suying Wei

Synthesis, structure and catalytic application of silver (I) coordination polymers based on 1,2,4,5-tetra(isopropylthio) benzene ligand
Srinija Kakumanu
Department of Chemistry and Biochemistry
Mentor: Dr. Perumalreddy Chandrasekaran
Waste water treatment using field deployable macroalgal tissue culture
Shishir Kumar, Ashiqur Rahman, and Gregory Rorrer
Department of Chemical Engineering
Mentor: Dr. Clayton Jeffries

Work in Progress: Programming is a Snap!: Increasing knowledge and Interest in Computing
Hannah LeLeux, Timothy Gonzales, Timothy Holcombe, Colin Smith, Alexander Strong, Greg Yera and
Diego Fernandez.
Department of Computer Sciences
Mentor: Dr. Peggy Doerschuk and Dr. Sujing Wang

Polyethylene Based Nanocomposite Films Display Increased Resistance to UV Irradiation
Iftekher Mahmud
Department of Chemistry and Bio-chemistry
Mentor: Dr. Paul Bernazzani

Building bi-directional Silicon Carbide Space Matrix Converter for Controlling Electric Machines
Lukas Moravits and Mitchell Davis
Department of Electrical Engineering
Mentor: Dr. Mohammad Reza Barzegaran

Effect of Electrolyte Ion Charges on the Supercapacitance Behavior of MoO₃
Tazmin Mumu
Department of Mechanical Engineering
Mentor: Dr. Ramesh K. Guduru

Capture of CO₂ using static and turbulent alkaline media
Likhith Nalluri
Department of Mechanical Engineering
Mentor: Dr. Ramesh Guduru

Finding impurities in medicines and flare towers using spectral analysis
John Pickren
Department of Physics
Mentor: Dr. Cristian Bahrim

Stochastic Modeling of Carbon Nanotube Morphology by Manufacturing Parameters and Finite Element Method
Luke Placette and Liangbiao Chen
Department of Mechanical Engineering
Mentor: Dr. Xuejun Fan
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Production and Kinetics of Metallic Nanoparticles from Phototrophic Cell Culture
Ashiqur Rahman, Shishir Kumar, Tsai-Nan Mai, Anudeep Kare, and Si Amar Dahoumane
Department of Chemical Engineering
Mentor: Dr. Clayton Jeffries

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MapReduce-based Clustering Algorithm for Big Data Analysis
Fredrick Ryans, Najar Aryal, and Garima Panta
Department of Computer Science
Mentor: Dr. Sujing Wang

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Synthesis and structural characterization of mercury (II) coordination polymers based on 1,2,4,5-tetra(isopropylthio) benzene ligand
Troy Selby-Karney, Srinija Kakumanu, Nishanth Kakarla, and Joel T. Mague
Department of Chemistry
Mentor: Dr. Perumalreddy Chandrasekaran

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Copper Tolerance of Magnetotactic Bacteria
Manisha Shrestha
Department of Chemistry and Biochemistry
Mentor: Dr. T. Thuy Minh Nguyen

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Work in Progress: Machine Learning in Robotics
Colin Smith, Timothy Holcombe, Greg Yera, Tim Gonzales, Hannah Leleux, Logan Smith, and Alexander Strong
Department of Computer Science
Mentor: Dr. Peggy Doerschuk and Dr. Sujing Wang

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Thi Kim Tran Tran
Department of Chemistry and Biochemistry
Mentor: Dr. T. Thuy Minh Nguyen

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Developing Photo-catalysts for Converting Waste Carbon Dioxide into Saleable Products
Jennifer Watters and Karishma Piler
Department of Chemical Engineering
Mentor: Dr. Tracy Benson
The Analyses of the Polarized Light Emitted by Glowing Objects Can Reveal Their Shape
Suzanne Wheeler, Keeley Townley-Smith, Azam Nurul, Gabrianna Escamilla, and Zakary Noel
Department of Physics
Mentor: Dr. Cristian Bahrim

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Magnetic Levitation: Holding Objects Against Gravity
Rachit Yadav
Department of Physics
Mentor: Dr. Cristian Bahrim

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Sustainable Anticorrosive Self-Healing Smart Coatings for Metal Protection
Chuanxing Zhan, Lauren Ware, Ken Lee, and Luyan Wang
Department of Chemistry and Biochemistry
Mentor: Dr. Suying Wei
An Introduction to the S-STEM Program and Highlights of Student Progress and Success

Fariba Ansari, Department of Physics & Biology
Co-Author: Grecia Acosta
Mentor: Dr. Jose Pacheco & Dr. Rebecca Escamilla, El Paso Community College

In partnership with UTEP, EPCC's S-STEM is currently working to provide our program’s students with opportunities to smooth the transition from a 2-year to a 4-year college successfully. Through a set of projects and other collaborative academic opportunities, such as Carbon Foot-Print, Hydroponic, and Robotics projects, students experience firsthand how S-STEM subjects are related, and they become familiar with tips and strategies to succeed at a 4-year college. Activities and projects are intended to increase students’ chances to complete their degrees at EPCC and easily continue their education at university.

Mitigation of Temperature Induced Single Event Crosstalk Noise by Applying Adaptive Body Bias

Pankaj Bhowmik, Department of Electrical Engineering
Mentor: Dr. Selahattin Sayil, Lamar University

Semiconductor devices are scaled down rapidly and the space between interconnects is shrinking aggressively, which make a CMOS circuitry more prone to crosstalk noise. Single Event Transient (SET) or Soft error is one of the most reliability issues, which is more prominent in advanced technology and in space application. High performance VLSI circuits are more power consuming and chip experiences high temperature for high utilization factor. Thus a Chip in terrestrial application suffered by both SET and high temperature. But when both reliability issues superimpose at a time, a new reliability issue is aroused, which is Temperature Induced Single Event Crosstalk Noise (TISECN). For some cases, the single event crosstalk noise could be treated as safe, after high temperature application the signal might not be safe enough to propagate in circuit or to drive a latch. It may toggle the output. This reliability issue is introduced very first time in literature. In this research work TISECN is mitigated using adaptive forward body bias. At high temperature, drain current reduces, and adaptive body biasing makes the CMOS to recover the drain current. A temperature sensor is proposed here to generate necessary voltage at the CMOS body. A good temperature sensitivity is achieved with the tiny sensors that keeps constant driving strength. Interconnect is modelled in using 10-π modeling and 45nm technology was use for this simulation. Our proposed method demonstrates that, almost 88% of TISECN at worst case scenarios are mitigated.

