Young Mathematicians Meeting 2023, Nesin Mathematics Village

Nesin Mathematics Village, Şirince, İzmir
June 28 - 30, 2023

Advisory Board
Ayşe Berkman
Burak Kaya
Eda Kırımlı
Mehmet Haluk Şengün
Alev Topuzoğlu

Wednesday, June 28 Schedule

DAY 1	
10:00 - 10:10	**Welcoming Remarks** Burak Kaya
Moderator: Eda Kırımlı	
10:10 - 12:00	**Lightning Talks**
12:00 - 14:00	**Lunch Break**
14:00 - 14:30	**Discussion with TMD** Özlem Beyarslan
Moderator: Neslihan Girgin Öztürk	
14:30 - 15:00	Kadri İlker Berktav
15:00 - 15:30	Melissa Özsahakyan
15:30 - 16:00	**Tea & Coffee Time**
16:00 - 17:00	**Çağlar Uyanık** (online)
Moderator: Melissa Özsahakyan	
17:30 - 18:00	Eda Kırımlı
18:00 - 18:30	Neslihan Girgin Öztürk
20:00 - 21:00	**Dinner**
21:00 - 22:00	**Burcu Baran** (online)

Thursday, June 29 Schedule

DAY 2	
09:00 - 10:00	**Ayesha Asloob Qureshi**
10:00 - 10:30	**Tea & Coffee Time**
Moderator: Kadri İlker Berktav	
10:30 - 11:00	Yağmur Çakıroğlu
11:00 - 11:30	Damla Acar
11:30 - 12:00	Zohreh Aliabadi
12:00 - 14:00	**Lunch Break**
Moderator: Şefika Kuzgun	
14:00 - 14:30	Enis Kaya
14:30 - 15:00	Murat Bayram Güven
15:00 - 15:30	Nesrin Manav Tatar
15:30 - 16:00	**Tea & Coffee Time**
Moderator: Ilgaz Çakar	
16:00 - 16:30	Şefika Kuzgun
16:30 - 17:00	Mohammad Zadeh Dabbagh
17:00 - 17:30	Tuba Sevyut
17:30 - 19:00	**Panel with Invited Speakers** *Moderator: Burak Kaya*
20:00 - 21:00	**Dinner**
21:00 - 22:00	**Hakan Özadam** (online)

Friday, June 30 Schedule

DAY 3	
09:00 - 10:00	**Atilla Yılmaz**
10:00 - 10:30	**Tea & Coffee Time**
Moderator: Enis Kaya	
10:30 - 11:00	Gamze Alkaya
11:00 - 11:30	Ilgaz Çakar
11:30 - 12:00	Pınar Şaşmaz
12:00 - 14:00	**Lunch Break**
Moderator: Jülide Miray Özkan	
14:00 - 14:30	Gülsemin Çonoğlu
14:30 - 15:00	İsmail Alperen Öğüt
15:00 - 15:30	Alp Eren Yılmaz
15:30 - 16:00	**Tea & Coffee Time**
Moderator: Yağmur Çakıroğlu	
16:00 - 16:30	Jülide Miray Özkan
16:30 - 17:00	Farzin Jahedpour Azar
17:00 - 17:15	**Closing Remarks**

INVITED SPEAKERS

Invited Speaker: Çağlar Uyanık

Affiliation: University of Wisconsin, Madison

Title: Geometry of infinite groups via combinatorial and dynamical techniques

Abstract: I will give an illustration of how different areas of mathematics, such as analysis, geometry, combinatorics, dynamics and topology, come together to inform us about the algebraic structure of infinite groups. The talk can be thought of as an introduction to Geometric Group Theory, which is a relatively new field that is largely motivated by Gromov's work in late 70's.

Date & Time: Wednesday, June 28, 16:00 - 17:00.

Invited Speaker: Burcu Baran

Affiliation: LinkedIn

Title: A Path to Machine Learning Through Mathematics

Abstract: In this talk I will talk about my personal transition from being a mathematician (specialized in Number Theory/Algebraic Geometry) to being a Machine Learning Engineer in technology. I will briefly mention pros and cons of having only a mathematics background during my own transition. I'll also talk about my day to day job, the problems that I solve with machine learning, and how much mathematics is involved in it.

