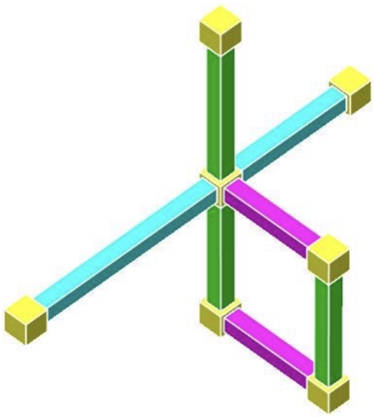
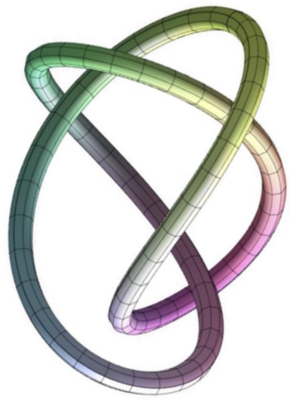
Knots and Spatial Graphs 2024

November 4-8, 2024





Organizers	Nafaa Chbili (United Arab Emirates University) Gyo Taek Jin (KAIST) Hwa Jeong Lee (Dongguk University WISE)
Contact	nafaachbili(a)uaeu.ac.ae jingyotaek(a)kaist.ac.kr hjwith(a)dongguk.ac.kr https://mathsci.kaist.ac.kr/~jin/meetings/K&SG2024.htm
Venue	United Arab Emirates University Building H4 Room 1008
Sponsors	National Research Foundation of Korea United Arab Emirates University

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1 Time Table

	Nov 4 MON	Nov 5 TUE	Nov 6 WED	Nov 7 THU	Nov 8 FRI
08:50	Arrival & Registration	Opening			Departure
09:00		**Jin**	**Baik**	**Kadokami**	
09:50		Coffee Break			
10:20		**Vera Arboleda**	**Wu**	**Lee**	
11:10		**Singh**	**Yoo**	**Nikkuni**	
12:00		Lunch		Excursion	
14:00		**Stoimenov**	Informal Activity		
14:50		**Qazaqzeh**			
15:40		Coffee Break			
16:00		**Kim**			
16:50		**Takioka**			
		Dinner			

2 Abstracts

Baik, Hyungryul

KAIST / hrbaik(a)kaist.ac.kr

Bifoliations on the plane and flows in 3-manifolds

The orbit space of a (pseudo-)Anosov flows in 3-manifold is an example of bifoliated plane. Barthelm-Bonatti-Mann recently gave a necessary and sufficient condition for a pair of circle prelaminations to be induced from a so-called pA-bifoliated plane (the class of pA-bifoliated planes includes all bifoliated planes from (pseudo-)Anosov flows in 3-manifolds). We first discuss this correspondence and then discuss how to reconstruct the 3-manifold and its flow from a group action on the bifoliated plane. This talk is based on the joint work with Chenxi Wu and Bojun Zhao.

Jin, Gyo Taek

KAIST / jingyotaek(a)kaist.ac.kr

Arc index and minimal grid diagrams

In $\mathbb{R}^3$ every knot can be embedded in the union of finitely many halfplanes having a common boundary line such that each halfplane contains a properly embedded single arc of the knot. Such an embedding is called an *arc presentation*. The minimal number of halfplanes required for an arc presentation of of a knot is called the *arc index* of the knot. Every knot has a diagram which is a non-simple rectilinear polygon such that vertical edges cross over horizontal edges at all crossings. It is called a *grid diagram*. It is easily seen that an arc presentation gives rise to a grid diagram and vice versa. In this talk, we explain how minimal grid diagrams of the prime knots up to 14 cossings are obtained and thus their arc index is determined.

Kadokami, Teruhisa

Kanazawa University / kadokami(a)se.kanazawa-u.ac.jp

A generalization of the link-symmetric group

J.Hillman defined the link symmetric group for an ordered oriented link. The notion includes amphicheirality and invertibility. We extend the notion by tracing the origin. Hence we can define the symmetries for 2-link, virtual link, multi-component spatial graph, and so on.

Kim, Hun

Korea Science Academy of KAIST / hunkim(a)ksa.kaist.ac.kr

Arc Index of a Theta-curve

In this study, we have found various upper and lower bounds for the arc index of theta-curves using various methods, including the Yamada polynomial. In addition, the spoke and the binding circle are presented as methods for finding the arc index of a theta-curve. Using these results, we computed the range of the arc index for various types of theta-curves, including pretzel theta-curves, Kinoshita-Wolcott theta-curves, and theta-curves with crossing number of 7 or less, and found that it is sufficiently tight.

Lee, Hwa Jeong

Dongguk University WISE / hjwith(a)dongguk.ac.kr

Knot mosaics and signed mosaic graphs

A *knot n-mosaic* is an $n \times n$ matrix of 11 kinds of specific mosaic tiles representing a knot or a link. In this talk, we consider the *alternating mosaic number* of an alternating knot K which is defined as the smallest integer n for which K is representable as a reduced alternating knot n-mosaic. We define a signed mosaic graph and a diagonal grid graph and construct Hamiltonian cycles derived from the diagonal grid graphs. Using the cycles, we completely determine the alternating mosaic number of torus knots of type $(2, q)$ for $q \geq 2$, which grows in an order of $q^{1/2}$.

