Abstract

The band-unknotting number of a knot (joint work with Ryuji Higa)

Tetsuya Abe (Osaka City University, D3)

This is a joint work with Ryuji Higa. A band-move is a local move on a link diagram which is performed by adding a band. We define the band-unknotting number of a knot to be the minimum number of band-moves needed to transform a diagram of the knot into a diagram of the trivial knot. In this talk, we show that the band-unknotting number of a knot is less than or equal to half the crossing number of the knot and the equality holds if and only if the knot is the trivial knot or the figure-eight knot.

Jointly homogeneous mappings and nonlinear equations

Eunkyung Ahn (Kyungpook National University, D3)

In this talk, we study nonlinear equations based on monotone and jointly homogeneous maps on an open convex normal cone. We derive the uniqueness and existence of positive solution by using Thompson's part metric and that the corresponding solution map is again monotone and jointly homogeneous. We apply our results to higher order geometric mean equations of positive definite operators on a Hilbert space.

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Quartically Hyponormal Weighted Shifts and Their examples

Seunghwan Baek (Kyungpook National University, M1)

In this talk, we introduce the definition of a quartically hyponormality and give some examples. Then we obtain an example of a quartically hyponormal weighted shift which is not 2-hyponormal.

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Polynomials of finite quandles and racks

Miju Cho (Pusan National University, M2)

We define a two-variable polynomial invariant of finite quandles. This polynomial quantifies the way in which the trivial action of one quandle element on another is distributed throughout the quandle as opposed to concentrated in a single identity element as in a group. We study the natural generalization of quandle polynomials to finite racks. Constant action racks are classified by their generalized rack polynomials and we show that ns^at^a-quandles are not classified by their generalized quandle polynomials. Also we give some applications about virtual links.

A new interior point algorithm for $P_*(k)$ LCP based on kernel functions

You Young Cho (Pusan National University, M2)

In this talk, we propose a new primal-dual interior point method based on kernel functions for $P_*(\kappa)$ linear complementarity problem. We analyze the iteration bound of algorithm and get better complexity than the classical barrier function.

Closed conformal Killing-Yano tensor and uniqueness of Kerr-NUT-de Sitter spacetime

Tsuyoshi Houri (Osaka City University, D3)

The higher-dimensional Kerr-NUT-de Sitter spacetime describes the general rotating asymptotically

de Sitter black hole with NUT parameters. It is known that such a spacetime possesses a rank-2 closed conformal Killing-Yano (CKY) tensor as a ghiddenh symmetry which provides the separation of variables for the geodesic equations and Klein-Gordon equations. We present a classification of higher-imensional spacetimes admitting a rank-2 closed CKY tensor. This provides a eneralization of the Kerr-NUT-de Sitter spacetime. In particular, we show that the Kerr-NUT-de Sitter spacetime is the only spacetime with a non-degenerate CKY tensor.

Groups of ribbon 2-knots

Atsushi Ichimori (Osaka City University, M1)

A ribbon 2-knot is a 2-knot in S^4, which is obtained from a trivial 2-link by adding 1-handles. For each ribbon 2-knot K, there is a ribbon 1-knot which is an equatorial cross section of K. We give a presentation of the fundamental group of the complement of a ribbon 2-knot from an associated ribbon 1-knot. We also consider the Alexander polynomial of a ribbon 2-knot.

The automorphism group of a compact smooth toric variety and its representations on sections of equivariant line bundles

Hiroaki Ishida (Osaka City University, M2)

A toric variety is a normal algebraic variety X containing the algebraic torus $(\mathbb{C}^*)^n$ as a Zariski open subset in such a way that the natural action of $(\mathbb{C}^*)^n$ on itself extends to an action on X. We will talk about representations of the identity component of the automorphism group of a compact smooth toric variety on sections of equivariant line bundles.