Active Flow Control and Solving the Ongoing Challenge in Aircraft Fuel Consumption Efficiency

Carlos Caballero, Department of Physics & Mechanical Engineering
Mentor: Dr. Cristian Bahrim, Lamar University

A brief description of Aerodynamic Drag (Turbulence), its effect on air travel, and the ever increasing industry demand to improve aircraft efficiency, especially, when it comes to fuel consumption will set up the stage for my presentation which will be focused on the experimental success and challenges of active flow control (AFC) systems research. After a basic introduction to AFC and its potential to reduce Aerodynamic Drag, the latest experimental data gathered by our in-house setup will be presented. The experiments used a MARK-10 series M3-5 force meter for measuring the load experienced by various material samples, such as cardboard, hardboard,
aluminum, titanium, and carbon fiber, when exposed separately to air flows aimed at different angles toward the surface. Additionally, possible sources of error and what we have been doing to correct them as well as future research will be discussed. Acknowledgements: This work has been sponsored by the Office of Undergraduate Research at Lamar University

A Comparative study on MIP, CP, and Heuristic Optimization methods on NP-Hard Terminal Allocation Problem

Burak Cankaya, Department of Industrial Engineering
Mentor: Dr. Berna Eren Tokgoz, Lamar University

The aim of this research is to develop a best scheduling solution for chemical tanker operations in a port. Typically, a chemical tanker visits multiple terminals to load/unload chemical cargos and undergoes a cleaning process after completing each terminal visit. This process is similar to the open-shop scheduling problem (OSSP). The complex port decision-making environment will be explained first. Comparison of different job scheduling optimization methods, Mixed Integer Programming (MIP), and Constraint Programming (CP) will be discussed next. Then, their performances will be compared with the current business practice, which is modeled by the First come First Served (FCFS) priority job scheduling heuristic. Finally, a chemical tanker scheduling in the Port of Houston will be performed to select the best scheduling method.

Using Statistical Approaches to Model Crude Oil Data
Audrene Edwards, Department of Mathematics
Mentor: Dr. Kumer Das, Lamar University

Extreme value analysis is an area of statistical analysis that can be used in many disciplines. These disciplines include engineering, science, actuarial science, and statistics. Extreme Value Theory (EVT) deals with the extreme deviations from the median probability distribution and is used to study rare but extreme events. When considering the use of Extreme Value Theory to model data where extremes exist, one must consider whether extreme events are stationary or non-stationary. There are two methods that can be used within EVT for effective modeling of data: the Block Maxima Method, which follows a generalized extreme value (GEV) distribution; and the Peaks Over Threshold Method, which follows a generalized Pareto distribution (GPD). For this study, EVT will be used to model spot prices for West Texas Intermediate (WTI) crude oil data from January 1986 to February 2016. With the spot prices for crude oil data, descriptive statistics will be used to model and interpret the characteristics of the data set, while determining whether the data contain extreme data. Next, hypotheses testing will take place to explore the applicable concepts such as the assumption of normality and independence. Considering that there are many factors that cause fluctuation in crude oil prices, such as supply and demand, natural disasters, and various world crises, hypothesis testing will also be used to determine whether the data is stationary or non-stationary. With the conclusion that the data are non-stationary, lastly, the Block Maxima Method for non-stationary extreme events will be used to analyze return levels. The return levels provide insight about the cost of future crude oil prices.

Dehydrogenation Properties of NH₃BH₃ Composites via Thermal, Kinetic and Vibrational Studies in Bulk and Nanofiber forms Supported by Polyacrylamide
Krishna Kharel, Department of Chemistry and Biochemistry
Co-Authors, Radhika Gangineni, Lauren Ware and Lu Yang,
Mentor: Dr. Ozge Gunaydin-Sen, Lamar University

In the current study, we studied the thermal, kinetic, and vibrational properties of ammonia borane (NH₃BH₃) in bulk and nanofiber composites. We used polyacrylamide with Mn ~150,000 blended with NH₃BH₃. Differential scanning calorimeter was used with different ramp rates and different temperatures to study the thermal and kinetic behavior of NH₃BH₃ composites. Hydrogen release temperature, and melting point for the composites were
found to be lower when compared with pristine NH$_3$BH$_3$. Thermal and kinetic properties had been observed to be improved in fiber form to a greater extent. We also used Fourier Transform Infrared studies of the fibers and bulk materials to support our results. Thermal gravimetric analysis of bulk and fiber composites showed significantly reduced weight for the composites due to the suppression of the unwanted boracic byproducts and NH$_3$. Confining NH$_3$BH$_3$ molecules within the polymer matrix, tuned properties of the novel composites were revealed.

**Spartina Patens Plant Microbial Fuel Cell with Stainless Steel Porous current collectors**

*Deep Narula, Department of Mechanical Engineering*
*Mentor: Dr. Ramesh K. Guduru, Lamar University*

At present the global energy infrastructure is highly dependent on (i) non-renewable fossil fuels with large emissions of greenhouse gases (ii) green fuels such as bioethanol and biodiesel with impact on current agricultural practices competing with food production for arable lands, fertilizers, also requiring additional energy input. This is where plant based microbial fuel cell (PMFC) technology can be found as a promising alternative to produce electricity without any side effects with an advantage of using sunlight as energy source. In the present study we developed PMFCs using *Spartina Patens*, a marshland grass abundantly available in the coastal regions of the USA. Figure 1 is a schematic for a PMFC with anode and cathode compartments where carbon based electrodes have been used by others for current collection. In contrast we attempted to utilize stainless steel electrodes with more surface area in order to enhance the current collection in the anode compartment as well as to increase the rate of reduction in the cathode compartment and thereby increase the amount of electricity produced. A detailed investigation of current production and the total power generated by these PMFCs will be presented during the conference. The study will give preliminary results on use of *Spartina Patens* in PMFC along with the porous stainless steel electrodes which have never been used in PMFCs before.

**Thor Sequences as a Platform for Interaction Between Relations and Their Components**

*Aaron Phillips, Department of Mathematics*
*Mentor: Dr. PJ Couch, Lamar University*

A graph G = (V,E,F) where V is the vertex set, E is the edge set, and F assigns a pair of vertices to each edge. Given a set of vertex weights, a Thor sequence T is a sequence of graphs on n vertices and m edges such that the vertex weights of G induce the edge-weights of G$_1$, the first term in the sequence, which induces the vertex-weights of G$_2$, the second term, and so on. This research focuses on determining the properties of these sequences.

**Novel Catalysts for the Photocatalytic Conversion of Waste Carbon Dioxide and Water to Syngas**

*Karishma Piler, Department of Chemical Engineering*
*Mentor: Dr. Tracy J. Benson, Lamar University*

This research will present the use of pairing Titania nanotubes with single walled carbon nanotubes for the photocatalytic conversion of waste carbon dioxide and water into useful fuels and chemicals. Titanium dioxide nanotubes are used due to their high specific surface area for interaction and optimum pore size for diffusion of active species. Also, because of their nanotube architecture, the recombination effect is greatly reduced. The reasons for implementing carbon nanotubes is because of their properties such as large surface area, one-dimensional electron transfer, and large electron storage capacity easily accepting photo-excited electrons. They also act as photosensitizers for TiO$_2$. They can adsorb twice the CO$_2$ molecules compared to activated carbon, another significant asset. The reason behind the pairing of titanium dioxide nanotubes and carbon nanotubes was to observe and implement the synergistic effects which can result from their unique photocatalytic properties (i.e.
Ti-O-C bond shifting from UV to visible wavelength region). The results of the characterizations of the synthesized photocatalyst, including FTIR, Raman, TEM, and XRD, will be presented.

