Mathematical Association of America
MD-DC-VA Section, April 23-24, 2021
Virtual
Abstracts

Abstracts for the workshop and invited addresses are listed first. This is followed by the abstracts for faculty and professional contributed talks. The middle includes the abstracts for student contributed talks. The student poster abstracts are listed at the end. Each list is in alphabetical order by the presenters last name.

Invited Addresses

FRIDAY WORKSHOP

Kendra Pleasant, Syafrida Syafrida, Ahlam Tannouri, Morgan State University

Why Do I Need to Take This Math Class? Engaging Students in Mathematics Using Culturally Responsive Teaching

4:00 PM, Workshop Zoom Room

We will introduce the five principles of Culturally Responsive Teaching; we will present several varied applications that integrate students' interests and lived experiences and share our experiences using CRT instructional practices in the classroom. Hands-on activities and applications will be drawn from engineering, biology, music, and architecture.

SATURDAY INVITED ADDRESSES

Anna Ying Pun, University of Virginia

Splendor in the Graphs

***8:30* AM, Zoom Room 1**

Algebraic combinatorics is a subject that interprets algebraic objects combinatorially, thereby obtaining deep connections between the two areas. The study of polynomial rings is one of the important topics in algebraic combinatorics, as the associated combinatorial tools provide profound connections with partitions of integers and the representation theory of the symmetric group, the general linear group, Hecke algebras, and other important algebras. It also gives fruitful information on objects in algebraic geometry such as the multiplicative structure of the cohomology ring of the Grassmannian. In this talk, I will introduce the ring of symmetric functions and discuss some important basis, with a more detailed discussion on Schur functions and semi-standard Young tableaux. I will then discuss some important theorems and open problems in Algebraic Combinatorics and end with a brief history of k-Schur functions and an exciting new family of symmetric functions called Catalan functions which provides a new insight on the existing theorems and conjectures inspired by Macdonald positivity conjecture.

Paul Patrone, National Institute of Standards and Technology

Take Data Analysis Seriously: You might Save Lives

***3:50* PM, Zoom Room 1**

Data analysis is such a common practice in scientific disciplines that its importance is easy to overlook. Yet, it is also the lens through which we extract meaningful information from experiments. Thus, it has the potential to bias, or even corrupt, the conclusions that we draw. In this talk, I consider two real-world examples where poor data analysis can lead to incorrect detection of COVID-19 and thereby endanger lives. The first example considers the roles of baseline subtraction and thresholds in quantitative polymerase chain-reaction (qPCR) measurements, the mainstay tool for early detection of the SARS-CoV-2 virus. I compare standard empirical (e.g. linear) data analysis models against a physics-based counterpart to illustrate how the latter can detect SARS-CoV-2 in cases where the former does not. The second example considers the task of mathematical classification as it pertain SARS-CoV-2 antibody testing. I discuss how a modeling-based approach rooted in conditional probability and optimal-decision theory improves the classification accuracy by up to a decade relative to traditional methods, which were originally developed for enemy aircraft detection during WWII. The key theme linking these examples is the observation that data analysis is ultimately an exercise in mathematical modeling. To the degree that we can improve our understanding and models of the underlying physical systems, we can more reliably extract useful information from measurements. Often, such approaches require interdisciplinary interactions and input from related fields such as physics, chemistry, biology, and metrology. Thus, a broader goal of this talk is to highlight a critical but often overlooked need to embed applied mathematicians in settings where they can bring more rigor and concentration to tasks such as data analysis.

Contributed Faculty Papers by Author

Abdinur Ali, Norfolk State University
Mushtaq Khan, Norfolk State University
Statistical Analysis of imperceptible Data in Digital Images
3:00, Zoom Room 1
Internet users transmit sensitive data which is embedded in images through the Internet without drawing any attention. Sometimes, the concealed data is used to work as a malware to infect other computer systems. In this talk, statistical analysis of clean digital images and the same digital images carrying encrypted data was investigated. Additionally, the detectability, and resistance to detectability of different data hiding methods were examined.
Content Area: Applied Mathematics
Recommended for Students: Yes

Jathan Austin, Salisbury University
Emelie Curl, Christopher Newport University
Combinatorics and Graph Theory in Simple Blokus
9:45, Zoom Room 3
In this talk, we will explore "Simple Blokus," a simplified two-player version of the game Blokus played on a 3-by-3 grid. We will discuss how to count all of the possible final game boards and how this counting problem can be translated into graph theoretical and combinatorial problems.
Content Area: Combinatorics/Graph Theory/Recreational Mathematics
Recommended for Students: Yes

