# MAA - FL SUNCOAST REGIONAL MEETING XLIV
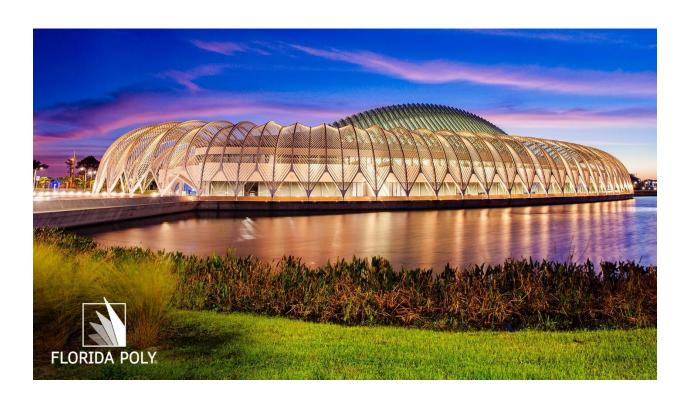
## PROGRAM AND ABSTRACTS

Florida Polytechnic University
December 2, 2022

# PROGRAM

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| **12:00 - 1:50** | **Registration / MAA Book Display** | ARC Atrium |

Greg McColm, USF
Florida Poly Students, Staff

**2:00 - 2:20**    **Session I**

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|---|---|
| ***Smooth Transition Functions in Multiple Dimensions*** | ARC 1123 |
| Charles Dalton — Florida Southwestern | |

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|---|---|
| ***A Survey on the Application of Deep Neural Network in Kalman Filtering*** | ARC 1158 |
| Wisdom Ogala — UCF | |

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|---|---|
| ***Examining Teacher Candidates Content Knowledge in a Middle Grades Mathematics Methods Course*** | IST 1067 |
| Ruthmae Sears — USF | |
| Sandra Vernon-Jackson – USF | |
| Renate McWilliam — University of The Bahamas | |

**2:30 - 2:50**    **Session II**

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|---|---|
| ***Advancements in Smoothed Polynomial Histograms*** | ARC 1123 |
| Galen Papkov, FGCU | |

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| ***Convergence of Solutions of the BBM and BBM-KP Model Equations*** | ARC 1158 |
| Jacob B. Aguilar — St. Leo | |

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|---|---|
| ***Teacher Candidates' Perspectives on Using Technology in Mathematics, and Factors that Can Impact their Decision to Use It*** | IST 1067 |
| Ruthmae Sears — USF | |
| Sandra Vernon-Jackson – USF | |
| Cynthia Castro-Minnehan — USF | |

**3:00 - 3:20**    **Session III**

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| ***Idempotents in quandle rings and Invariants of knots*** | ARC 1123 |
| Dipali Swain — USF | |

**3:00 - 3:20**  **Session III, cont.**

***Uniqueness of the Solution to the Inverse Problem of***     ARC 1158
***Scattering Theory for Eigenparameter Dependent Discrete***
***Sturm-Liouville Equation***
Turhan Koprubasi — Kastamonu University
Ram Mohapatra — UCF

***Triangular Numbers as a Generator for Pythagorean Triples***     IST 1002
Michael A. Long — Polk State College

***Statistical Anatomy of Four Stock Market Crashes***     IST 1064
Ted Andresen — Honeywell Aerospace & St. Petersburg
College (ret.)

***The impact of COVID-19 pandemic on students'***     IST 1065
***performance in Calculus I course***
Katiuscia Teixeira — UCF

***Internships for Math Majors***     IST 1067
Monika Kiss — St. Leo
Jacci White — St. Leo

**3:30 - 3:50**  **Session IV**

***The Shape of Water – A Shallow Dive into Variational***     ARC 1123
***Calculus***
Aaron Bardall — Florida Polytechnic University

***Existence, Uniqueness, and Positive Solutions of a Nonlinear***     ARC 1158
***Fractional Differential Equation with Riemann-Liouville***
***Derivatives***
Jaffar Ali Shahul Hameed — FGCU