**Fabrication and analysis of Super hydrophobic metal surfaces**

*Divine Sebastian, Department of Mechanical Engineering*

*Co-Author: Kirby Clayton, and Mehrdad Mohsenizadeh*

*Mentor: Dr. Chun-Wei Yao, Lamar University*

Artificial super hydrophobic surfaces have a significant role in the modern applications such as thermal management and condensation. The effects of structured micro and nanoscale features on self-cleaning mechanisms and other applications have been under scrutiny by the scientific community for a long time. In the current study, the effects of surface morphology and surface chemistry on the water-repellent property have been investigated using fabricated metal surfaces, specifically copper metal. The purpose of this study is to analyze the influence of fabrication methods on the characteristic features of a super hydrophobic surface thus obtained. The hydrophobic nature was introduced by processing the copper metal through different phases of chemical interaction, which includes etching and wet chemical reactions with intermediate cleaning. The coating is achieved exclusively with the aid of chemical reaction and etching. It was observed that not only the concentration and strength of the chemical reagents are significant in deciding the degree of hydrophobicity, but also the duration of the interaction between the chemical and the metal surface is crucial. The surface characterization of the obtained surfaces was performed using SEM images and AFM images along with the measurement of water contact angles. The measurement experiments showed that considerably higher water contact angle was achieved and also droplets exhibit smaller sliding angles on the engineered copper surfaces. The hydrophobic copper surface could find use in condensers, where rapid removal of condensate droplets and enhanced heat transfer performance is highly desirable. The improved thermal conductivity characteristics also enables the use of such engineered copper metals in complex micro-electronics applications. With appropriate improvement, similar surface fabrication techniques can be also introduced onto materials used in marine environments in order to have better corrosion resistance and other desirable features.

**Structural Properties of Ammonia Borane / Polyvinylpyrrolidone Composites**

*Ramanjaneyulu Seemaladinne, Department of Chemistry and Biochemistry*

*Co-Author: Sahithya Pati and Adarsh Bafana*

*Mentor: Dr. Ozge Gunaydin-Sen, Lamar University*

Ammonia borane (NH₃BH₃) is a promising hydrogen storage material, but its application is hurdled by the slow hydrogen release kinetics from this compound. Ammonia borane exhibits structural transition at Tp~223 K, but the details of the mechanism are still unclear. AB: PVP (40,000-360,000) (polyvinylpyrrolidone) composite shows decrease in the transition quantities (i.e. enthalpy and entropy) by the rise in polymer proportion. High temperature studies were performed to investigate dehydrogenation kinetics. We conducted decomposition at diverse heating rates and calculated activation energies. The activation energies of the composites were developed to be lower than the neat NH₃BH₃. The drop in the temperature for the release of hydrogen divulged the enhanced kinetics for the composites specified. The above particularities were emerged by the interaction between the AB and PVP. Those were backed by the detailed infrared studies. In addition, it also reveals the hydrogen release pattern during decomposition at high temperature ranging from 350-450 K.
Finite difference scheme for large-deflection analysis of non-prismatic Cantilever Beam subjected to transverse concentrated load and non-uniform distributed Load

Adnan Shahriar, Department of Mechanical Engineering
Co-Author: Moosfika Haque Treesh
Military Institute of Science and Technology

An efficient new approach for large-deflection analysis of a non-prismatic, slender, straight cantilever beam subjected to external transverse non-uniform distributed load and concentrated load has been developed. A first order non-linear differential equation governing this type of beam, as well as equations for non-uniform load and variable geometry, has been presented. Finite Difference Method is used to discretize and implement these equations on each node along the beam. An iterative method has been developed to carry out these calculations for different initial conditions until the result satisfies boundary condition. Finally, several numerical examples have been demonstrated for prismatic and non-prismatic beams subjected to both uniform and non-uniform distributed load. An analogy has been made with solutions from other literatures to illustrate the merits of this adopted method.

An Investigation on Chemical Absorbents for the Effective Removal of Hydrogen Sulfide from Crude Oils

Obakore Agbroko, Department of Chemical Engineering
Co-Author: Karishma Piler
Mentor: Dr. Tracy J. Benson, Lamar University

The aim of this research is to develop and test a series of absorbents (known as scavengers) for the removal of hydrogen sulfide (H₂S) from crude liquid oils. Crude oils that have sulfur concentrations more than 0.5 wt% are considered sour crudes, since they are characterized by a foul, odorous smell. Sour crudes are of lower quality and present serious health and environmental concerns. Therefore, sustainable measures to lower the sulfur content (i.e. crude oil sweetening) are of significant importance, financially and environmentally. H₂S is normally removed using amine based absorbing materials, known as scavengers. Removing of H₂S at the wellhead before transporting via pipeline or railcar increases the value of crude oil and in some cases is necessary to conform to legal transport laws. This research explores a series of scavengers to identify specific physical and chemical characteristics for optimum H₂S removal in crude oils. Physical properties such as specific gravity (SG), viscosity, and solubility will be tested. Mass spectrometry and infrared and Raman spectroscopies will be used to determine chemical functional groups required for optimum H₂S removal. Preliminary results, culminating from an in-depth literature review and laboratory testing, have identified several scavengers as being used, or potentially useful, by the industry. This research seeks to answer how and why some scavengers perform better for some crudes and environmental conditions than others, with the long-term goal to develop designer scavengers and processing conditions for the crude oil industry.

Poster Abstracts

All Posters are listed alphabetically by last name of the primary presenter

An Investigation on Chemical Absorbents for the Effective Removal of Hydrogen Sulfide from Crude Oils

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Growth and Magnetic Studies of Bacteria from the Marquez Crater  
Manish Baviskar, Department of Chemistry and Biochemistry  
Mentor: Dr. T. Thuy Minh Nguyen, Lamar University

Meteoroid impacts show different physico-chemical properties as well as deviation in magnetic property and gravity on impacted sites. In Marquez, Leon County, Texas, USA, is a buried complex impact crater where unique physical and chemical properties including gravity and magnetic anomalies are found in the surrounding rocks and soil. This study demonstrates the presence of mixed populations of south and north seeking magno tactic bacteria at the Marquez crater. The bacteria showed a typical response in the form of movement towards the South and North Poles of magnets revealing the presence of primitive south seeking bacteria and ubiquitous north seeking bacteria. The observed psychrotrophic to mesophilic temperature range of growth is characteristic of adaptation from Paleocene to the modern Era.