Mark Branson, Stevenson University
Math for the People - Quantitative Literacy for Social Justice
11:00, Zoom Room 4
Math for the People is a collaborative textbook project which aims to create a new, freely available, interactive textbook which introduces students to mathematics concepts through social justice applications. Each module, collaboratively authored by members of the QR community, will introduce students to a social justice topic and then guide them through exploring that topic using mathematics. In this talk, we'll discuss the project, our timeline, and how you can be involved in creating this exciting new text.
Content Area: Quantitative Literacy
Recommended for Students: Yes

Bud Brown, Virginia Tech
Three gems from three giants of recreational mathematics
10:10, Zoom Room 3
The three pairs of gems and giants of the title are Elwyn Berlekamp's double-dealing strategy for the game Dots and Boxes, Ron Graham and parties of six, and Martin Gardner's favorite puzzle — namely, the monkey and the coconuts -- and how one of the puzzle's first appearances drove a magazine editor crazy.
Content Area: Recreational Mathematics
Recommended for Students: Yes

Jim Case, Unaffiliated
May the Best Team Lose
10:35, Zoom Room 3
Both MLB and the NFL are currently planning to admit more teams to post-season play. In so doing, they seem blissfully unaware that tournament design is a well-developed branch of mathematics -- one from which they could learn much.
Content Area: Sports & Sports betting
Recommended for Students: Yes

Maila Hallare, Norfolk State University
2-adic Valuations of Cubic Sequences
3:25, Zoom Room 3
Three semesters ago, I presented my work on constructing 2-adic valuation trees of quadratic sequences. This time, I will share my results on constructing 2-adic valuation trees of cubic sequences. I will also show how valuation trees can be used to solve some generalized Ramanujan-Nagell quadratic and cubic equations. This is a new way of finding the roots of some Diophantine equations that is accessible to undergraduate students.
Content Area: number theory
Recommended for Students: Yes

ILHAN M. IZMIRLI, George Mason University
An Elementary Proof of the Hexachord Theorem
2:35, Zoom Room 2
In this talk, we will give an elementary proof of the hexachord theorem, which is a very significant concept in music theory, in particular, in the theory of twelve-tone compositions.
Simply put, mathematically, it states that if numbers from 1 to 12 are divided into two complementary six-element sets, the positive differences determined by all possible pairs drawn from these sets would be identical. Musically, if we think of these complementary
sets as chords, the theorem implies that the complement of a chord that uses half of the pitches of a scale has the same interval structure as the original chord.
Content Area: Applications of Mathematics
Recommended for Students: Yes

Dan Kalman, American University
Generalizing a Mysterious Pattern
11:00, Zoom Room 2
In his book, *Mathematics: Rhyme and Reason*, Mel Currie discusses what he calls a *mysterious pattern* involving the sequence

$$a_n = 2^n\sqrt{2-\sqrt{2+\sqrt{2+\cdots+\sqrt{2}}}}$$

where *n* is the number of nested radicals. The mystery hinges on the fact that a_n converges to a surprising limit. Specifically, $\lim_{n\to\infty} a_n = \pi$. In this paper we explore a variety of extensions of the pattern, sequence, and limit.
It is somewhat surprising how many directions lead off from the mysterious pattern, and how many of them lead to interesting extensions, insights, or generalizations. Here are a few examples:

$$\lim_{n\to\infty} 2^n\sqrt{2-\sqrt{2+\sqrt{2+\cdots\sqrt{3}}}} = \frac{2\pi}{3}$$

$$\lim_{n\to\infty} 2^n\sqrt{2-\sqrt{2+\sqrt{2+\cdots\sqrt{1+\varphi}}}} = \frac{4\pi}{5}$$

$$\lim_{n\to\infty} 2^n\sqrt{-2+\sqrt{2+\sqrt{2+\cdots\sqrt{16/3}}}} = 2\ln 3.$$

(Note that φ is the golden mean, $(1+\sqrt{5})/2$.) The basis for this talk is ongoing joint work with Currie.
Content Area: Iterated functions, plane geometry, contraction maps
Recommended for Students: Yes