Date & Time: Wednesday, June 28, 21:00 - 22:00.

Invited Speaker: Ayesha Asloob Qureshi

Affiliation: Sabancı University

Title: Monomial ideals and combinatorics

Abstract: The very first major connection of combinatorics with commutative algebra appeared in 1975 in the work of Richard Stanley where he strengthened the proof of the upper bound conjecture for simplicial spheres. Later on, due to wide applications of combinatorial techniques in commutative algebra, combinatorial commutative algebra emerged as a sub-branch of commutative algebra, which is now considered as one of the most active branches of modern commutative algebra. A centrepiece of combinatorial commutative algebra is the correspondence between simplicial complexes and squarefree monomial ideals which appeared in the work of Stanley. Later on, monomial ideals have been connected to several combinatorial structures to facilitate the study of their algebraic and homological properties. Common examples of these combinatorial structures include graphs, hypergraphs, polytopes and matroids. One of the main focuses of this talk is to introduce students to several topics and open problems related to the combinatorics of monomial ideals.

Date & Time: Thursday, June 29, 09:00 - 10:00.

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Invited Speaker: Hakan Özadam

Affiliation: Senda Biosciences

Title: The journey of a mathematician into computational biology

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Abstract: This talk aims to shed light on the career path of a mathematician in computational aspects of biology highlighting the motivations and challenges along the way. This presentation will give a high-level overview of some active areas of research in biology and explain how mathematics and computer science are used to tackle them. This interdisciplinary area of research has some important applications in therapeutics.

Date & Time: Thursday, June 29, 21:00 - 22:00.

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Invited Speaker: Atilla Yılmaz

Affiliation: Temple University

Title: Stochastic homogenization of Hamilton-Jacobi equations

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Abstract: Hamilton-Jacobi equations are a type of nonlinear partial differential equations that arise in a wide range of fields and contexts such as classical mechanics, geometrical optics, fluid dynamics, optimal control, game theory and mathematical finance. Stochastic homogenization refers to considering such an equation in a heterogeneous environment which is modeled by taking the terms & coefficients of the equation to be random, zooming out, and obtaining an effective equation which is deterministic and hence much simpler. Rigorously, the solution of the original equation with any given initial condition, when scaled appropriately, converges to the solution of the effective equation with the same initial condition. The main goals in this research topic are to prove/disprove homogenization, to identify the effective equation, and to find the speed of convergence. I will give a gentle introduction, mention classical results, recent works as well as open problems.

Date & Time: Friday, June 30, 09:00 - 10:00.

TALKS OF YOUNG RESEARCHERS

Speaker: Kadri İlker Berktav
Affiliation: Istanbul Technical University
Title: Shifted geometric structures

Abstract: In this talk, we outline a general framework for derived algebraic geometry and explain how to define familiar geometric structures in this context. We also mention some of our work in this research direction.
Date & Time: Wednesday, June 28, 14:30 - 15:00 .

Speaker: Melissa Özsahakyan
Affiliation: Mimar Sinan Fine Arts University
Title: Pairs of Oriented Abelian Groups

Abstract: In this talk, we introduce oriented abelian groups and give the relation with ordered abelian groups. Specifically, we focus on regularly dense oriented abelian groups and give model theoretic results of these groups. We define the $\mathcal{O}$-minimality of oriented abelian groups, which is a similar concept to the o-minimality for ordered abelian groups. Then we show that $\mathcal{O}$-minimality implies NIP. Finally, we give some results about pairs of oriented abelian groups.
Date & Time: Wednesday, June 28, 15:00 -15:30.

Speaker: Eda Kırımlı
Affiliation: University of Bristol/Université de Neuchâtel
Title: Isogeny graphs of abelian surfaces

Abstract: Isogeny-based cryptography is an active research area in post-quantum cryptography, and its security depends on variants of isogeny problems, namely the problem of finding an explicit isogeny between two abelian varieties. Although much of the research focused on isogenies of elliptic curves so far, it is interesting to understand isogeny graphs in dimension 2 in full generality, and the recent attacks using isogenies in higher dimensions switched the attention to dimension 2 more than ever. Unlike known methods, we use very geometrical and arithmetical objects called refined Humbert invariants defined by Kani. We propose promising applications using refined Humbert invariants of abelian surfaces such as determining minimum walks, finding split abelian surfaces, a security reduction to computing the degree of an isogeny, and multilinear maps. This is a joint work with Harun Kır.
Date & Time: Wednesday, June 28, 17:30 - 18:00.