The Impact of the Salt Water Barrier on Rangia cuneata Clam Size and Distribution in the Lower Neches River  
Jami Brown, Department of Biology  
Co-Authors: Gayle Polansky, Warren Beadle, and Lauren Huff  
Mentor: Dr. Ana Christensen, Lamar University

Rangia cuneata is a brackish water clam found in estuarine habitats along the Gulf of Mexico. While adults are capable of surviving in freshwater, reproduction and larval success is dependent on the salinity, requiring 2 to 10 PSU for 15-30 days. The average life span is 4-5 years with an estimated maximum of 15 (Wolf & Petteway, 1968). Rangia were able to encroach further up the Neches River because of the increased salinity levels due to dredging for industrial use (Harrel, 1993). The Lower Neches River permanent saltwater barrier was constructed in 2003 to prevent saltwater intrusion up river and to protect Beaumont’s drinking water source. We predicted that with the decrease of salinity north of the saltwater barrier, Rangia beds would no longer be stimulated to reproduce and would instead put their energy towards growth, thus larger clams in lower numbers were expected to be present. We expected to find smaller clams with higher population densities south of the saltwater barrier. Using historical Rangia bed data, we revisited selected beds, surveying population densities and sizes of the established clams. Our data supported our hypothesis, as the clams found north of the barrier were larger (range 44-81 mm shell length, median 69 mm), and less than 1 per 5 m2. South of the barrier, the population density was greater (5-169 per m2) and the clams were smaller (range 21-63 mm, median 51 mm), demonstrating more recent reproduction and recruitment.

Port Disaster Risk Prioritization  
Burak Cankaya, Department of Industrial Engineering  
Mentor: Dr. Berna Eren Tokgoz, Lamar University

Historical data shows that the Southeast Texas region receives a major hurricane every 7 years. Chemical and petrochemical industries produce raw materials for different industries. Most of the chemical substances are hazardous and might cause mortalities and catastrophes. In case of a hurricane, chemical tankers need to be evacuated from ports within a very short period of time. The optimized decision is complex because of the limited time to respond in an emergency case with multiple hazardous loads on the vessels. This research determines a sustainable plan to define an evacuation order for chemical tankers depending on their locations and materials that they are carrying.
Influence of Titanium (II) Oxide on the Structural and Thermal Behavior of Polyethylene Films

Abhaysingh Deshmukh, Department of Chemistry and Biochemistry
Mentor: Dr. Paul Bernazzani, Lamar University

Nanocomposites are polymer based materials containing nanometer sized compounds, such as TiO$_2$, with improved chemical, electrical, physical or thermal properties over the pure polymer. The molecular reason for the improvements imparted by the presence of nanoparticles is still the object of debate. One possible explanation is the chemical interactions between polymer chain and nanomaterial. Our objective is to quantify the amount of chemical interactions between TiO$_2$ and polyethylene (PE) chains and relate it to thermal behavior of the nanocomposite. Differential scanning calorimetry (DSC) was used alongside Fourier transform infrared spectroscopy (FTIR). Results show that the DSC and FTIR can be a measure of the thermal and of the crystal behavior of the nanocomposite films. Further analysis is ongoing.

Design and Synthesis of para-Dichlorobenzene-Based Herbicides

Hannah Donnelly, Department of Chemistry and Biochemistry
Mentor: Dr. Xiangyang Lei, Lamar University

Herbicides are widely used in agriculture and urban areas for weed management. They can be classified into different families according to their modes of action. We mainly focus on two important types of herbicides: acetolactate synthase (ALS) inhibitors and synthetic auxins. ALS is a key enzyme in the biosynthesis of branched-chain amino acids. ALS inhibitors can lead to plant death by lowering the concentration of branched-chain amino acids in the plant. Auxins are an important class of plant growth substances that can stimulate plant growth at low concentrations but cause plant death at high concentrations. Based on the structure-activity relationships, we designed two para-dichlorobenzene-based herbicides, which can be classified as an ALS inhibitor and synthetic auxin, respectively. The preparation of the two target molecules can be achieved by multi-step organic synthesis. Once the target molecules are successfully synthesized, their activities as herbicides will be tested on a wide range of plants.

Analyzing Fuel Economy of Automobiles using Statistical Approaches

Chris Hagner, Department of Mathematics
Mentor: Dr. Kumer Das, Lamar University

The fuel economy of your vehicle may depend on more variables than you believe at first, such as rated horsepower and the relationship between engine revolutions and vehicle speed. In this study, we apply statistical analysis to real-world vehicle data using the statistical software SPSS. The many variables in this study are carefully analyzed to determine what exactly contributes to the fuel economy of your vehicle. This study uses regression analysis to test trends in the data of all vehicles from 2011 to 2016 that use standard gasoline, and it concludes by looking at trends in fuel economy, such as if fuel economy has increased or decreased significantly through the years.

Robot for Automated Benthic Survey of Pterois volitans Infestation

Tristen Harris, Department of Electrical Engineering
Co-Authors: Mahdi Nadaff
Mentor: Dr. Harley Myler, Lamar University

An ongoing challenge with the invasive red lionfish (Pterois volitans) in U.S. coastal waters continues to escalate as the range of infestation expands. With this in mind, a new solution to combat the invasive was desired. Current solutions involving spear fishermen harvesting lionfish have many limitations. This project provides the means to...
an alternative solution more effective than solely human efforts. Utilizing the advantages of robotics, image processing, machine vision and operator control, the invasive lionfish may be effectively remediated in a new and unique manner. This research project aims to continue to develop and implement a method of locating, identifying and tracking lionfish using the existing technology of remotely operated vehicle (ROV) underwater robotics in benthic survey tasks. Controlled underwater environments were used to test the effectiveness of this method. Throughout the project much was learned about: microelectronics, control systems, and specialized structuring for underwater tasks. The challenges of underwater robotics, and machine vision were also dealt with. All of this culminated in a distinctive learning opportunity about the applications of robotics and software in a new environment. Eventual applications will involve little to no human interaction and the implementation of autonomous methods. This can be scaled up for widespread use in aiding the developing invasive species remediation issue.

**Regression Methods Being Applied to University Retention**

*Cameron Henry, Department of Mathematics*

*Co-Authors: Marcus Trent and A'Quisha Morgan*

*Mentor: Dr. Kumer Das, Lamar University*

The intention of this paper is to show the regression analysis using student retention from a university. Regression is an important practice that sorts out which variables have major impacts [6]. Regression methods can also be used to seek out the variables that would have no particular purpose. There are various methods that regression can be used for, seeing as it is one of the most common practices used in statistics. In this paper, we will look at how regression can be used to examine the retention rates within a university. We will also look at other factors, such as multicollinearity and principal component analysis. With multicollinearity, it is a method that shows the highly correlated variables in a regression model [5]. This method can also be used alongside regression in terms of seeing which variables have high correlation with each other. However, this can become an issue when attempting to figure out which variables are better suited when dealing with the regression aspect. With multicollinearity potentially becoming a problem, the method of principal component analysis can help to solve this problem. Principal component analysis is a process used for analyzing data. It is also a statistical approach that converts correlated variables into linearly uncorrelated values. These values are then called “principal components.” This method is also used for analyzing data that came from regression, but consequently cannot remove the multicollinearity correlation. Throughout this paper we will show what occurs when showing the regression methods used to explain the given data.