***Classifying Situations with Polyhedra***     IST 1002
Joy D'Andrea — USF

***Real Data Dirven Predictive Model for Parkinson's Disease***     IST 1064
Malinda Iluppangama — USF

**3:30 - 3:50**     **Session IV, cont.**

*The Tools of Education and their Impact* [start]     IST 1065
Eric Torres — Santa Fe College

*Making Calculus Accessible* [start]     IST 1067
Vincent Matsko — Eckerd

**4:00 - 4:20**     **Session V**

*Using topological data analysis to visualize NFL play data in*     ARC 1123
*an undergraduate mathematics seminar course*
Justin Hoffmeier — Florida Polytechnic University

*A Different Perspective of Lewy's 1957 Example*     ARC 1158
Arthur David Snider — USF

*Autonomous Vehicles Testing and Verification*     IST 1002
Ala' J. Alnaser — Florida Polytechnic University

*Parametric and Nonparametric Survival Analysis of Non-*     IST 1064
*Epithelial Ovarian Cancer*
Ranju Karki — USF

*The Tools of Education and their Impact* [cont.]     IST 1065
Eric Torres — Santa Fe College

*Making Calculus Accessible* [cont.]     IST 1067
Vincent Matsko — Eckerd

**4:30 - 4:50**     **Session VI**

*Prodsimplicial Homology for Directed Graphs*     ARC 1123
Lina Fajardo Gomez — USF

*Engineering Implications of Tychonov's 1935*     ARC 1158
*Nonuniqueness Example*
Arthur David Snider — USF

*Trilevel Network Interdiction Game for the Minimum-Cost*     IST 1002
*Flows Problem with Interdependent Networks*
Adam Rumpf—Florida Polytechnic University

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| **4:30 - 4:50** | **Session VI, cont.** | |
| | ***A Mathematical Driven Optimization Method in Finance Problem Based on Desirability Function*** <br> Jayanta K. Pokharel — USF <br> Erasmus Tetteh-Bator — USF <br> Chris P. Tsokos — USF | IST 1064 |
| | ***Incorporating Data Analytics into the Math Department*** <br> Jazmine Everheart — Florida Southern College <br> Susan Serrano — Florida Southern College <br> Dan Jelsovsky — Florida Southern College | IST 1065 |
| | ***Team-Based Inquiry Learning in Computational Linear Algebra at Florida Poly*** <br> Jared Bunn — Florida Polytechnic University | IST 1067 |
| **5:00 - 5:05** | **Welcome** <br> Dr. Terry Parker <br> Provost and Executive Vice President <br> Florida Polytechnic University | IST 1067 |
| **5:05 - 5:50** | **Plenary Session** | |
| | ***Data Science: from improving sports performance to predicting disease outbreaks*** <br> Michael Dorff <br> Professor of Mathematics at Brigham Young University <br><br> The world is becoming more data driven with cell phones, GPS, Google, and social media. This data can be used to improve things from the performance of athletes to predicting disease outbreaks. Data science is growing fast, and in this talk we will give an overview of this topic. | IST 1067 |
| **6 - 7:15** | **Dinner** | |
| | By reservation only | ARC 2200 |
| **7:15 - 7:30** | **Closing Remarks** | ARC 2200 |
| | Greg McColm — USF | |

# ABSTRACTS

**In ARC 1123:**

Charles Dalton — Florida Southwestern
***Smooth Transition Functions in Multiple Dimensions***                     2:00 pm

A smooth transition function connects two separated functions respective to their domain through an infinitely differentiable and continuous function. In this discussion, we share some examples of a smooth transition function applied to multiple dimensions.

Galen Papkov — FGCU
***Advancements in Smoothed Polynomial Histograms***                     2:30 pm

Smoothed polynomial histograms efficiently estimate distributions for pre-binned or massive datasets by generating an approximation that matches binned sample moments. Bonferroni simultaneous confidence intervals can account for the sampling error, resulting in improved density estimates.  Smoothed wavelet histograms will also be introduced.