Three-bridge presentations of Montesinos links

Yeonhee Jang (Hiroshima University, D2)

In the last Graduate Student Workshop held in Pusan National University, we gave a classification of 3-bridge presentations of non-Montesinos algebraic links. In this talk, we refine the argument on the relation between 3-bridge presentations of links and genus-2 Heegaard splittings of their double branched coverings, and use this to classify 3-bridge presentations of Montesinos links up to isotopy.

On a simplicial complex of the Alexander polynomials

In Dae Jong (Osaka City University, D3)

We introduce a simplicial complex structure on the set of the Alexander polynomials and study a subcomplex which consists of the Alexander polynomials of alternating knots. We detect whether a reciprocal integer polynomial $\sum_{i=0}^{4} a_i t^i$ with $1 \leq |a_0| \leq 100$ is realized as the Alexander polynomial of an alternating knot.

Geometric mean of n-operators

Changdo Jung (Kyungpook National University, D3)

For n positive definite operators $A_1, \cdots, A_n$, Ando-Li-Mathias defined geometric mean of n-operators $\mathfrak{G}(A_1, \cdots, A_n)$ by symmetric procedure. It has many nice properties, and is studied by many authors. But the process is so complicated to compute. In this paper, we shall attempt to make a new construction of geometric mean of n-operators which we can compute it easier than geometric mean by Ando-Li-Mathias.

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Lightlike surfaces in the Minkowski Space

Sunmi Jung (Kyungpook National University, D3)

In the Minkowski space $\bar{M}^n$, one can distinguish three different classes of regular surfaces in $\bar{M}^n$. A surface M in $\bar{M}^n$ is said to be lightlike if its first fundamental form (metric form induced from the metric on $\bar{M}^n$) on M is degenerate of rank 1.
In this talk, we will give some properties of lightlike surfaces.

The V.A. polynomial of periodic virtual links

Joonoh Kim (Pusan National University, D3)

In this talk, we introduce the notion of a periodic virtual link diagram and give conditions to be satisfied by Manturov's virtual knot invariant for an oriented virtual link to have periodic p.

On relation between mutually unbiased bases and orthogonal decompositions of Lie algebras of type A

Kyoungtark Kim (Pusan National University, M2)

Let $\mathbb{C}$ be the field of complex numbers. Two orthonormal bases $\mathbf{B}_1$ and $\mathbf{B}_2$ of the Hilbert space $\mathbb{C}^n$ are called *mutually unbiased* if and only if $|\ \langle\phi|\psi\rangle\ | = 1/\sqrt{n}$ for every $|\phi\rangle \in \mathbf{B}_1$ and every $|\psi\rangle \in \mathbf{B}_2$ where we used Dirac's bra-ket notations. The problem of determining upper bounds on the maximum number of mutually unbiased bases(MUBs) over $\mathbb{C}^n$ is an important open problem. It is a well-known fact that the maximum number of MUBs is less than or equal to $n+1$ and if n is a power of prime then the maximum number of MUBs is $n+1$. But if n is not a power of prime then it is very hard to find the maximum number of MUBs. The complete MUBs of $n+1$ orthonormal bases gives rise to an

orthogonal decomposition(ODs) of the special linear algebra $sl(n, \mathbb{C})$ into its Cartan subalgebras which are by definition nilpotent self-normalizing subalgebras. It is a longstanding conjecture that the special linear algebra $sl(n, \mathbb{C})$ has an ODs only if n is a power of prime. In this presentation we introduce the notions of MUBS, ODs and the relation between MUBs and ODs.

Criterion of singular weights for discrete and continuous spectrums

Seong Uk Kim (Pusan National University, D1)

In this talk, I introduce a criterion of singular weight functions for which the second order linear eigenvalue problems with Dirichlet boundary condition are discrete or continuous. I also introduce similar results for p-Laplacian eigenvalue problem.

The properties and examples of some polynomial invariant of virtual links

Sera Kim (Pusan National University, M2)

We introduce a polynomial invariant $f(t)$ of virtual links and the computation of $f(t)$ for virtual pretzel knots and links as applications. We also show the properties about $f(t)$ such as the Vassiliev invariant, the double flype move and the extension version of $f(t)$ for virtual magnetic graph diagrams.