**Modified Power Plant Solid Waste Fly Ash for Absorption of CO₂**

*Justin Ho, Department of Mechanical Engineering*

*Mentor: Dr. Ramesh K. Guduru, Lamar University*

Coastal regions of Texas are the hub for petrochemical, chemical, and refinery industries, and these areas are very much polluted because of strong emissions from the refineries, local industries, and transportation. The level of CO₂ in the Houston area has gone up to 450 ppm, which is quite high compared to the rest of the country, and in the long run it may have negative impacts on the surrounding marine ecological systems. Therefore, capturing of CO₂ from the atmosphere is very critical in order to reduce global warming and other ecological problems. Alkaline media is usually very good for CO₂ absorption, however, the use of alkaline materials (e.g. KOH) on a large scale for these purposes might become expensive. Therefore, we propose to utilize industrial fly ash waste to capture the CO₂ by leaching its alkaline content in deionized water. Fly ash can be easily found as a solid waste from the power plants, which is usually sent to the landfills. In this project, we modified the fly ash into nano particulates through a high energy ball milling process and then suspended in deionized water to leach the alkaline content. Thus prepared suspension was then utilized to capture the atmospheric CO₂ using a closed loop system that was equipped with CO₂ sensors. The data indicated an increasing amount of CO₂ absorption with increasing the ball milling time, i.e., by increasing the refinement of particle size for class C fly ash, whereas this enhancement was not very significant in case of class F fly ash. The discrepancy between the class C and class F fly ash CO₂ absorption behavior can be attributed to lower content of CaO in class F fly ash, which did not really contribute to improved
absorption in spite of longer ball milling times; however, the class F fly ash showed a relatively better absorption of CO₂ after ball milling. These studies clearly indicate the effect of particle size and the CaO content on the absorption of atmospheric CO₂. This research provides insights on utilization of fly ash for economical capture of CO₂ while reducing the fly ash landfill.

**Model of Hepatitis C Viral Dynamics through Deterministic and Stochastic Methods**

*P. Griggs Hutaff, Jr., Department of Chemistry*

*Co-Authors: Maria P. Kochugaeva and Anatoly B. Kolomeisky*

*Rice University, Houston, Texas*

In most people infection by Hepatitis C Virus (HCV) leads to liver failure. However, rare patients show the ability of spontaneous recovery. The reasons of such phenomenon are still not well understood, but it has been found that in chronically infected individuals there is a high level of HCV diversity due to high mutation rate in the virus. Furthermore, different mutants have diverse properties, and thus how they are hazardous for human immune system varies. The infected organism responds efficiently until a fit enough mutant arises that escapes the immune pressure. Here we present the theoretical analysis of virus dynamics with incorporation of mutations and immune response that may shed the light on the disease progression and spontaneous recovery. We roughly estimate the time for the appearance of escape mutant for different conditions. Our method consists of the solution of the kinetic model and stochastic Monte-Carlo simulations based on Gillespie algorithm. Preliminary results show that in the stochastic simulations some of the virus mutants completely disappear while it is not observed in the kinetic model. Moreover, kinetic model always demonstrates the immediate growth of escape mutant due to self-reproducing, but it appears in the organism mainly because of the mutations which is proved by stochastic simulations. Obtained results are utilized to analyze clinical data.

**New Nickel-Based Catalytic Systems with Nitrogen-Containing Pincer Ligands for Suzuki Cross-Coupling Reactions**

*Jimmy Huynh, Department of Chemistry and Biochemistry*

*Co-Authors: Zhifo Guo and Kenny Huynh,*

*Mentor: Dr. Xiangyang Lei, Lamar University*

Nickel-based catalytic systems have attracted considerable attention for cross-coupling reactions because they are more economical and more environmentally friendly than precious metal-based catalytic systems. Meanwhile, nitrogen-based ligands are superior to phosphine-based ligands as they are more air-stable and less toxic. We synthesized three nitrogen-containing pincer ligands. The new nickel-based catalytic systems with these nitrogen-containing pincer ligands show high activity for Suzuki cross-coupling reactions. Under the optimal reaction conditions the coupling reactions can be completed in a short time (2 hours for most substrates) in open air to give the coupling products in moderate to high yields.

**MoO₃ Based Hybrid Supercapacitors: The Effect of Current on Capacitance and Cyclability in Multivalent Aqueous Electrolytes**

*Juan Icaza, Department of Mechanical Engineering*

*Co-Author: Ketan Solanki*

*Mentor: Dr. Ramesh K. Guduru, Lamar University*

As super capacitors (SC), hybrid supercapacitors have been extensively investigated due to enhanced charge storage capacity. They combine the non-faradic properties of electric double layer capacitors (EDLC) and faradic properties of pseudo capacitors to provide higher capacitance with improved energy density. In the present study, intercalation of multivalent ions into MoO₃ electrode was found along with the co-intercalation of protons in hybrid super capacitor configuration. At high rates of charge-discharge and also with less acidic electrolytes, the capacitance of MoO₃ electrodes was observed to improve due to minimized parasitic reactions and co-intercalation
of protons, respectively. These phenomena were studied in aqueous 0.5M and 2M BeSO$_4$, and 0.5M and 2M Al(NO$_3$)$_3$ electrolytes. The electrochemical performance of the MoO$_3$ electrodes was examined by galvanostatic charge-discharge at varying currents from 0.5 to 20 Ag$^{-1}$, cyclic voltammetry, and impedance spectroscopy measurements. The results will be presented in the conference.

**PDMS/CNT Nanocomposites Membranes: Preparation and Characterization**

*Dilruba Islam, Department of Chemistry and Biochemistry*

*Mentor: Dr. Suying Wei, Lamar University*

Desulfurization of gasoline is an important subject, as the sulphur containing compounds will cause issues like low fuel combustion value, engine damage, and reforming catalyst poison. Polydimethylsiloxane, PDMS, has been one of the materials choices for membrane preparation towards gasoline desulfurization process. Here, we are targeting carbon nanotube based PDMS nanocomposite membrane synthesis. PDMS/CNT membranes with different loadings of various CNTs (single walled, multi walled, and mixture) will be synthesized, followed by characterization and property analysis with a variety of analytical tools, including Fourier transform infrared spectroscopy (IR), thermal gravimetric analysis (TGA), and tensile testing.

**Synthesis, structure and catalytic application of silver (I) coordination polymers based on 1,2,4,5- tetra(isopropylthio)benzene ligand**

*Srińija Kakumanu, Department of Chemistry and Biochemistry*

*Mentor: Dr. Perumalreddy Chandrasekaran, Lamar University*

In recent years coordination complexes containing d$^{10}$ metals have attracted significant interest in chemical community due to their exciting photo-physical properties and catalytic activities. In this context, we have synthesized and structurally characterized silver(I) coordination polymers based on 1,2,4,5-tetra(isopropylthio)benzene, [C$_6$H$_2$(SiPr$_4$)] ligand. Tetrahydrothioether ligand [C$_6$H$_2$(SiPr$_4$)] forms stable 1:1 complex with silver(I) salts such as AgNO$_3$, AgPF$_6$, AgOTF, Ag(OAc) and AgClO$_4$ through chelation of two sulfur donors. Crystal structures of AgNO$_3$, Ag(OAc) and AgClO$_4$ complexes reveals formation of zigzag one-dimensional coordination polymers containing six coordinated silver centers with coordinated anions, whereas AgPF$_6$ and AgOTF forms linear coordination polymers with tetrahedral A$^3$ coupling reactions involving aldehyde, acetylene and amines.