Dipali Swain — USF
***Idempotents in quandle rings and Invariants of knots***                     3:00 pm

A Quandle is a non-associative algebraic structure whose binary operation models the three Reidemeister moves in Knot theory. Given a quandle, one associates its quandle ring which is an interesting structure since it allows performing linear algebra on it.  The most naturally occurring objects in quandle rings are idempotents.  We study these objects and investigate when such a collection of objects itself forms a quandle and hence use it to define an invariant of knots/links.

Aaron Bardall — Florida Polytechnic University
***The Shape of Water – A Shallow Dive into Variational Calculus***                     3:30 pm

We will analyze the shape a droplet of fluid will take absent a container. Will it form a flat puddle or a round droplet? We will use variational calculus to analyze the profile of a two-dimensional droplet and it's transition from small droplet to large puddle.

Justin Hoffmeier — Florida Polytechnic University

***Using topological data analysis to visualize NFL play data in an undergraduate mathematics seminar course*** 4:00 pm

Topological Data Analysis (TDA) utilizes results from algebraic topology to infer robust qualitative information about the structure of a point cloud. Using a TDA clustering technique, Mapper, we construct a map of National Football League (NFL) play data provided from a partnering NFL data analytics firm, Pro Football Focus. This work was completed as part of an undergraduate seminar course in coordination with the MAA, SIAM, and NSF program, Preparation for Industrial Careers in Mathematical Sciences.

Lina Fajardo Gomez — USF

***Prodsimplicial Homology for Directed Graphs*** 4:30 pm

We propose prodsimplicial complexes, which are constructed by attaching cells corresponding to products of transitive tournaments, to apply topological data analysis on acyclic directed graphs. We investigate the types of cycles that generate nontrivial homology as well as the effects of certain changes in the complexes on the homology.

**In ARC 1158:**

Wisdom Ogala — UCF

***A Survey on the Application of Deep Neural Network in Kalman Filtering*** 2:00 pm

Kalman Filtering is a class of sequential algorithms used for extracting more accurate estimate of the state of a noisy dynamical system based on the observations made by noisy sensors. We will discuss the state-of-the-art deep-neural network application to Kalman Filtering, open problems and research directions based on existing literatures.

Jacob B. Aguilar — St. Leo

***Convergence of Solutions of the BBM and BBM-KP Model Equations*** 2:30 pm

In this work, it is shown that the solution of the Cauchy problem for the BBM-KP equation converges to the solution of the Cauchy problem for the BBM equation in a suitable function space, provided that the initial data for both equations are close as the transverse variable $y \to \pm\infty$.

Turhan Koprubasi — Kastamonu University; Ram Mohapatra — Kastamonu University & UCF

***Uniqueness of the Solution to the Inverse Problem of Scattering Theory for Eigenparameter Dependent Discrete Sturm-Liouville Equation*** 3:00 pm

In this study, the uniqueness of the solution of the discrete Sturm-Liouville equation with a eigenparameter dependent boundary condition is mentioned as a inverse problem of the

scattering theory. We will present the results including the main equation and the scattering data set of this boundary value problem.

Jaffar Ali Shahul Hameed — FGCU
***Existence, Uniqueness, and Positive Solutions of a Nonlinear Fractional Differential Equation with Riemann-Liouville Derivatives***                                            3:30 pm
Using Banach's contraction principle and Schauder's fixed point theorem, the authors establish results on the existence and uniqueness of solutions to a fractional boundary value problem of order $1 < r < 2$. We use the Avery–Peterson fixed point theorem to prove the existence of multiple positive solution to the problem. As an application, we prove the existence of at least two positive solutions to a model of hematopoiesis (red blood cell production).


Arthur David Snider — USF
***A Different Perspective of Lewy's 1957 Example***                                            4:00 pm
Inconsistency in linear systems is commonplace – a fact that may shortsightedly undervalue the significance of Lewy's startling example (1957) of a complex linear partial differential equation with no solution. We cite real versions of the example, underscoring its milestone stature.


Arthur David Snider — USF
***Engineering Implications of Tychonov's 1935 Nonuniqueness Example***                     4:30 pm
We survey some recent commentary regarding Tychonov's surprising demonstration of nonuniqueness of solutions to the one dimensional heat equation in an infinitely long rod; specifically, we critique and speculate on additional (nonverifiable) conditions that restore uniqueness, a painstaking numerical simulation, and some metaphysical interpretations.