Some numerical methods for solving a matrix polynomial

Young Jin Kim (Pusan National University, D1)

We can consider some numerical methods for solving a matrix polynomial which has the form

$$P(X) = A_0X^m + A_1X^{m-1} + \cdots + A_{m-1}X + A_m = 0 \tag{1}$$

where A_i are complex square matrices for $0 \leq i \leq m$. For solving a matrix polynomial (1), Newton's method was studied by Kratz and Stickel (1987) and conjugate gradient method was considered by Ko and Kim (2007). Dennis etc. (1976) introduced Bernoulli's method. Seo and Kim (2008) improved Newton's method with Schur Algorithm and induced exact line search. We compare Newton's method and conjugate gradient method. Finally, we will show some experiments.

Coalescing Black Holes in Five-Dimensions

Masashi Kimura (Osaka City University, D3)

We construct multi-black hole solutions in the five-dimensional Einstein-Maxwell theory with a positive cosmological constant on the Eguchi-Hanson space, which is an asymptotically locally Euclidean space. The solutions describe the physical process such that two black holes with the topology of S^3 coalesce into a single black hole with the topology of the lens space $L(2;1) = S^3/Z_2$.

The IH-complex of spatial trivalent graphs

Kengo Kishimoto (Osaka City University, D3)

This is a joint work with Atsushi Ishii. An IH-move is a local spatial move on spatial trivalent graphs. We define the IH-distance between two spatial trivalent graphs by the minimal number of IH-moves needed to transform one into the other. We give a lower bound for the IH-distance by using invariants for flowed spatial graphs. We introduce the IH-complex and show some properties of the complex.

The sharp-Gordian distance of knots

Shinya Kishimoto (Osaka City University, M2)

A sharp-move is a local move on oriented knot diagrams, which was introduced by Hitoshi Murakami. The sharp-Gordian distance between two knots is the minimal number of sharp-moves needed to transform one knot into the other. We study the sharp-Gordian distances among knots with up to seven crossings.

An extension of matrix reverse Holder inequality to n-operators via the geometric mean by Lawson-Lim

Hosoo Lee (Kyungpook National University, D4)

A matrix reverse Holder inequality is given as a counterpart of the concavity of the weighted geometric mean. In this talk, we extension to n-operators via the geometric mean by Lawson-Lim.

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On the Alexander polynomial of periodic links

In Sook Lee (Kyungpook National University, D1)

A link L in $\mathbb{R}^3$ is called a *periodic link* of period n if there is a map ψ of $(\mathbb{R}^3, L)$ such that ψ is $\frac{2\pi}{n}-$rotation about a line F in $\mathbb{R}^3$ and $F \cap L = \phi$.
In this talk, we will give a formula for the determinant of matrices with a kind of symmetry. As an application of the formula,we will calculate the Alexander polynomial and the determinant of periodic links from those of the base links.

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A polynomial invariant of long virtual knots

Kyeunghui Lee (Pusan National University, D4)

In this talk we introduce a polynomial invariant of long virtual knots. This is non-trivial for many long virtual knots, but is trivial on classical long knots. We also give various properties of this polynomial invariant and some examples.

The effect of multiple host for malaria transmission

Kyeongah Nah (Kyungpook National University, M2)

When bitten by malaria infected mosquito, human could be infected and pass a malaria parasite on to another mosquito. However, animals never catch the malaria even though they suffer from mosquitoes

attack in swarms. This phenomenon may affect on malaria transmission by diverting blood feeding from people to animals. The purpose of this paper is to detect whether the increased cattle abundance does influence upon malaria transmission.

The transmission model is based on the situation of South Korea, in which there was sudden increase of P. vivax malaria since 1993. Mathematical analysis and computer simulations are employed to find the relationship between the change of animal population and the number of cases of malaria in South Korea. The result say that decreasing the number of animals will decrease the risks associated with an epidemic.