**Waste water treatment using field deployable macroalgal tissue culture**

*Shishir Kumar, Department of Chemical Engineering*

*Co-Authors: Ashiqur Rahman and Gregory Rorrer*

*Mentor: Dr. Clayton Jeffryes, Lamar University*

Macroalgae can remove nitrates, phosphates, and heavy metals from contaminated waters as well as break down recalcitrant compounds, e.g. trinitrotoluene (TNT), while synthesizing halogenated compounds, which have antibiotic, antifungal, and antitumoral properties. The macroalgae also produce high levels of compounds relevant to biofuels, such as terpenes and cyclic sesquiterpenes. The metabolic pathways that allow the synthesis and breakdown of cyclic compounds may also enable the capability to remediate phenolics or other wastes from agricultural and petrochemical industries. Hence, initially, we aim to produce preliminary data to develop a field-deployable macroalgal tissue culture system for the bioremediation of surface waters in a “waste to value” process that will simultaneously produce bioactive compounds or biofuels. Further, we propose a field-deployable, “biogenic packed bed,” high cell-culture density system and determine nutrient, metal, and phenolic removal capacities. Therefore, this study has investigated a high density cultivation system and quantified the ability to remove nutrient loads from agricultural wastewater. Additionally, because the biomass itself can also be used as a fertilizer or animal feed, the objective of the study is directly related to the water-energy-food nexus.
Work in Progress: Programming is a Snap!: Increasing knowledge and Interest in Computing

Hannah Leleux, Department of Computer Science
Co-Authors: Timothy Gonzales, Timothy Holcombe, Colin Smith, Alexander Strong, Greg Yera and Diego Fernandez

Mentor: Dr. Peggy Doerschuk and Dr. Sujing Wang, Lamar University

This project investigates whether high school students’ interest and knowledge in computing can be increased by engaging them in an hour-long hands-on game programming lab that is led by undergraduates. The undergraduates created the instructional materials, conducted the hands-on activity and participated in evaluating the effectiveness of the approach. Instructional materials included a partial game that students completed, a set of slides that explain concepts, and instruments that measure students’ interest and knowledge in programming before and after the activity. Three workshops have been successfully conducted in Spring 2016 with 50 students each using the questionnaires. The assessment based on content-based quizzes is done. The preliminary results indicate that the workshops have the potential to have a significant effect on increasing knowledge of programming concepts. The workshops will continue to be conducted and evaluated in a series of on-campus visits by high schools planned for this academic year. This work was funded in part by the National Science Foundation, Lamar University’s Office of Undergraduate Research, and ExxonMobil.

Polyethylene Based Nanocomposite Films Display Increased Resistance to UV Irradiation

Iftekher Mahmud, Department of Chemistry and Biochemistry
Mentor: Dr. Paul Bernazzani, Lamar University

Polymers exposed to natural elements age at an increased rate mostly because of UV and air exposure. Nanocomposites, i.e. polymers containing different types of nanoparticles, may help or inhibit degradation. To understand the effect of the nature of the particles on the degradation process, particles of TiO₂, FeO, ZnO, and CdCl₂ were incorporated into polyethylene thin films and exposed to UV irradiation (254 nm) for different durations. The crystal content and degradation temperature of the polyethylene film nanocomposites were investigated using differential scanning calorimetry (DSC) under both nitrogen and air atmospheres. Results suggest that the addition of ZnO and CdCl₂ decreases the crystal content of the films, while the addition of TiO₂, ZnO, and FeO significantly modified the degradation temperature supporting the hypothesis that the nature of the particles influences the degradation properties of the nanocomposite.

Building bi-directional Silicon Carbide Space Matrix Converter for Controlling Electric Machines

Lukas Moravits, Department of Electrical Engineering
Co-Author: Mitchell Davis
Mentor: Dr. Mohammad Barzegaran, Lamar University

This project involves a bi-directional sparse matrix power converter using silicon carbide (SiC) as a switch. The SiC has several advantages, including faster switching frequency, high blocking voltage, and lower power dissipation, and it has not been implemented in power converters for controlling machines. Simulation was carried out for the comparative analyses regarding ripple reductions of torque and speed response of electric machine and improvements of transient response. The advantages of a SiC converter are being verified by comparing the result with a conventional converter.
Effect of Electrolyte Ion Charges on the Supercapacitance Behavior of MoO$_3$

Tazmin Mumu, Department of Mechanical Engineering
Mentor: Dr. Ramesh K. Guduru, Lamar University

The demand for energy storage devices with high power and energy densities has been growing day by day, for example in automobile applications. To cope up with this increasing demand, researchers have been investigating different materials and chemistries to enhance the power and energy densities of supercapacitors. Metal oxides have good potential to be used in supercapacitors as they exhibit long cycle life and high specific capacitance. Now a day's multivalent electrolytes and metal oxides with multivalent states, such as MoO$_3$, have attracted a huge attention because of multivalent states and a possibility for delivering high specific capacitance.

In the present research we examined the capacitive behavior of MoO$_3$ electrodes using three different electrolytes with varying valence-Li$_2$SO$_4$, MgSO$_4$ and Al$_2$(SO$_4$)$_3$. In addition, MoO$_3$ was also tested against activated carbon cloth for its electrochemical performance as well as to distinguish the effect of ion charges on the capacitance while using above three electrolytes. All the evaluations were done through cyclic voltammetry, impedance and Galvano static charge-discharge cycling along with cyclability, which will be presented in the conference. These will demonstrate the advantages of using multivalent oxides and multivalent electrolytes for enhanced capacitance and energy densities of supercapacitors.

Capture of CO$_2$ using static and turbulent alkaline media

Iikhith Nalluri, Department of Mechanical Engineering
Mentor: Dr. Ramesh K. Guduru, Lamar University

Increasing CO$_2$ levels in the atmosphere is one of the serious problems because of the greenhouse effects. In order to capture the CO$_2$ from atmosphere, alkaline solutions have been used by many researchers. However, most of these studies were performed through exchange and flow mechanisms. In contrast, in the present study we used both static and turbulent Ca(OH)$_2$ based alkaline media to chemically absorb the atmospheric CO$_2$ in order to mimic the natural water sources, such as sea or pond water. Experiments were conducted using atmospheric air in a lab scale reactor with a CO$_2$ sensor in a closed loop system. The results showed an increase in the absorption of CO$_2$ with increasing Ca(OH)$_2$ concentration in the seawater until the concentration of sorbent reaches to an equilibrium. The results also confirmed with the changes in pH values of the alkaline media, and these studies will be presented in detail in the conference.

