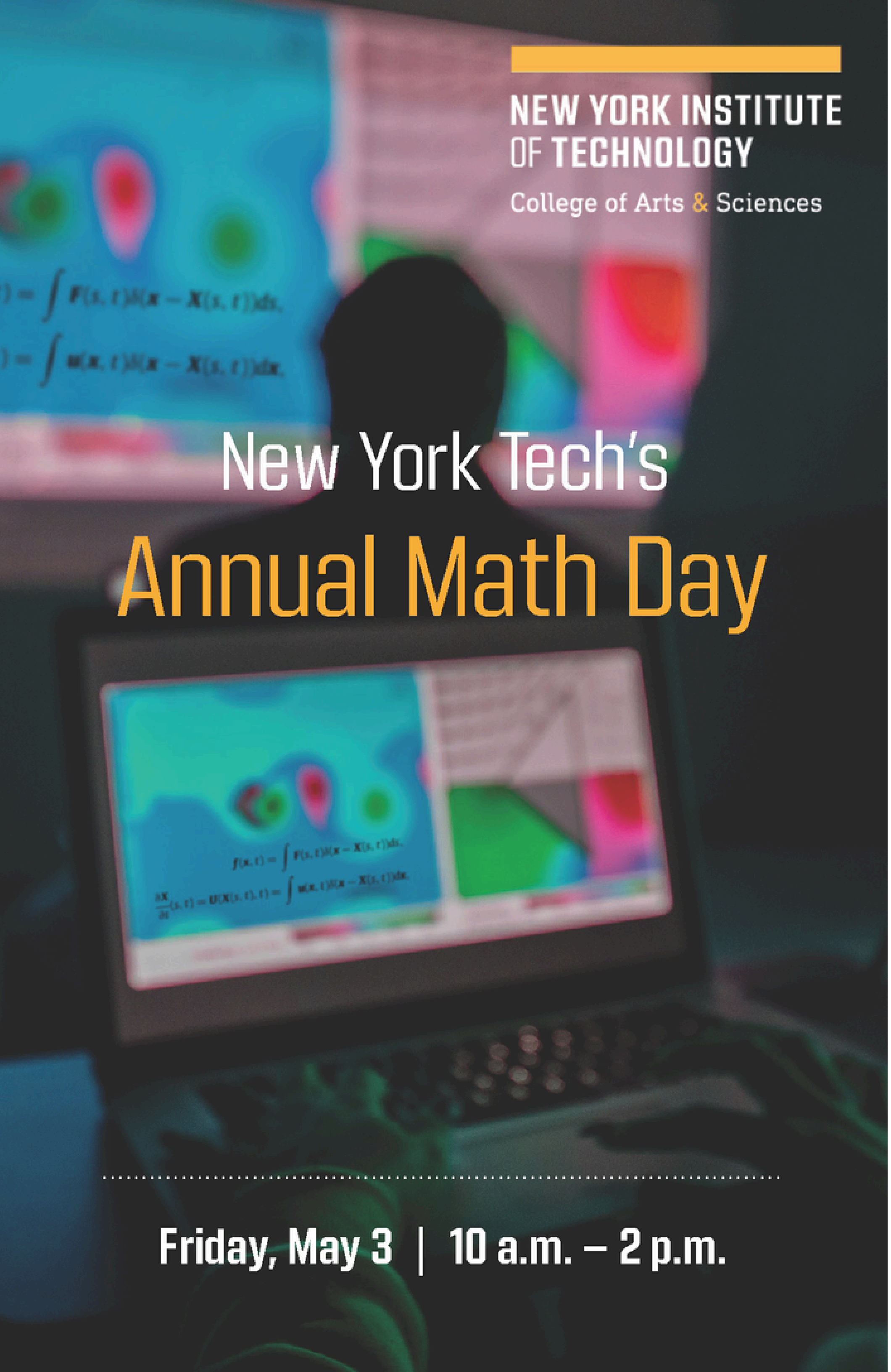

NEW YORK INSTITUTE OF TECHNOLOGY
College of Arts & Sciences

New York Tech's Annual Math Day

Friday, May 3 | 10 a.m. – 2 p.m.

Schedule

10 – 10:05 a.m.	Opening Remarks
10:05 – 10:15 a.m.	Why Math (by Vitaly Katsnelson)
10:15 a.m. – 12 p.m.	Student Symposium
12 – 1 p.m.	Lunch (provided) and Poster displays
1 – 1:15 p.m.	Math and Music (by Andrew Hofstrand)
1:15 – 1:55 p.m.	Math Games (fun math games recognizing winners)
1:55 – 2 p.m.	Concluding Remarks

Student Talks

10:15-10:30 a.m.