**In IST 1002:**


Michael A. Long — Polk State College
***Triangular Numbers as a Generator for Pythagorean Triples***                               3:00 pm
Initially, it was observed that with some Pythagorean Triples, each of the middle numbers, which represents the longer leg of a right triangle, was always four times a triangular number. Furthermore, the shorter leg was an odd number and the hypotenuse was one more than the longer leg. The question emerged as to whether all of the Pythagorean Triples could be generated using the triangular numbers. A proof of this along with a connection to Euclid's generating formula will be shared.


Joy D'Andrea — USF
***Classifying Situations with Polyhedra***                                                   3:30 pm
In this talk we will present an extension of Euler's Polyhedral Theorem for classifying polyhedra. We will present four cases of this extension concept. Applications of these cases will be discussed.

Ala' J. Alnaser — Florida Polytechnic University
***Autonomous Vehicles Testing and Verification: A Mathematical Point of View***     4:00 pm
Autonomous Vehicles can profoundly change our daily commute and more. Progress in AI and sensory technologies are turning this once science fiction concept into fact. However, work is still needed to test  AV's. Mathematically defining test scenarios and equivalence classes for tests may potentially answer several currently open questions.

Adam Rumpf — Florida Polytechnic University
***Trilevel Network Interdiction Game for the Minimum-Cost Flows Problem with Interdependent Networks***     4:30 pm
We consider a game theoretic model for planning the optimal set of fortifications to a collection of interdependent civil infrastructure networks (which could include transportation, telecommunications, electrical power, etc.) against a targeted attack or worst-case natural disaster. Exact solution and approximation algorithms are explored for the resulting multilevel optimization model.

**In IST 1064:**

Ted Andresen — Honeywell Aerospace & St. Petersburg College (ret.)
***Statistical Anatomy of Four Stock Market Crashes***     3:00 pm
Besides Black Monday in 1987 there have been three rapid declines in the SPY stock index.  The Dot-Com Crash of 2000, the Crash of 2008 and the COVID Crash of 2020 will be analyzed.   All the crashes exhibit statistical similarities that may be of use to the average investor.  A novel method for anticipating an impending slide will be presented and applied to each crash.

Malinda Iluppangama — USF
***Real Data Dirven Predictive Model for Parkinson's Disease***     3:30 pm
Our objective is to develop a real data driven statistical model that given a set of risk factors will classify a patient having or not having Parkinson's disease. The proposed method is a binary logistic regression model with a 98% accuracy.

Ranju Karki — USF
***Parametric and Nonparametric Survival Analysis of Non-Epithelial Ovarian Cancer***     4:00 pm
The objective of the present study is to identify the probability distribution function (PDF) that characterizes the probabilistic behavior of the survival times of 276 non-epithelial ovarian cancer (NEOC) patients. Parametrically, 3P-lognormal PDF best characterizes the data. The Kernel Density method, and Kaplan-Meier method were used and compared with each other.

Jayanta K. Pokharel, Erasmus Tetteh-Bator & Chris P. Tsokos — USF
***A Mathematical Driven Optimization Method in Finance Problem Based on Desirability***
***Function*** 4:30 pm
A mathematical driven optimization method based on desirability function is effectively applied in finance problem. The present study offers insight to investors and companies for managerial strategic planning based on utilizing over analytical findings to maximize the profit of their investments. Real data is used to illustrate our results.

**In IST 1065:**

Katiuscia Teixeira — UCF
***The impact of COVID-19 pandemic on students' performance in Calculus I course*** 3:00 pm
The present study investigated the impact of COVID-19 pandemic on students' academic performance in Calculus I course at UCF. Students' performance data from Spring 2017 to Fall 2021 were collected, compared, and analyzed. The results suggest the need for change pedagogical plans to better educate, retain, and graduate STEM students.

Eric Torres — Santa Fe College
***The Tools of Education and their Impact*** 3:30 pm
Why do we need to be experienced in change to best use current and emerging Technology? I will talk about how we as educators can harness current technology. Yet why me must have our eyes equally on the horizon because the emerging technology could transform our society with of equity.