Speaker: Neslihan Girgin Öztürk
Affiliation: Mimar Sinan Fine Arts University
Title: Iterative constructions of irreducible polynomials over finite fields with the arithmetic of function fields

Abstract: Let q be a prime power and $\mathbb{F}_q$ be the finite field with q elements. The explicit constructions of irreducible polynomials over $\mathbb{F}_q$ of high degree is one of the main problems in the arithmetic of finite fields which has many applications in several areas such as coding theory and cryptography. In general, some recursive methods are preferred to do these constructions using rational transformations. In particular, we are interested in methods that are obtained by using quadratic transformations. For doing this, we will first classify and normalize the rational transformations of degree 2 using the behaviour of the ramified places in the corresponding rational function field extensions over the finite field $\mathbb{F}_q$. Then we will investigate the constructions using Galois theory and some basic observations in group theory. This approach helps to better understand the iterative constructions and gives various generalisations of them. It also enables to determine the requirements put on the initial polynomials.
Date & Time: Wednesday, June 28, 18:00 18:30.

Speaker: Yağmur Çakıroğlu
Affiliation: Hacettepe University
Title: Codes on weighted projective spaces

Abstract: Weighted projective spaces are natural generalizations of classical projective spaces having rich structures and exhibiting interesting algebraic geometric properties. They have been regarded as convenient ambient spaces to create interesting classes of linear codes over finite fields in the literature. The purpose of this talk is to introduce these codes over a finite field, to give results for their main parameters, and to reveal the role of computer algebra packages to study some of the relevant combinatorial commutative algebraic invariants. Also, another of the main purpose of this talk is to introduce weighted projective spaces. We pay a particular attention on two dimensional case to obtain more explicit information about the minimal free resolution of the vanishing ideal of the weighted projective plane $\mathbb{P}(1, a, b)$ over $\mathbb{F}_q$. This yields to the Hilbert function giving the dimension of the code and regularity index which is crucial to eliminate trivial codes. We also compute the minimum distance of codes on the weighted projective space of the form $\mathbb{P}(1, 1, b)$.
Date & Time: Thursday, June 29, 10:30 - 11:00.

Speaker: Damla Acar

Affiliation: Ege University

Title: Quantum error-correction codes and stabilizer codes

Abstract: Quantum error-correction codes were introduced by Shor. These codes are needed to protect the coherent states against noise and other undesirable situations in quantum computing and communication. Quantum error-correction code is a method of storing or transmitting k bits of quantum information using $n > k$ qubits. Here the transmitted quantum information can be completely recovered if any subset of n qubits are exposed arbitrary errors. In this speech, quantum error-correction codes will be discussed and explained with examples. A commutative subset of error operators that leave each state in the code constant is called stabilizer of code, S. Quantum stabilizer codes are the common $+1$ eigenspace of S. The first examples of quantum codes introduced by Shor and Steane are stabilizer codes. General quantum stabilizer codes are given by Gottesman and Calderbank. Since these codes have simple coding algorithms and can be analyzed using classical coding theory, they are important among quantum error correction codes. In this speech, non-binary quantum stabilizer codes will be discussed.

Date & Time: Thursday, June 29, 11:00 - 11:30.