Polynomial Interpolation and Cubic Splines

Avery Gilson, Larosh Shaikh, Mark Farley

Abstract

Polynomial interpolation is a fundamental technique in numerical analysis used to approximate a function by fitting a polynomial that passes through a given set of data points. Given a set of distinct points (x0, y0), (x1, y1), . . . ,(xn, yn), polynomial interpolation seeks to find a polynomial function P(x) of degree n or less that satisfies P(xi) = yi for all i = 0, 1, . . . , n. This technique finds widespread applications in various fields such as engineering, computer graphics, and scientific computing. However, while polynomial interpolation can provide accurate approximations for well-behaved functions, it may exhibit undesired behaviors such as oscillation or divergence for certain datasets, prompting the exploration of alternative interpolation methods like spline interpolation. Overall, polynomial interpolation stands as a powerful tool for function approximation, offering a balance between simplicity and accuracy in numerical computations. This work is based on a course project in NYIT's Math 330: Computational Analysis Spring Semester 2024.

Bios

Larosh Shaikh is currently a fourth year Applied and Computational Mathematics (B.S.) student at New York Tech whose primary research interest is in Machine Learning. He hopes to use that knowledge to help contribute to algorithm analysis in the future.

Avery Gilson is a junior majoring in Physics (B.S.) with a minor in Mathematics at NYIT who has always been fascinated by physics and the language of math that is used to describe it. He is most interested in experimental optics and mathematical physics and hopes to go to graduate school upon graduation to obtain a PhD in Physics.

Mark Farley is a senior Computer Science major (B.S.) at NYIT who also chose to get a minor in Mathematics as mathematics is something that has always interested him in school. He is planning to try and get a job in the field of cybersecurity.

10:30-10:45 a.m.

Cracking the Complexity: Discrete Optimization Explored

Austin Stietzel

Abstract

This talk explores discrete optimization, a field with applications ranging from logistics to resource allocation. By illustrating optimization challenges in various industries, from delivery route optimization for companies to resource allocation in cloud computing, the groundwork for understanding discrete optimization is laid out. Through examples such as the traveling salesperson problem and the knapsack problem, the importance of formulating constraints that ensure solutions meet the practical requirements of the problem is emphasized. By applying real-world applications and fundamental problem formulation, this talk gives a concise yet comprehensive exploration of discrete optimization.

Bio

Austin Stietzel is a graduate student finishing his M.S. in Electrical and Computer Engineering at New York Tech. He is currently involved in many projects, including patent prototyping through the NYIT ETIC for NASA, a flood/network modeling project with Dr. Cecelia Dong, and his M.S. thesis. His thesis is on solving optimization problems focused on edge/cloud computing, which is why he chose to share an introductory talk on discrete optimization.

10:45-11:00 a.m.

Game of Cycled on Maximal Planar Graphs

Aakash Gurung

Abstract

We investigate the properties of specific maximal planar graph and how the game of cycles introduced by Su (2020) is played on such maximal planar graphs. Our approach involves analyzing the invariant properties of these graphs and the associated matrices to establish winning strategies in a two-player mode.

Bio

Aakash Gurung is currently studying Mathematics at LaGuardia Community College CUNY. As of now, he is interested in algorithmic fields of mathematics. He hopes to learn more about geometry and its connection to Physics in the near future.

11:00-11:15 a.m.

Sequential Failure Model of Carbon-Epoxy Composite Lamina in Type-IV Hydrogen Gas Storage Vessels

John Estrella; Mentor: Prof. Urmi Duttagupta; project proposed by Akash Kumar Burolia, under the supervision of Dr. Swati Neogi

Abstract

During the past decades, the population has become increasingly aware of the harms of fossil fuels for our environment and how limited their reserves currently are. It’s estimated that by 2060 we will run out of this type of fuel if we don’t find any more reserves and if we continue to deplete their reserves at the current rate we do. This will cause global warming which will disrupt ecosystems and threaten different species survival due to habitat loss, change in migration patterns, etc. Some small parts of big cities such as NYC might be underwater Because of this in the near future. There has been increasing efforts in finding safer alternatives for fossil fuels such as wind energy, solar energy, and last but not least hydrogen energy. Hydrogen is the most abundant element in the universe and one of the most abundant elements on earth. It’s a renewable, zero-emissions source that we can take advantage of and that we can take straight from the ocean. However, there are a lot of problems with the process of manufacturing, storing, distributing, and utilization that we need to find solutions for.

My project is about the carbon-epoxy composite laminas for storage of compressed hydrogen in type-IV hydrogen vessels. My objective was to improve a computer program that finds out the first ply failure code to find the rest of plies that fail until the last one. The carbon fibers plies are unilateral and plies have different orientation and are stacked on top of each other. We used the Tsai-wu failure criterion for testing the strength ratio of each lamina and determining the first ply for them. After this, we recalculate our values but now without the previous failed ply. After a lot of testing, based on the first time running the code, you can tell the sequence of the plies that are going to fail without needing to recalculate. This model since we are combining the power of computer and theory to simulate real physical experiments can save time and resources due to its reusability and can help determine the optimal orientation of laminas so that we get the most out of each lamina and have the most possible strength in the composite so it can handle the most amount of pressure.