Jazmine Everheart, Susan Serrano & Dan Jelsovsky — Florida Southern College
***Incorporating Data Analytics into the Math Department*** 4:30 pm
Increasingly, students' main criterion for choosing majors is employment prospects.  This is problematic for math departments where career opportunities are often misunderstood. Data Analytics is a rapidly growing, high paying field, whose practitioners need significant amounts of math and statistics. Pairing math with analytics creates a symbiotic relationship.

**In IST 1067:**

Ruthmae Sears; Sandra Vernon-Jackson — USF; Renate McWilliam — University of the Bahamas
***Examining Teacher Candidates Content Knowledge in a Middle Grades Mathematics Methods Course*** 2:00 pm
In this presentation, we describe teacher candidates' performance on a mathematical content knowledge exam focused on middle grades mathematics and how the results were used for programmatic improvement. The results highlight the need to develop teacher candidates' knowledge of geometric reasoning, number sense, and operations.

Ruthmae Sears; Cynthia Castro-Minnehan; Sandra Vernon-Jackson – USF
***Teacher Candidates' Perspectives on Using Technology in Mathematics, and Factors that Can Impact their Decision to Use It*** 2:30 pm
We describe secondary mathematics teacher candidates' perspectives on using technology in mathematics and factors influencing their willingness to integrate technology during instruction. Particularly, we will: describe the importance of technology in mathematics teaching and learning, share survey results, and consider the implications for teacher preparation.

Monika Kiss & Jacci White — St. Leo
***Internships for Math Majors*** 3:00 pm
This session will be a round table type opportunity for faculty to share the internships their students have experienced. This might include where to look for internship opportunities, documentation and assignments associated with internships, pitfalls to be aware of, positives to look for, etc. The presenters will bring the documentations/contracts they use for internships. The intent is that all faculty will walk away ideas to increase the number and value of internships for their mathematics students.

Vincent Matsko — Eckerd
***Making Calculus Accessible*** 3:30 pm
Many students find mainstream calculus textbooks unreadable. Learn about a project to create an open-source textbook which (1) emphasizes concepts over algebraic manipulation, (2) uses informal language rather than precise mathematical language, (3) illustrates extensively with graphs (static and interactive), and (4) organizes concepts pedagogically rather than adhering to mathematical formalism.

Jared Bunn — Florida Polytechnic University

***Team-Based Inquiry Learning in Computational Linear Algebra at Florida Poly***        4:30 pm

Team-Based Inquiry Learning (TBIL) is a new way to engage students in mathematics by combining Inquiry-Based Learning and Team-Based Learning. This talk describes the presenter's experience incorporating TBIL into two sections of Computational Linear Algebra in Fall 2022. We discuss TBIL preparation, supporting materials, and a typical day using TBIL.

Michael Dorff — Brigham Young University

***Data Science: from improving sports performance to predicting disease outbreaks***        5:05 pm

The world is becoming more data driven with cell phones, GPS, Google, and social media. Over 90% of all the data in the world was created in the past 2 years. This data can be used to improve things from the performance of athletes to predicting disease outbreaks. This area is known as data science, and it is growing fast. Mathematics, statistics, and computer science form the foundation of data science. In this talk we will give an overview of this topic with online resources to begin to learn more about data science and some examples of problems that can be investigated.



Michael Dorff is the past President of the MAA and a professor of mathematics at Brigham Young University. He earned his Ph.D. in complex analysis from the University of Kentucky. He is interested in promoting mathematics to the general public, in math careers in industry, and in undergraduate research. He co-directs the MAA PIC Math program (Preparation for Industrial Careers in the Mathematical Sciences), was the founder of CURM (Center for Undergraduate Research in Mathematics), and is currently the executive director of TPSE Math. He is a Fellow of the American Mathematical Society (AMS), a CUR Fellow (Council on Undergraduate Research), a Fulbright Scholar in Poland, and a member of the steering committee for the East African Centre for Mathematical Research in Uganda.