Sarah Loeb, Hampden-Sydney College
Emily Meehan, Gallaudet University
Michael Strayer, Hampden-Sydney College
MAA IP Guide Reading Group: What We Learned
2:35, Zoom Room 4
Five faculty from four colleges and universities in the section formed a professional learning community to read through the MAA Instructional Practices Guide (MAA IP Guide), meet to discuss the readings, and make plans to use the guide to improve teaching practices. In this talk we will discuss how we structured the reading group, take-aways from our participation in the reading group, and specific examples of how we used what we learned from the group and the MAA IP Guide to inform our teaching.
Content Area: Mathematics Education
Recommended for Students: No

Alex Meadows, St. Mary's College of Maryland
Adding Squares by Counting Squares
10:10, Zoom Room 5
We show a fun new way to prove the formula for the sum of the first n squares.
Content Area: Combinatorics and Numbers
Recommended for Students: Yes

Stephen A Meskin, Unaffiliated
Crossnumber Problems
3:00, Zoom Room 3
Crossword Puzzles are very popular, even among some mathematicians. Some people think of Sudoku as a mathematical crossword puzzle, but it is really a logic problem. Not that there is anything wrong with logic. Today, we will look at three varieties of numerical mathematical problems that have the look and feel of crossword puzzles. I call them Crossnumber Problems. And then there is the meta-puzzle, why do I call them problems rather than puzzles?
Content Area: Recreational Math
Recommended for Students: Yes

Alice Petillo, Marymount University
Connecting Students to Compelling Mathematics using Current Events
3:25, Zoom Room 4
This session will describe the use of a current events discussion board assignment in undergraduate liberal arts core mathematics classes. The presenter will share the description of the assignment, the grading rubric, sample student postings and lessons learned from incorporating current events as a class assignment. Feedback from students over the last 2 years indicates that this assignment was meaningful and helped students connect mathematics to the world around them. Students also expressed a sense of wonder for the varied applications of mathematics that were previously unconsidered. Participants will have an assignment and grading rubric they can use as is or adapt to their particular situation or course management system. Students also expressed a sense of wonder for the varied applications of mathematics that were previously unconsidered. Participants will have an assignment and grading rubric they can use
as is or adapt to their particular situation or course management system.
Content Area: Mathematics Education
Recommended for Students: Yes

Jan Rychtar, Virginia Commonwealth University
Modeling Guinea worm disease
9:45, Zoom Room 1
Guinea-worm disease (GWD) was thought to be almost eliminated in Chad when it reemerged in 2010. The disease now shows a peculiar pattern of spreading along Chari River and its tributaries, rather than clustering around a particular drinking water source. We create a mathematical model of GWD that includes the population dynamics of the parasite as well as the dynamics of its hosts (copepods, fish, humans, and domestic dogs). We calibrate our model based on data from the literature and validate it on the recent GWD annual incidence data from Chad. The effective reproduction number predicted by our model agrees well with the empirical value of roughly 1.25 derived directly from the data. Our model thus supports the hypothesis that the parasite now uses fish as intermediate transport hosts.
Content Area: mathematical biology
Recommended for Students: Yes

Dewey Taylor, Virginia Commonwealth University
Mathematical Model of Visceral Leishmaniasis
3:25, Zoom Room 1
Visceral leishmaniasis (VL) is a deadly neglected tropical disease caused by the parasite Leishmania donovani and spread by female sand flies. There is conflicting evidence regarding the role of insecticide treated nets (ITNs) on the prevention of VL. Numerous studies demonstrated the effectiveness of ITNs. However, KalaNet, a large trial in Nepal and India did not support those findings. We attempt to gain insight into the situation by mathematical modeling. We expand a mathematical model of VL transmission based on the KalaNet trial and incorporate the use of ITNs explicitly into the model. This work was done as part of an online REU in summer 2020. We will talk about the model and how the project was conducted with students.
Content Area: Mathematical Biology
Recommended for Students: Yes

Jill Tysse, Hood College
Mr Drum's Scheduling Problem
9:45, Zoom Room 5
Ten teams play in a tournament that lasts ten weeks. Is there a way to schedule the tournament so that each week, teams compete in three groups of three, leaving one team off on a bye and so that each team plays every other team exactly twice over the ten weeks? The answer is YES, and the combinatorial structure so-described is known as a near-resolution of a near-resolvable $(10,3,2)$ design. In this talk we discuss a way to turn $(10,4,2)$-designs into such near-resolvable designs and go on to examine if it is possible to turn $(v, 4,2)$-designs into near-resolutions of near-resolvable $(v,3,2)$-designs for any other values of v.
Content Area: Combinatorial designs
Recommended for Students: Yes