Bio

John Estrella is a student at New York City College of Technology CUNY with an Associate's Degree in Computer Science. Currently, he is pursuing a bachelor's degree in applied mathematics. Additionally, he was honored to be a recipient of the National Research Foundation (NSF) S-STEM scholarship. He enjoys solving problems and has a deep passion for learning new things from different topics in STEM. Over this winter break, we were given the privilege and opportunity to visit India on a research and cultural trip with our mentor, Urmi Duttagupta. We stayed at the Indian Institute of Technology, Kharagpur. While there, we worked alongside the chemical engineering department under the supervision of Dr. Swati Neogi and three of their PhD students. This research project was proposed by Akash Kumar Burolia, and it’s an ongoing project.

11:15-11:30 a.m.

How to Determine the Monthly Social Security Benefit

Jiale Lin

Abstract

In this project, we will learn how to determine the monthly social security benefit. Social Security is a social insurance program run by the government. It provides continuing payment to retired workers aged 62 or older, disabled workers and their dependents and survivors. The most of social security benefit is paid by current employees and employers. Using the combination of function graph and formula, we determine monthly social security benefits through three steps: Average Indexed Monthly Earnings (AIME), Primary Insurance Amounts (PIA), and Monthly Benefit Amounts. Meanwhile, considering the inflation and changes in the value of currency, we need to find different inflation indexes. During research, we also found some current issues of social security benefits: Population Ageing and Birth Rate Decline Finally, we could easily get someone's monthly insurance amount by formula and graph

Bio

Jiale Lin is currently a freshman at LaGuardia Community College CUNY. Although his major is in Electrical Engineering, Jiale's passion gravitates toward mathematics as the subject resonates with his analytical spirit. He appreciates the elegance of mathematical formulas, not for memorization but rather for creative imagination. As Jiale navigates through the formative stages of his education, he is in pursuit of his true calling for seeing more mathematics in Electrical Engineering and mastering the knowledge that bridges these two realms.

11:30-11:45 a.m.

Steady Coherent States in Rayleigh-Bénard Convection at Infinite Prandtl Number

Abdul Raafay Irfan

Abstract

Rayleigh-Bénard convection (RBC), a classical problem in fluid dynamics, plays a significant role in a wide range of phenomena across engineering, geophysics, and astrophysics. This problem has been studied extensively to gain insights into the development of turbulence.Recent investigations show that steady solutions share many features with the turbulent RBC from direct numerical simulations and form the state space skeleton of the turbulent dynamics.This study focuses on the steady convection roll solutions for two-dimensional RBC at infinite Prandtl number between no-slip boundaries. We compute the steady solutions using Newton's method and vary the domain aspect ratio to seek the steady solution achieving the maximal heat flux. The computations have been conducted at a Rayleigh number of 10^8. Future work will extend these computations to the infinite-Rayleigh-number limit, aiming to elucidate the asymptotic behavior of heat transport in these steady coherent solutions.

Bio

Abdul Raafay Irfan is a dedicated Mechanical Engineering: Aerospace Major currently in his junior year at the prestigious Old Westbury Campus of New York Tech. Hailing from Pakistan, Abdul is an international student with a fervent passion for the realms of outer space and the intricate machinery that facilitates our journey into it. From a young age, Abdul's fascination with the cosmos ignited a profound curiosity that has since been the driving force behind his academic pursuits. His affinity for mathematics has been unwavering, finding solace and fulfillment in the elegance of completing equations and unraveling the complexities of theorems.

In addition to his primary field of study, Abdul is committed to broadening his intellectual horizons by pursuing a minor in mathematics, recognizing its indispensable role in advancing his understanding of aerospace engineering. Embracing the opportunities afforded by New York Tech, Abdul aspires to cultivate his potential exponentially, striving for excellence in both academic and research endeavors. His dedication and academic prowess have earned him the esteemed privilege of presenting his research at the inaugural Annual Math Day, a testament to his commitment to scholarly advancement. With a steadfast determination and a boundless enthusiasm for exploration, Abdul Raafay Irfan stands poised to make significant contributions to the field of aerospace engineering, exemplifying the spirit of innovation and academic excellence at New York Tech and beyond.

11:45 a.m.-12:00 p.m.

Markov Chain Monte Carlo - Cholesky Decomposition

Sey Kim

Abstract

The paper explores the Cholesky decomposition as a technique for generating correlated random variables from a given covariance matrix. By decomposing the covariance matrix into a lower triangular matrix and using it to transform independent standard normal random variables, the method effectively produces random variables with the desired correlations, as demonstrated through Python simulations involving 2x2 and 3x3 matrices under different covariance scenarios. The results emphasize the importance of Cholesky decomposition in realistic modeling and analysis across various domains.

Student Poster Session

12:00-1:00 p.m.

Approximate Solutions of a Nonlinear Mathematical Pendulum
Dayshaun Kalra

Principal Component Analysis
Spencer Newman, Greta Sarno

ETIC MATH CHALLENGE
Pranaav Venkatasubramanian

Applications of Differential Equations to Electrical Circuits
Maleshia Motilall

Linear Regression and Gradient Descent
Faraz Khan, Kyle Stephens

Dynamics of HIV Infection
Anna Dykhno

Assessing the Economic Feasibility of a 100% Renewable Energy City
Jiale Lin