Speaker: Zohreh Aliabadi

Affiliation: Sabancı University

Title: A note on the hull and linear complementary pair of cyclic codes

Abstract: The Euclidean hull of a linear code C is defined as $C \cap C_\perp$, where $C_\perp$ denotes the dual of C under the Euclidean inner product. A linear code with zero hull dimension is called a linear complementary dual (LCD) code. A pair (C, D) of linear codes of length n over $\mathbb{F}_q$ is called a linear complementary pair (LCP) of codes if $C \oplus D = \mathbb{F}_q^n$. In this paper, we give a characterization of LCD and LCP of cyclic codes of length $qm - 1, m \geq 1$, over the finite field $\mathbb{F}_q$ in terms of their basic dual zeros and their trace representations. We also formulate the hull dimension of a cyclic code of arbitrary length over $\mathbb{F}_q$ with respect to its basic dual zero. Moreover, we provide a general formula for the dimension of the intersection of two cyclic codes of arbitrary length over $\mathbb{F}_q$ based on their basic dual zeros.

Date & Time: Thursday, June 29, 11:30 - 12:00.

Speaker: Enis Kaya

Affiliation: KU Leuven
Title: p-adic integration on curves of bad reduction

Abstract: Let X be a curve over a p-adic field with semi-stable reduction and let ω be a meromorphic 1-form on X. There are two notions of p-adic integration one may associate to this data: the Berkovich–Coleman integral which can be performed locally; and the Vologodsky integral with desirable number-theoretic properties. In this talk, we present a theorem comparing the two, and describe an algorithm for computing Vologodsky integrals in the case that X is a hyperelliptic curve. We also illustrate our algorithm with a numerical example computed in Sage. This talk is partly based on joint work with Eric Katz.
Date & Time: Thursday, June 29, 14:00 - 14:30.

Speaker: Murat Bayram Güven

Affiliation: Erciyes University
Title: Investigation of Middle School Mathematics Teachers' Technological-Pedagogical Content Knowledge and Competencies for Mathematical Modeling

Abstract: The purpose of this research is to examine middle school mathematics teachers' technological-pedagogical content knowledge and their competencies in mathematical modeling. In the research, descriptive analysis techniques, one of the quantitative research methods, were used. The sample consists of a total of 60 middle school mathematics teachers working at middle school levels in state or private education institutions affiliated to the Ministry of National Education located in the districts of a city center in Central Anatolia. The Technological-Pedagogical Content Knowledge Scale (TPACKS) developed by Övez and Akyüz (2013) was used to determine middle school mathematics teachers' perceptions of general technological pedagogical content knowledge. The teachers' views on models and modeling were determined with the help of the scale developed by Güneş, Gülçiçek, and Bağcı (2004). The scales were applied to mathematics teachers electronically via Google Forms in the spring semester of the 2021-2022 academic year. According to the data obtained from the research, it has been revealed that male teachers have better perceptions of technological-pedagogical content knowledge than female teachers. Professional experience, state and private school, graduation status, education level, and the district where they work, no significant mean difference was found between both the knowledge and perceptions of mathematics teachers about mathematical modeling and their knowledge and perceptions of the technological pedagogical field. It is recommended to increase the awareness and knowledge of mathematical modeling with in-service training prepared for mathematics teachers.
Date & Time: Thursday, June 29, 14:30 - 15:00.

Speaker: Nesrin Manav Tatar

Affiliation: Erzincan Binali Yıldırım Üniversitesi

Title: Fixed point theorems in modular metric spaces

Abstract: Khamsi, Kozlowski, and Reich presented the fixed point theory in modular function spaces in 1990. The principle of modular vector spaces, which Nakano first developed, embraces a particular variant referred as modular function spaces. After Chistyakov introduced modular metric spaces, Abdou and Khamsi done extensive research on fixed point theory in modular metric spaces.They applied an entirely various methods than that which was examined in their work. In this talk, I'd like to clarify how to use the same technique, and that's what is being accomplished.The sense of logic standard metric space generalizations are appealing is because they provide a deeper comprehension of the proven metric space outcomes. When developing a new generalization, one must always proceed with caution. For instance, some of the previously known findings in metric spaces may no longer be attainable if the triangle inequality is relaxed. This is accurate of the generalized metric distance as Jleli and Samet presented in their work. This authors demonstrated that this generalization covers modular vector spaces, dislocated metric spaces, metric spaces, and b-metric spaces.This talk provides an overview of generalized modular metric space, incorporating both a modular metric space and a generalized metric space in the sense of Jleli and Samet. Belatedly, for quasicontraction mappings in this new space, proceeds to exhibit the Banach contraction principle and Ciric's fixed point theorems. Using the contraction constant k with C, where C is specified in their work, to demonstrate Ciric's fixed point theorem in this larger space.