Student Abstracts by Author

Caleb Allen, Shenandoah University
Using Category Theory to Study Logic Operations and Other Properties of Stochastic Matrices Through Convex Sets
10:35, Zoom Room 2
The category of stochastic matrices is a poor environment for logical operations. Other categories, such as the category of convex sets, have a lot more structure which allows for said operations. We will define and examine the category of convex sets; work on finding and studying functors between the categories of stochastic matrices and convex sets, as well as the properties and viability of these functors; and work to find what logical operations such as ∧ and ∨ mean in convex sets. Additional work needs to be done in order to find sensible functors back to stochastic matrices from convex sets, as well as to study the advantages and limitations of using these operations on stochastic matrices.

Abstracts

Paige Beidelman, University of Mary Washington
Game Chromatic Number on Segmented Caterpillars
10:10, Zoom Room 2
In the graph theory, the n-coloring game consists of two players, Alice and Bob, alternate to properly color a graph. Alice wins if every vertex is properly colored with n colors, otherwise Bob wins. The least number of colors needed for Alice to have a winning strategy is the game chromatic number. It is known that tree graphs have a game chromatic number of at most 4, but the criteria for a tree T to have $\chi_g(T)=4$ is still unknown. To help in answering this question, we give the classification of a subclass of trees, which we call segmented caterpillar graphs. These segmented caterpillars have at least one vertices of degree 2, 3, and 4, and therefore the game chromatic number cannot be determined by previous results.

Megan Gunn, Randolph-Macon College
Filling in Missing Entries in a Matrix
11:00, Zoom Room 5
We explore the problem of missing or unknown entries in a matrix. We begin by developing methods for recovering and filling in a single missing entry in rank one and rank two matrices using the known entries. Truly-lower-rank matrices as well as matrices with added noise are each considered. We then note that the rank two method can also be applied to higher rank matrices. Finally, we extend the methods for filling in a single missing entry to matrices containing a block of missing entries.

Julianna Hart, Shenandoah University
Effective Teaching Strategies in Mathematics
9:45, Zoom Room 4
Math is a difficult subject to teach and learn. What if changing the way teachers teach and students learn math could improve the outcome of math classes, and leave students feeling proud and successful. The most common form of teaching math is lecture, and teaching math in lecture form has shown to be ineffective. There are much better ways to teach math. A method shown to be more effective is the flipped classroom environment. A flipped classroom provides time for students to problem solve with the teacher, and to watch the lessons from home. Students in math seem to struggle with homework and problem solving. If a professor or a teacher is able to guide them when a student goes astray it will prevent the student from learning the information incorrectly. However, most students seem to not enjoy a flipped classroom environment. In this presentation we will look at data showing students preferences of classes, and how a flipped classroom might be changed to better suit the average student.

Nicholas A Hausler, Virginia Military Institute
Kaleb Francisco, Virginia Military Institute
Zhang Yuchen, Virginia Military Institute
The Influence of Music Using Network Analysis
3:00, Zoom Room 4
Throughout this presentation , we dive deep into the world and history of music. We try to understand the influence artists had on each other as well as their effect on the evolution of genres over time. Using multiple musical parameters , we were able to correlate them with the artist and the genres to have a better understanding of what really sparked fame and connected the artist with its followers.

Cheyenne Hawkins, Shenandoah University
Mathematical Applications in Population Models for Fish Abundance Data
11:00, Zoom Room 1
Mathematical applications are key components to analyzing population data in ecology and conservation biology. Different models can be applied, depending on the available data that is collected for the studied species. This study uses mathematical applications to analyze National Ecological Observatory Network (NEON) fish data sampled using electrofishing, fill netting, and fyke netting counts from two sites in Virginia from 2016 to 2020 to display the relevance of math in ecology and conservation biology data analysis. A variety of applications, including statistical models and differential equations, were studied during the research to discover the best methods for analyzing the fish population data when abundance, environmental changes, and fish length and weight is known for the specified time period. It was determined that logistic growth models would be the best mathematical application to study the population fluctuations with the data collected. The logistic growth function was further analyzed to determine if carrying capacity (K) and other variables can be predicted when current population size and time is known.