Nikkuni, Ryo

Tokyo Woman's Christian University / nick(a)lab.twcu.ac.jp

Capturing knots and links in spatial graphs

A set of cycles Γ of a graph G is said to be *knotted* if for any spatial embedding f of G there exists an element γ of Γ such that the knot $f(\gamma)$ is nontrivial, and also said to be *minimally knotted* if none of its proper subsets are knotted. In addition, a set of pairs of disjoint cycles Λ of a graph G is *linked* if for any spatial embedding f of G there exists an element λ of Λ such that the 2-component link $f(\lambda)$ is nonsplittable, and also said to be *minimally linked* if none of its proper subsets are linked. In this talk, I will introduce what is known so far about the research of knotted sets of cycles and linked sets of cycle pairs for graphs.

Qazaqzeh, Khaled

Yarmouk University, Jordan / qazaqzeh(a)yu.edu.jo

A simple characterization of adequate links

We show that the Jones diameter of a link is twice of its crossing number in the case if the breadth of its Jones polynomial is equal to the difference between its crossing number and its Tureav genus. This implies that such a link is adequate according to the characterization of adequate links given by E. Kalfagianni and C. Lee. Combining this last result with the result by T. Abe, we get a simple characterization of adequate links based on some numerical link invariants. As an application, we provide a simple obstruction for a link to be quasi-alternating. Moreover, we use this result to give a lower bound for the crossing number of some classes of links which would be very useful to determine the crossing number in certain cases.

Singh, Vivek Kumar Singh

New York University Abu Dhabi / vks2024(a)nyu.edu

Quiver Representations of Double Twist Knots

First. I will give a brief introduction on the knot-quiver correspondence. We then present a study on quiver representations for the family of knots known as double twist knots, denoted by $K(p, -m)$. Utilizing the reverse engineering approach of the Melvin-Morton-Rozansky (MMR) formalism, we identify the matrix patterns associated with these quivers. Our method provides a systematic way to understand the quiver representations of double twist knots.

Stoimenov, Alexander

Dongguk University WISE / stoimeno(a)stoimenov.net

Strong quasipositivity and arc index

We present a viewpoint on Euler characteristic 0 braided surfaces as grid diagrams. This leads to some results regarding estimates of Thurston-Bennequin invariants of knots, strong quasipositivity of Whitehead doubles, jump numbers of slice-torus invariants, and arc and braid index.

Takioka, Hideo

Kanazawa University / takioka(a)se.kanazawa-u.ac.jp

4-Move distance of knots II

In our previous work, we considered the 4-move unknotting number of knots with up to 9 crossings. In this talk, we show new methods to give a sharper lower bound of the 4-move distance of a knot. In particular, we give a table of the 4-move distance of knots with up to 7 crossings. Moreover, we show that there exists a knot K_n with 4-move unknotting number n for any positive integer n. This is a joint work with Taizo Kanenobu.

Vera Arboleda, Anderson Arley

IBS - Center for Geometry and Physics / andersonvera(a)ibs.re.kr

On the Le-Murakami Ohtsuki Invariant

The Le-Murakami-Ohtsuki invariant is a powerful invariant of 3-manifolds (universal among quantum invariants and finite-type invariants), in particular it dominates all the Reshetikhin-Turaev invariants. The LMO invariant takes values in a space of graphs called Jacobi diagrams or Feynman diagrams. Its original definition uses the Kontsevich integral of links, the so-called iota maps and several projection maps between different quotients of spaces of Jacobi diagrams. In this talk we explain how to omit one of such projection maps without losing the invariance property. (This talk is based on a joint work with Benjamin Enriquez)

Wu, Zhongtao

Chinese Univerisity of Hong Kong / ztwu(a)math.cuhk.edu.hk

Alexander polynomial of spatial graph

Alexander polynomial has been one of the most important tools in the development of knot theory since its discovery 100 years ago. For spatial graphs, Bao and the speaker defined an analogous invariant. In many aspects, the Alexander polynomial of spatial graphs shares similar topological properties with the classical one for knots; but it also contains certain unique graph theoretical information, such as, its evaluation at t=1 gives the number of spanning trees of the graph. This talk aims to give a general introduction to this invariant.

Yoo, Hyungkee

Sunchon National University / hyungkee(a)scnu.ac.kr

Three-page presentations and arc indices for knots

A knot is a simple closed curve in $\mathbb{R}^3$ (or S^3). An arc presentation of a knot is an embedding into the open book decomposition of $\mathbb{R}^3$ such that each half plane contains a properly embedded single simple arc. However, in this talk, I limit the number of pages in the arc presentation to three and instead have multiple mutually disjoint arcs on each page. This type of arc presentation is called a three-page presentation and the minimal number of disjoint arcs in three-page presentation is called a three arc index. In this talk, I introduce the relationship between arc indices and three arc indices for any knots. Furthermore, I introduce some results for three arc indices of several knot types. Using these facts, I determine exact three arc indices of knots with small crossing numbers. And I discuss knotted surfaces made up of only triangles or hexagons

3 List of Participants

Surname	Given Name	Affiliation
Baik*	Hyungryul	KAIST
Chbili	Nafaa	United Arab Emirates University
Jin*	Gyo Taek	KAIST
Kadokami*	Teruhisa	Kanazawa University
Kim*	Hun	Korea Science Academy of KAIST
Lee*	Hwa Jeong	Dongguk University WISE
Nikkuni*	Ryo	Tokyo Woman's Christian University
Qazaqzeh*	Khaled	Yarmouk University, Jordan
Rafiqi	Ahmad	American University of Sharjah
Singh*	Vivek Kumar Singh	New York University Abu Dhabi
Stoimenov*	Alexander	Dongguk University WISE
Takioka*	Hideo	Kanazawa University
Vera Arboleda*	Anderson Arley	IBS - Center for Geometry and Physics
Wu*	Zhongtao	Chinese Univerisity of Hong Kong
Yoo*	Hyungkee	Sunchon National University

*Speaker