

# MATHEMATICS

## Undergraduate

<b>Title:</b> 3-Body Orbital Resonance Study		<b>Presentation ID:</b> A89 – AN
<b>Author:</b> Jacody Coronado	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Tarleton State University	<b>Student Level:</b> Undergraduate	
<b>Co-Authors:</b> Aaron Kramer & Eric Manning	<b>Mentor(s):</b> Dr. Bryant Wyatt	
<p><b>Abstract</b>            Henri Poincare showed in 1887 that the general three-body problem has no analytical solution. Three-body systems can be chaotic, meaning that small variations in initial conditions can cause large variations in outcomes. This can lead to systems that have counterintuitive behavior. Here we investigate a specific case where two Earth-like ‘planets’ with the same radius and period are placed in orbit around a ‘Sun’. Intuition would suggest that the two small bodies would attract due to gravitational forces and eventually collide. What is observed is that the separation distance between the two planets oscillates and never drops to zero. This phenomenon of satellites affecting each other’s orbits in a periodic pattern is known as orbital resonance. The aim of this study is to investigate and analyze this orbital resonance.</p>		

<b>Title:</b> An Investigation Of Elementary Students’ Mathematics Misconceptions		<b>Presentation ID:</b> A90 – AN
<b>Author:</b> Deyanira Morales	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Texas A&M University International	<b>Student Level:</b> Undergraduate	
<b>Co-Authors:</b>	<b>Mentor(s):</b> Dr. Selina V. Mireles	
<p><b>Abstract</b>            Researchers suggest that mathematics misconceptions differ significantly from mistakes (Swan, 2001; Almeida, 2010). Whereas learning can be influenced by teacher-led error analysis and typically occurs further along the learning spectrum, learning through student- led diagnosis of misconceptions yields deeper understanding from the onset (Almeida, 2010).            The literature was reviewed to determine if an evidence-based list of common misconceptions exists. Furthermore, students from an elementary pre-service math course were asked to determine what they believed were common misconceptions.            Results show that there are common misconceptions. These common misconceptions are categorized according to Mathematics Standards.            This research will assist math elementary teachers in identifying when their students are most likely to encounter misconceptions. Then, the teachers may anticipate these situations and furthermore prepare and empower their students to tackle the misconceptions. These teachers can then develop strategies to identify when a misconception is forming. Consequently, teachers can modify their instruction to prevent the misconception from occurring.</p>		

<b>Title:</b> Formative Assessment In Introductory Calculus		<b>Presentation ID:</b> A91 – AN
<b>Author:</b> Jennifer Patterson	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Texas A&M University – Commerce	<b>Student Level:</b> Undergraduate	
<b>Co-Authors:</b> Rebecca Dibbs	<b>Mentor(s):</b> Rebecca Dibbs	
<p><b>Abstract</b>  One of the main reasons for the exodus in STEM majors can be traced back to the introductory calculus curriculum. Although there is evidence that curricula like CLEAR calculus promoted significant gains in students' growth mindset, it is unclear how this curriculum promotes mindset changes. The purpose of this case study was to investigate which features of CLEAR Calculus promoted positive changes in students' mindsets. After administering the Patterns of Adaptive Learning Scale to assess students' initial mindset in one section of calculus, four students were selected for interviews. Although participants were selected for maximal variation in their mindset at the beginning of the course, there were a lot of similar themes in their interviews. Students cited that CLEAR Calculus curriculum challenges them in ways that facilitates deeper comprehensive learning than that of a traditional calculus course. Students demonstrated strong growth tendencies regardless of mindset.</p>		

<b>Title:</b> Greener Energy		<b>Presentation ID:</b> A92 – AN
<b>Author:</b> Jorge Torres	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Texas A&M University – Kingsville	<b>Student Level:</b> Undergraduate	
<b>Co-Authors:</b>	<b>Mentor(s):</b> Dr. Sangsoo Lee and Dr. Hui Shen	
<p><b>Abstract</b>  Slowly the world moves to make improvements in everyday life by being responsibly green or sustainable. Of these improvements, the common engine has been modified and redesigned to accommodate our current demands. The research conducted will discuss an alternative way of obtaining common resources through use of a Combined Heating and Power (CHP) system. These resources of course are electricity, heating and cooling. I will introduce the benefits and advantages of obtaining a CHP system, through the analysis of Lucio Hall (dormitory) in Texas A&amp;M University – Kingsville campus. The analysis was concluded to have certain input and output specifications when compared to CHP systems that are available to the market. The goal is to set a new standard of living through cleaner and efficient engineering by use of a CHP system. The results that are to be expected should show further proof that this system is worth the investment. To prove this a selection of four average temperatures in Kingsville, one for every season, was taken and used in the calculations to see if it is as efficient and sustainable as can be. Currently these calculations are in its preliminary stages.</p>		

<b>Title:</b> Two-Body		<b>Presentation ID:</b> A93 – AN
<b>Author:</b> Gabriel Wedel	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Tarleton State University	<b>Student Level:</b> Undergraduate	
<b>Co-Authors:</b>	<b>Mentor(s):</b> Bryan Wyatt	
<p><b>Abstract</b>  In this study we are comparing popular integration techniques used in solving n-body problems. N-body problems, where n is greater than two, have no analytical solution. Therefore, we will be comparing the results of the different integrating methods with the exact solution of the two-body problem to determine accuracy. Large n-body problems will be simulated using each technique to study their qualitative behaviors. These many bodied simulations will be analyzed against known physical phenomena for accuracy of the bulk behavior. Conservation properties of the techniques, the speed of the simulation, and the ease of multi-threading will be compared using</p>		

modern GPU's. The goal of this study is to determine which technique is most applicable for a given n-body problem.