Date & Time: Thursday, June 29, 15:00 - 15:30.

Speaker: Şefika Kuzgun

Affiliation: University of Rochester

Title: KPZ fixed point

Abstract: In this talk, I will discuss the universality phenomenon in probability and introduce KPZ fixed point.

Date & Time: Thursday, June 29, 16:00 - 16:30.

Speaker: Mohammad Zadeh Dabbagh

Affiliation: Sabancı University

Title: Parity conditions on Rogers-Ramanujan-Gordon's type overpartitions

Abstract: In 2010, Andrews imposed parity restrictions on Rogers, Ramanujan and Gordon identities. In the conclusion of the paper, he offered considering parity conditions for some overpartition identities as an open problem. In 2013, Chen, Sang and Shi proved the Rogers-Ramanujan-Gordon's identity for overpartitions. Later, in 2020, Sang, Shi and Yee put parity restriction for that identity and proved it for some cases. We followed their work and in a constructive method, developed by Kurşungöz, we re-proved their identities and proved the remaining cases.

Date & Time: Thursday, June 29, 16:30 - 17:00.

Speaker: Tuba Sevyut

Affiliation: Hacettepe University

Title: Is the infinite set unlimited?

Abstract: In this study, it is aimed to reveal how the concept of infinity, which is one of the important concepts related to infinity and is often thought of as a synonym, is interpreted by pre-service teachers. Case study design, one of the qualitative research methods, was used. The participants of the study consisted of 45 mathematics education 3rd grade pre-service teachers. As a data collection tool, "Readiness Questions for the Concept of Infinity", which was prepared as a step of the ongoing doctoral thesis and consisted of open-ended questions, was used. Descriptive analysis was used in the analysis of the obtained data. Questions that are thought to be relevant to this research and some of their answers are presented. The lack of knowledge of pre-service teachers and the situations that may cause them are emphasized.

Date & Time: Thursday, June 29, 17:00 - 17:30.

Speaker: Gamze Alkaya

Affiliation: Gazi University

Title: Generalized space-form for structures on a manifold

Abstract: In this study, a general space form is defined for various structures defined on a manifold. When this space form is reduced to the specific, the generalized Sasakian, complex and complex contact metric space form is obtained. In addition, some tensors were investigated for the newly defined space form.

Date & Time: Friday, June 30, 10:30 - 11:00.

Speaker: Ilgaz Çakar

Affiliation: Middle East Technical University

Title: Discretization of the Laplace-Beltrami Operator

Abstract: Discrete differential geometry studies the local properties of discrete shapes. Its main purpose is to translate the objects and tools such as curves, surfaces, curvature from smooth category to discrete category so that they can be easily used for computational purposes. One of these tools from smooth category is the Laplace-Beltrami operator whose discrete version is well-known for its applications in geometry processing such as surface smoothing, computing a vector field with prescribed singularities, or mesh parametrization. As the discrete form can be used in computers with more ease, the discretization of the Laplace operator is of utmost importance. In this talk, after giving a brief introduction to the topic, we will see how the Laplacian is discretized on triangular meshes with the help of finite elements method. If time permits, we will discuss why these Laplacians are not 'perfect'.

Date & Time: Friday, June 30, 11:00 - 11:30.

Speaker: Pınar Şaşmaz

Affiliation: Muğla Sıtkı Koçman University

Title: On the $cl_\omega^\diamond$ operator in primal topological spaces

Abstract: The main purpose of this study is to introduce two new operators, called $(.)_\omega^\diamond$ operator and $cl_\omega^\diamond$ operator, by utilizing the notions of primal and ω-open sets in topological spaces. The notion of primal is the dual of the notion of grill. Also, we discuss some of their fundamental properties. In addition, the operator $(.)_\omega^\diamond$ does not satisfy the Kuratowski closure axioms while the operator $cl_\omega^\diamond$ come across Kuratowski closure operator. Moreover, we obtain a topology weaker than the old one via the operator $cl_\omega^\diamond$. Finally, we not only investigate some of their properties but also give some examples related to above mentioned notions.