Finding impurities in medicines and flare towers using spectral analysis

John Pickren, Department of Physics
Mentor: Dr. Cristian Bahrim, Lamar University

The chemical composition of medicines as well as their impurities, can be measured using optical analysis of the light emitted by the excited atoms within. For this, we pour powdered medicines in flames so we can produce excitation of their atomic constituents. We analyze the emission spectra using an Ocean Optics RedTide USB650 spectrometer with an optical resolution of 0.6 nm and a PASCO Xplorer GLX device for quick data analysis. For a more detailed analysis, we use the DataStudio software. From these spectra we find the temperature of the flame source by using methods such as Doppler (pressure) broadening of emission lines and Boltzmann distribution of atoms. The accuracy of our spectral measurements is assessed from standard NIST spectral data, including Grotrian diagrams and transition probabilities. The weaker emission lines are identified as impurities. Medicines with different functions (i.e. Aleve and Sudafed) show similar light patterns. We want to gather information from different medicines and classify them based on their function and treatment of different ailments. We apply the same technique to analyze the emission of flare towers from refineries located near Lamar University in order to determine their pollutants by using a Celestron AstroMaster 70 telescope. Our optical measurements support results in experiments of chemical analysis. We acknowledge the financial support of the STAIRSTEP program and Office of Undergraduate Research under the OUR grant.
Stochastic Modeling of Carbon Nanotube Morphology by Manufacturing Parameters and Finite Element Method

Luke Placette, Department of Mechanical Engineering
Co-Author: Liangbiao Chen
Mentor: Dr. Xuejun Fan, Lamar University

Carbon nanotubes have been shown to be one of the strongest, most promising materials in a variety of applications. Their use in nanocomposites offers flexibility in mechanical, electrical, and thermal properties, to tailor them for specific purposes; these include potential uses in computer processors, electrode interconnects, prosthetics, and semi-permeable membranes among others. The most cost-effective method to produce carbon nanotubes in bulk is through chemical vapor decomposition on substrates, resulting in aligned growth; however, the carbon nanotubes produced have noticeable imperfections, such as waviness, which significantly alter their physical properties. Though several models have been presented which examine the effect of some of these imperfections, they are neither conducive to researching the actual growth of carbon nanotubes, nor can they be used to predict the physical properties of a given vertically aligned carbon nanotube array, which is non-uniform. In the presentation, a summary of current work will be provided, leading to the consideration of a new model which will potentially remedy these problems with mass derivation. The relationship between manufacturing factors (e.g., inter-CNT spacing and packing coordination number) and designated volume fraction of CNTs is established and implemented using Python. Future work to advance current understanding is also outlined, which is to test the theoretical model through statistical programming and mechanical simulations such as molecular dynamics and finite element analysis.

Production and Kinetics of Metallic Nanoparticles from Phototrophic Cell Culture

Ashiqur Rahman, Department of Chemical Engineering
Co-Authors: Shishir Kumar, Tsai-Nan Mai, Anudeep Kare and Si Amar Dahoumane,
Mentor: Dr. Clayton Jeffryes, Lamar University

Biosynthesis of nanoparticles has experienced a tremendous expansion during the last two decades. Among the biological production platforms, algae have attracted increasing attention from research scientists because they represent a trend towards greener, more sustainable processes which reduce or eliminate potentially toxic solvents and reagents and minimize energy requirements. These “green” synthesized nanobiomaterials can be used to fabricate biosensors, therapy and diagnostics tools, medical imaging agents, as well as tissue engineering scaffolds and biomaterials. Indeed, microalgae are produced in photo bioreactors in aqueous solutions at ambient temperatures and pressures and at a near neutral pH. Additionally, under the appropriate bioprocess conditions phototrophic algal cell cultures can catalyze the conversion of soluble metal cations, such as silver cation (Ag+), to metallic silver Nanoparticles (Ag°NPs). It is proposed in the literature that the reducing power required to drive this reaction is derived from the electron flux produced in the algae's photosynthetic apparatus, or specifically, in the thylakoid membrane. Furthermore, the as-produced NPs show a narrow size distribution because the thylakoid membrane provides a shape-directing template. This research carries out controlled photo bioreactor cultivations for the biological production of Ag°NPs. In fact, we are using silver as a model compound, but the technological platform developed could be expanded to encompass noble metals, oxides, and chalcogenides NPs. Photon and mass balances are used to determine rate NP production kinetics and identify potential rate-limiting steps. This study represents a path forward towards the scalable, sustainable, economical production of metallic NPs from photosynthetic cell culture.
MapReduce-based Clustering Algorithm for Big Data Analysis  
Fredrick Ryans, Department of Computer Science  
Co-Authors: Najar Aryal, and Garima Panta  
Mentor: Dr. Sujing Wang, Lamar University

High dimensionality of big data introduces unique computational challenges, including scalability and storage bottleneck, due to the huge volume of data, the complexity of data types and structures, and the speed of new data creation and growth. It is difficult or even impossible for large-scale data to be sorted and processed on a single computer. Processing big data requires high performance computing infrastructure. Therefore, efficient data mining techniques are needed to address these challenges, and to provide effective solutions to analyze massive data by integrating modern computer infrastructures (e.g., Cloud, GPU, Clusters, and GRID) and powerful programming platforms. MapReduce is a desirable parallel programming platform due to its simplicity, scalability, and full tolerance to overcome this obstacle. Thus, this project will develop an efficient clustering technique utilizing high-performance computing clusters and powerful programming platform (MapReduce) for big data analysis. In particular, this work will focus on developing the MapReduce-based Clustering algorithm for big data analysis. However, performing such clustering algorithm efficiently in real-world applications of big data is very challenging due to the scalability problem. This work will solve this problem as well.

Synthesis and structural characterization of mercury (II) coordination polymers based on 1,2,4,5-tetra(isopropylthio) benzene ligand  
Troy Selby-Karney, Department of Chemistry  
Co-Authors: Srinija Kakumanu, Nishanth Kakarla, and Joel T. Mague  
Mentor: Dr. Perumalreddy Chandrasekaran, Lamar University

Coordination chemistry of 1, 2, 4, 5-tetra (isopropylthio) benzene (L1) ligand with mercury (II) halides have been investigated in solution and solid states. Ligand L1 forms one-dimensional coordination polymers [{L1} HgX₂]∞ (2, X = Cl; 3, X = Br) with HgCl₂ and HgBr₂ respectively. Whereas L1 reacts with two equivalent of HgI₂ to produce dinuclear mercury complex [I₂Hg{L1}HgI₂] (4). The X-ray crystallographic structure of 2 and 3 reveals formation of coordination network in which [X₂Hg{L1}HgX₂] (X = Cl, Br) units are bridged by L1 through two para-thioether sulfur donors. The geometry around the mercury centers in complex 2 and 3 are distorted square pyramidal, whereas in complex 4 the mercury centers are in a seesaw geometry.