Maria Hoogeveen, Shenandoah University
Is Virtual good for Math?
Abundance Data
10:10, Zoom Room 4
With data gathered from 2018 through 2020, We will show the affect of covid on students grades, from there we will look at how students adjust or cope with moving to a hybrid/virtual education platform in the fall of 2020. The adjustment to Virtual learning would have occurred in the spring semester of 2020, so the continued usage of that platform should be something that students have adjusted to and will hopefully show whether students can do well in college math with a virtual learning base. Currently we are only able to look at the data of one schools math program and only have a couple hundred students data to work with so the findings may not be across the board the same for all schools. In the future we would like to look at hybrid synchronous learning environments versus online asynchronous learning environments and which is a better fit for math.

Andrew Kappel, Shenandoah University
Using Baseball Sabermetrics to Predict Goal Scoring in Hockey
11:00, Zoom Room 3
This presentation will try to apply Sabermetrics to predict goal scoring in hockey. I am trying to take the statistics and equations that are used in analyzing baseball and transforming them into data that will make sense for hockey. From there, I will try to make my own equation for goal scoring in hockey, and make predictions for goal scoring in hockey. I am also using linear regression models to make predictions comparing goals scored and wins, goals allowed and wins, goals scored and playoffs, goals allowed and playoffs, etc. I will then run a quick accuracy test based off prior seasons numbers. This will allow me to present how many goals a team will need to score in order to get a certain number of points, and then how many points they will need to make the playoffs. To take this project a step further I am going to analyze the top 10 forwards ranked in hockey every year going back at least 10 years. They will be classified as either Sniper, Playmaker, or Two-Way. I will find a pattern and try to discover which type of player will be used the most in the near future to help teams be better. After that I will look into where on the ice goals are scored and try to analyze where players should go on the ice to optimize scoring as well as what type of shot they should be taking.

Victoria Krist, Shenandoah University
A Modified Approach of Storing Delaunay Triangulation
2:35, Zoom Room 1
Delaunay Triangulation has been used previously in fingerprinting studies as a paired approach to compare template and input data. This method of triangulation has been shown to be very efficient as opposed to other methods since total evaluation of spatial characteristics is done with only similar triangles yielded from Delaunay. In this talk, the Delaunay Triangulation of fingerprint and constellation data is used to model the efficiency of a modified yield of triangulations in order to shorten the size of stored data for comparison. Components of the modified triangulation include a threshold based on the weighted average of input nodes and edge relationships between vital nodes. Effectiveness has been tested using constellation data with known stars.

Joshua Lang, Stevenson University
Automated Sports Scheduling Using Computer Programming
2:35, Zoom Room 3
This paper addresses balanced schedule generation by creating a division-weighted schedule. Using Sports Scheduling, Graph Theory, and Combinatorics algorithms were written in Python to automatically generate the corresponding schedules with varying parameters. We aim to find patterns and ranges on the given inputs where division-weighted schedules exist and/or do not exist and analyze them for broader understanding.

Taylor Powell, Old Dominion University
Undetermined Coefficients: A Fully Generalized Approach
10:35, Zoom Room 5
In this presentation, I outline the development of a fully-generalized solution of M-th order, linear, non-homogeneous differential equations with constant coefficients and whose non-homogeneous function is any product of sinusoidal, exponential, and polynomial functions. This particular method does not require the reader to work with annihilator operators or additional related ODEs, and only requires an understanding of summation notation, matrix multiplication, and calculus. Additionally, this method provides a straightforward way to develop a program to implement the technique, and potentially reduces the time-complexity for solutions with comparisons to other analytical methods.

Joseph Sanz, Marymount University
An Agent-Based Approach to Modeling Evolutionary Advantage
10:10, Zoom Room 1
NetLogo is a program that specializes in agent-based modeling, a modeling technique that observes the actions of autonomous agents. This technique was used to simulate the way in which a species with an advantage will overwhelm one without. The model observed populations with and without language, where language-speaking populations only receive a bonus to their reproduction when near another language-speaker. The simulation was run to test the effect of movement range on the advantage language speakers get.

Joseph Sanz, Marymount University
Minor Minimally 3-Linked Graphs
3:25, Zoom Room 2
An abstract graph is a set of vertices and edges that connect them. An abstract graph can be embedded into 3-dimensional space. An embedded graph is linked if it contains two cycles that form a non-split link. A link, L, is non-split if there is no possible embedding of a 2-sphere, F, in the complement of L such that each component of the complement of F contains at least one component of L. If an embedding of a graph contains a non-splits 3-component link, it is known as 3-linked. A graph, G, is intrinsically 3-linked if it contains a 3-link in every embedding of G. A graph, H, is a minor of a graph, G, if it can be obtained from G through some finite sequence of edge contractions and edge deletions. A graph, G, is minor minimally 3-linked if it is intrinsically 3-linked, and no minor of G is intrinsically 3-linked. Our research identifies a new minor minimally intrinsically 3-linked graph through proving that the graph is minor minimally 3-linked.