Master's

<b>Title:</b> Flavours Of Physics		<b>Presentation ID:</b> B89 – AN
<b>Author:</b> Nina Culver	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Tarleton State University	<b>Student Level:</b> Master's	
<b>Co-Authors:</b> Charles Tintera and Cheyenne McCoy	<b>Mentor(s):</b> Jesse Crawford	
<b>Abstract</b> Using data from CERN—the European Organization for Nuclear Research—obtained through the Kaggle Competition "Flavours of Physics," a statistical model was built in order to identify the possibility of a hypothetical situation where a certain particle decays into another particle. Using techniques in Python and RStudio, along with extensive research into this field of physics, the model was built with small chance of over fitting by including conceptual and physical factors. The current result of using this model has a 0.826793 accuracy, according to the leader board on Kaggle, but further optimization and research should yield a better result.		

<b>Title:</b> A Finite Difference Method For The Fitzhugh-Nagumo Equations		<b>Presentation ID:</b> B90 – AN
<b>Author:</b> Hongsong Feng	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Texas A&M University International	<b>Student Level:</b> Master's	
<b>Co-Authors:</b>	<b>Mentor(s):</b> Runchang Lin	
<b>Abstract</b> In this project, a special finite difference method is proposed to approximate traveling wave solutions of the FitzHugh-Nagumo equations. Consistency and stability of the method have been investigated. Numerical results are provided to illustrate the performance of the method. The threshold phenomenon of the neural system have also been studied numerically.		

<b>Title:</b> Detection And Tracking A Moving Object In A Video		<b>Presentation ID:</b> B91 – AN
<b>Author:</b> Chetana Nimmakayala	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Texas A&M University – Commerce	<b>Student Level:</b> Master's	
<b>Co-Authors:</b>	<b>Mentor(s):</b> Dr. Nikolay Sirakov	
<b>Abstract</b> Detection and tracking of a moving object in a video has a strong application in science, industry and security. The accurate detection and tracking a target in a video significantly decreases the time for searching a suspect. Such a work is done now by a human who observes the surveillance video by naked eye. Also, the tracking methods lie in the fundament of the upper level tasks such as gesture and event recognition. The main purpose of this study is to present the application of blob analysis and Gaussian mixture models to accurately track moving objects in a busy scene. We aim at detecting regions in frames which differ in properties, like brightness or color compared to its surrounding regions. All regions in a 'blob' are assumed to have similar properties, basically they are under motion. The theoretical concepts are validated in a MATLAB environment using multiple videos. Our future research will continue developing an app roach to aid the existing tool with possibilities to enhance the accuracy of object and its details identification.		

<b>Title:</b> Effectively Using Data Warehousing To Store Non-Profit Data	<b>Presentation ID:</b> B92 – AN
<b>Author:</b> Lain Tomlinson	<b>Discipline:</b> Mathematics
<b>Campus:</b> Tarleton State University	<b>Student Level:</b> Master's
<b>Co-Authors:</b> Juliann Booth and Parash Upreti	<b>Mentor(s):</b> Dr. Jesse B. Crawford
<p><b>Abstract</b>  In a world where databases are more frequently utilized, it is important to have data in an accessible place for authorized employees to be able to gain easy access to search and retrieve data. This can be an arduous task for smaller businesses without proper technology or funds. Using the techniques learned from the data mining program at Tarleton State, data was received from a small, non-profit business located in Tennessee and reformatted for easier access. The result was a database that is accessible on multiple computers and is built to prevent errors in the database such as duplications or double scheduling.</p>	

Doctoral

<b>Title:</b> A Unified Criterion Accounting For Void Coalescence Under Combined Tension And Shear		<b>Presentation ID:</b> B93 – AN
<b>Author:</b> Mohammad Torki	<b>Discipline:</b> Mathematics	
<b>Campus:</b> Texas A&M University	<b>Student Level:</b> Doctoral	
<b>Co-Authors:</b> Ahmed A. Benzerga & John-B. Leblond	<b>Mentor(s):</b> Ahmed A. Benzerga	
<b>Abstract</b> A micromechanics-based yield criterion is developed for a porous ductile material deforming by localized plasticity in combined tension and shear by internal necking or shearing. The model is obtained by limit analysis and homogenization of a cylindrical cell containing a coaxial cylindrical void of finite height, bounded by rigid volumes reminiscent of boundary conditions of a periodic nature. With the reference volume at hand, the given velocity field has supplied a totally analytical coalescence model for the first time. Plasticity in parts of the matrix is modeled using rate-independent J2 flow theory, and the effective dissipation function is calculated by exploiting an approximate volumetric averaging method as well as exact integration, the former leading to an elliptical function and the latter generating a combined function of the applied stress space embedding a hyperbolic function, simplified into the Gurson model for a similar unit cell. Due to the existence of algebraic singularities within the dissipation function, the complete model comprises a regular curved part seamlessly appended to a singular flat zone, the transition in between occurring without any vertices. Model predictions are compared with available finite-element based estimates of limit loads on similar cells under periodic boundary conditions. The condition of zero lateral void growth is relaxed at first sight to allow for pre-coalescence void growth ensued by post-coalescence in a unified manner. The yield function is privileged with point symmetry with respect to the origin of the stress space.		