Date & Time: Friday, June 30, 11:30 - 12:00.

Speaker: Gülsemin Çonoğlu

Affiliation: Sabancı University

Title: On complex irreducible characters of finite groups and their zeros

Abstract: Given a finite group G, an irreducible characher of G is a map from G to the complex numbers satisfying some special conditions. A conjugacy class x of G is called a vanishing class if there exists an irreducible character of G such that $\chi(x) = 0$. The element x is called a zero of G. The relation between the set of irreducible characters denoted by $Irr(G)$ and the set of vanishing classes denoted by $Van(G)$ has been consider by different groups of authors. In this talk, we focus on the relation between the number of vanishing classes of G and its group structure. In particular, we consider the non-solvable groups each of whose vanishing class sizes are divisible by at most two prime numbers and we present some results on odd-square-free sizes of vanishing classes of a non-abelian simple group G.

Date & Time: Friday, June 30, 14:00 - 14:30.

Speaker: İsmail Alperen Öğüt

Affiliation: Ankara University

Title: Subcharacter algebra of a finite group and its deformations

Abstract: Strange structures associated with a finite group have been very useful in proving results that otherwise seem out of reach. Subcharacter algebra of a finite group G, formed by equipping subgroups of $G \times G$ with one-dimensional characters is yet another instance of such structures. It provides a playground to embed and study the algebra of fibred bisets of a finite group G in a setting where the multiplication is much simpler. Using this ability, we shall show how to obtain deformations of the more complicated algebra. Over a field of characteristic zero, in the particular case where G is abelian we shall also prove that the deformation of the subcharacter algebra afforded by the inclusion of natural numbers, which corresponds to the algebra of fibred bisets is not semisimple.

Date & Time: Friday, June 30, 14:30 - 15:00.

Speaker: Alp Eren Yılmaz

Affiliation: Koç University

Title: Quiver representations and Auslander-Reiten quivers

Abstract: Quivers are finite simple directed graphs. A representation of a quiver is a representation assigning a K-vector space to each vertex and a K-linear map to each arrow in a quiver where K is an algebraically closed field. In this talk, we aim to give an introduction to quiver representations and introduce Auslander-Reiten quivers. We are talking about morphisms in representations of a quiver Q by approaching category theory. Our primary focus will be constructing Auslander-Reiten quivers by the Knitting algorithm. If we have time, we will show many examples of Auslander-Reiten quivers and the interaction between quiver representations and geometry.

Date & Time: Friday, June 30, 15:00 - 15:30.

Speaker: Jülide Miray Özkan

Affiliation: Özyeğin Üniversitesi

Title: Strongly monolithic characters and why?

Abstract: We will give a brief explanation to why we are interested in strongly monolithic characters and where they came from. Then we will justify their existence by using them to better understand the structures of finite groups (not all finite groups but which ones and why will later be clearer).

Date & Time: Friday, June 30, 16:00 - 16:30.

Speaker: Farzin Jahedpour Azar

Affiliation: Middle East Technical University

Title: Deuring Correspondence in Cryptography

Abstract: Let E be an elliptic curve defined over a field of characteristic p with no non-trivial p-torsion points, namely supersingular. Also, let $B_{p,\infty}$ be a quaternion algebra B over $\mathbb{Q}$ ramified exactly at p and ∞. The endomorphism ring of such an elliptic curve is isomorphic to a maximal order $\mathcal{O}$ in $B_{p,\infty}$. Conversely, for any maximal order in $B_{p,\infty}$, there exists a supersingular elliptic curve over a field of characteristic p such that whose endomorphism ring is isomorphic to this maximal order. This, indeed, is a correspondence which is called *Deuring correspondence*. Generally, for a fix maximal order $\mathcal{O}_0 \cong End(E_0)$, there exists an equivalence between the category of supersingular elliptic curves under isogenies and the category of left fractional $\mathcal{O}_0$-ideals under homomorphisms of O_0-modules. This talk will cover some general aspects of this correspondence and its importance in constructing isogeny-based cryptosystems.

Date & Time: Friday, June 30, 16:30 - 17:00.