Joseph Scafetta, Marymount University
Agent-Based Modeling of COVID Spread
10:35, Zoom Room 1
I used NetLogo to create a new model for the spread of Coronavirus. This started with the virus model built into NetLogo and then modifications were made to represent the specifics of the COVID-19 pandemic. Our enhanced model can simulate the spread of the disease with different levels of mask use and public testing.

Madison Shannon, Shenandoah University
Effectiveness of Embedded Tutors and Mastery Based Testing
10:35, Zoom Room 4
In this study we tried to determine the effectiveness of embedded tutoring and mastery based testing. We did so by analyzing the final grades from Fall 2018 to Fall 2020 for College Algebra, PreCalculus, and Statistics. To help us determine the effectiveness we ran independent t-tests, proportion tests, and compared means and standard deviations. From these tests, contrary to the hypothesis, the classroom aid methods did not have an effect on student success. Future work for this project would consist of eliminating variables that may skew the results, ie different professors, COVID-19, etc.

Anshu Sharma, Randolph-Macon College
Commutativity of Noisy Matrices
9:45, Zoom Room 2
This talk will discuss Pearcy and Shield's 1979 theorem relating almost commuting and nearly commuting matrices, other measures of commuting matrices involving diagonalization and eigenvectors, and an empirically supported finding relating the magnitudes of matrix noise to the magnitude of the commutator.

Laura Short, Salisbury University
Stephanie Warman, Salisbury University
Galkin's Lower Bound Conjecture holds for the Grassmannian
3:00, Zoom Room 2
Let Gr(k,n) be the Grassmannian. The quantum multiplication by the first Chern class induces an endomorphism of the finite-dimensional vector space specialized at q=1. Our main result is a case that a conjecture by Galkin holds. It states that the largest real eigenvalue of this endomorphism is greater than or equal to dim Gr(k,n)+1 with equality if and only if Gr(k,n)=P^(n-1).

Student Poster Abstracts by Author

2:35, Zoom Room 5

Mikayla Ingram & Juliet Triani, Hood College
3D Printing Mathematics through History
In the summer of 2020, students Mikayla Ingram and Juliet Traini joined Dr. Sara Malec, supported by a Hood College SRI grant, to learn to make more effective use of Hood's 3D printer. The research included modeling ancient and medieval mathematics as well as multivariable calculus objects for class use.

Lindsey Mercer, Virginia Military Institute
Andrew Ho, Virginia Military Institute
Isaiah Weaver, Virginia Military Institute
Bees, Wasps, and Asian Giant Hornets, oh my!
Our poster contains the problem we have chosen to do, which deals with the concern of the growing population of the Asian giant hornets in the United States as well as some background information about the Asian giant hornets. Our poster additional consists of a tree diagram model and the K Nearest Neighbor model and the results that were obtained from both models.

Joshua Myers, Virginia Military Institute
Po-Yin Su, Virginia Military Institute
Chengbo Yao, Virginia Military Institute
Measuring The Health of Higher Education For A Country
Our poster shows the steps we took to model the health of higher education. We show the important metrics used and how we modeled a country based on the data collected. Finally, we provide policy suggestions to a less healthier country and provide the results of these suggestions.

Nicole Stock, James Madison University
Higher Order Fourier Finite Element Methods for HodgeLaplacian Problems on Axisymmetric Domains
We construct efficient higher order Fourier finite element spaces to approximate the solution of Hodge Laplacian problems on axisymmetric domains. In Minah Oh, “de Rham complexes arising from Fourier finite element methods in axisymmetric domains”, Computers & Mathematics with Applications, Volume 70, Issue 8, 2015, a new family of Fourier finite element spaces was constructed by using the lowest order finite element methods. These spaces were used to discretize Hodge Laplacian problems in “The Hodge Laplacian on axisymmetric domains and its discretization”, IMA Journal of Numerical Analysis, 2020. In this research, we extend the results of both papers by using higher order Fourier finite element spaces. These new higher order Fourier finite element methods provide improved computational efficiency as well as increased accuracy.