Copper Tolerance of Magnetotactic Bacteria  
Manisha Shrestha, Department of Chemistry and Biochemistry  
Mentor: Dr. T. Thuy Minh Nguyen, Lamar University

Magnetotactic bacteria (MTB) are unique organisms that develop magnetosomes, nanometer sized iron particles contained within an organic shell. MTB can orient and migrate under the influence of an external magnetic field. Due to this peculiar feature, MTB can be isolated from other bacteria. Because of the capability of absorbing iron, we emit the hypothesis that MTB can be used in bioremediation and bioaccumulation of different heavy metals. We investigate the potential of MTB isolated from the Marquez crater to tolerate different concentrations of copper. Results show that one MTB isolate was significantly more resistant to Cu (II) compared to control samples.
Work in Progress: Machine Learning in Robotics
Colin Smith, Department of Computer Science
Co-Authors: Timothy Holcombe, Greg Yera, Tim Gonzales, Hannah Leleux, Logan Smith, and Alexander Strong
Mentor: Dr. Peggy Doerschuk and Dr. Sujing Wang, Lamar University

This work investigates the combination of reinforcement learning and radial basis function neural network (RBFNN) learning to improve the performance of a robot’s task execution. Due to the benefits of a controlled environment and controlled variables, the robot has been ported to a simulator called VREP. In the current phase the robot is learning to follow a wall. This machine learning technique uses episodic learning, which only processes the learning algorithms once the state has changed. The state is evaluated using ultrasonic sensors, positioned on the front, left, and right sides of the robot. These sensors detect the distance from a solid object, the wall, and the sensor itself. The robot evaluates the distances returned from all sensors and calculates its orientation and distance from the wall, combining them into a state. It processes this state through the reinforcement learning algorithm to decide on an action to take. The knowledge gained through reinforcement learning is then used to train the RBFNN, which refines the actions corresponding to each state to improve the robot’s performance. We are currently in the debugging phase. This work is funded in part by Exxon Mobil and the Lamar University Office of Undergraduate Research.

Identification of Contaminants in Dredged Material
Thi Kim Tran Tran, Department of Chemistry and Biochemistry
Mentor: Dr. T. Thuy Minh Nguyen, Lamar University

Dredged material consists of soil and debris removed from rivers and waterways to ensure proper depth for navigation. Dredge soil has little use and is accumulated in placement areas. The long-term impact on the environment of the accumulation of this material is not fully understood. The objectives of this research are twofold: to determine the amount and nature of the organic contaminants in dredge soil and to evaluate the rates of leaching of these contaminants into the environment. Samples from specific placement areas were obtained and analyzed for their organic content, using basic extraction methods. Analysis of the presence, nature, and quantity of the contaminants was performed using Fourier transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), and gas chromatography – mass spectrometry. The presence of contaminants was confirmed using FTIR and DSC. Our preliminary results suggest that the organic content in dredge can be removed using cyclohexane. More analysis remains to be performed.

Developing Photo-catalysts for Converting Waste Carbon Dioxide into Saleable Products
Jennifer Watters, Department of Chemical Engineering
Co-Authors: Karishma Piler
Mentor: Dr. Tracy J. Benson, Lamar University

This study involves the conversion of waste carbon dioxide, namely from electric power generators and petroleum refineries, to saleable products, such as gasoline and diesel fuels. A light activated catalyst, formed from titania and carbon nanotubes, has been developed to readily convert mixtures of CO₂ and steam to syngas (CO and H₂), which are feedstock compounds for Fischer – Tropsch reactions. These photo-catalysts have been synthesized and will be tested in the laboratory and are expected to achieve molar CO₂ conversions of 20 %, which is up from 2 % of today’s best photo-catalysts for CO₂ transformation to syngas.
The Analyses of the Polarized Light Emitted by Glowing Objects Can Reveal Their Shape

Suzanne Wheeler, Department of Physics
Co-Authors: Keeley Townley-Smith, Azam Nurul, Gabrianna Escamilla, and Zakary Noel
Mentor: Dr. Cristian Bahrim, Lamar University

We built a setup for finding the shape of a glowing object from the analysis of light emitted. Our setup uses complex optical equipment including filters, polarizers, lenses, and light sensors. The topic was inspired by an article published in Nature (2006) by Leonard at al., which talks about the asymmetry of a core collapse supernova based on the analysis of the degree of polarization of the core’s radiation induced by the gaseous cloud around it. Our built in-house table-top setup includes a blackbody cavity covered by small openings of various shapes (such as triangular, square, polygon, crest) in order to simulate various shapes of glowing objects. Our control signal is generated by a circular opening with a diffuser located behind it in order to eliminate the shape of the blackbody’s filament. Various openings are placed in front of the circular opening and along the setup’s optical axis. A motor allows us to steadily rotate a polarizer connected to the motion sensor and thus, to polarize the light emitted by the glowing objects. Malus’ law is used for data processing: The raw data follows a cosine squared variation but with a variable amplitude, depending on the shape of the opening. A complex numerical program built in MATLAB processes the raw data and extracts the amplitudes of the light signal. The analysis of these amplitudes and their departure from our control signal will be reported. Our methodology used to find the shape of the openings will be discussed. We acknowledge the Society of Physics Students (SPS) for the UG Research Award offered to our SPS Chapter. Also many thanks to STAIRSTEP and OUR for partial financial support.

Magnetic Levitation: Holding Objects Against Gravity

Rachit Yadav, Department of Physics
Mentor: Dr. Cristian Bahrim, Lamar University

Angular motion of electrons inside atoms leads to magnetism. There are two types of angular motion: orbital motion of electrons and their intrinsic spin motion. The number of electrons in the last orbit and their angular characteristic typically decide the type and strength of magnetic response to the presence of an external magnetic field. Atoms with paired electrons in the last atomic orbit typically show diamagnetism, while atoms with unpaired electrons show a paramagnetic response. According to Pauli’s exclusion principle (the chemical principle that decides the organization of electrons in atoms), the paired electrons have opposite spins. Magnetic levitation is possible when one can break down the correlation between these pairs of electrons and align them opposite to an external magnetic field. This split induces a transient magnetic field opposite in direction to the external magnetic field, which is called induced dipole moment. On the other hand, a paramagnetic response leads to the transient alignment of the unpaired electrons in the same direction as the external magnetic field. Several technological applications of the two phenomena will be included in my presentation.

Sustainable Anticorrosive Self-Healing Smart Coatings for Metal Protection

Chuanxing Zhan, Department of Chemistry and Biochemistry
Co- Author: Lauren Ware, Ken Lee, and Luyan Wang
Mentor: Dr. Suying Wei, Lamar University

Linseed oil is a natural renewable resource that can be considered as an alternative to the usage of fossil source. The example here is using the linseed oil to make polyurethane (PU) self-healing coating. The anticorrosive self-healing smart coating was prepared in two steps: first the diol linseed fatty amide, and second the polyurethane was synthesized by diol linseed fatty amide and tolylene-2,4-diisocyanate. FTIR and NMR were carried out to verify the structure. The self-healing coating with PU as the coating matrix and linseed oil based microcapsules will be tested on their anticorrosion performance and thermal stability properties.
Grant Recipient Award Reception
University Reception Center, John Gray Library
Wednesday, November 9, 2016
10:00 a.m. – 12:00 p.m.

Poster on the Hill 2016
Council on Undergraduate Research
Application due November 2, 2016

3rd Annual Humanities, Arts, Social Sciences and Education Conference
Galloway Building
Saturday, November 12, 2016
Abstract Submit Deadline: October 21, 2016
Registration Deadline: November 1, 2016

OUR Faculty Talk
Landes Auditorium, 1st Floor of Galloway Building
Dr. Kathy Fracastora, Professor of Economics & Finance
Thursday, November 17, 2016
3:30 p.m. – 4:30 p.m.

5th Annual Texas STEM Conference
See you next year!!!