An incubation period is a duration from an inoculation (by an infected mosquito) to onset of a disease. To estimate that of malaria in Korea, we used the idea of Nishiura et al.(2007) and patients data from KCDC's 2006 2008. The data suggest that cases fall into two categories with short- and long-term incubation periods, respectively. Weibull and normal distributions were reasonably fitted to these periods.

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The differences of Alexander polynomials caused by a single crossing change in the case of 10_{132}

Yuki Okada (Kobe University, M2)

In this talk, we will characterize the Alexander polynomials of knots obtained from 10_{132} by a single crossing change. The proof is given by a surgical description of Alexander matrices. As a corollary, it holds that $d_G(10_{132}, 3_1) = 2$, $d_G(10_{132}, 6_2) = 2$ and so on.

On the Turaev-Viro SO(3) invariants of lens spaces at even roots of unity

Kenta Okazaki (RIMS, Kyoto University, M2)

The Turaev-Viro $SO(3)$ invariants of closed 3-manifolds are defined at any roots of unity. At odd roots of unity, the Reshetikhin-Turaev $SO(3)$ invariants are defined, and the Turaev-Viro $SO(3)$ invariants can be derived from them. For the lens spaces, the values of the Reshetikhin-Turaev $SO(3)$ invariants have been calculated, and therefore the values of the Turaev-Viro $SO(3)$ invariants for the lens spaces are known at odd roots of unity.

In this talk, we calculate the Turaev-Viro $SO(3)$ invariants of some lens spaces at even roots of unity. In particular, for the lens space of type $(4, 1)$, we show that the Turaev-Viro $SO(3)$ invariant is equal to the Turaev-Viro $SU(2)$ invariant at any even root of unity. A main idea of our calculation is to reduce the calculation of $6j$-symbols to the linear skein of 'chain-mail' links.

On Heegaard genus, bridge genus and braid genus for a 3-manifold

Shin'ya Okazaki (Osaka City University, D1)

We introduce two kinds of genera on a closed connected orientable 3-manifold obtained by the 0-surgery of the 3-sphere along a link to compare with Heegaard genus. We show that these invariants are linearly independent.

7-colored diagrams with exactly four colors

Kanako Oshiro (Hiroshima University, D2)

In this talk, we study Fox 7-colorings for diagrams of 1-dimensional knots. In general, for non-trivial p-colorings of knots, the diagrams do not necessarily have all colors $0, 1, \cdots, p-1$ of $\mathbb{Z}_p$. We show that any 7-colorable knot has a 7-colored diagram such that exactly four colors of seven are assigned to the arcs of the diagram. As an application, we also show that any 7-colorable ribbon 2-knot has a 7-colored diagram with exactly four colors.

Braid presentation of a knotted arc with singular points

Maeng Sang Park (Pusan National University, D3)

A knotted arc with singular points is an immersed image of an unit interval into $\mathbb{S}^3$ with finite transversal double singular points such that the images of two endpoints of the unit interval are different and not the singular points. In this talk we consider braid presentation of a knotted arc with singular points.

Note on $L(n)$-Hyponormality

Sun Hyun Park (Kyungpook National University, D3)

A new notion of $L(n)$-hyponormality is introduced in order to provide a missing bridge between subnormality and paranormality, two concepts receiving considerable attention of operator theorists since 1950's. Criteria for $L(n)$-hyponormality are furnished. Relationships to other hyponormality notions are discussed in the context of weighted shift and composition operators.

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The warping degree of a link diagram

Ayaka Shimizu (Osaka City University, D1)

This is an expansion of my talk in Graduate Student Workshop in last summer. The warping degree $d(D)$ of an oriented link diagram D is the smallest number of crossing changes which are needed to obtain a monotone diagram from D. We show that $d(D) + d(-D) + sr(D)$ is less than or equal to the crossing number of D, where $-D$ denotes the inverse of D and $sr(D)$ denotes the number of component subdiagrams which have at least one self-crossings. Moreover, we give a necessary and sufficient condition of the equality. By considering the minimal $d(D) + d(-D)$, $sr(D)$ and $d(D) + d(-D) + sr(D)$ for all diagrams D, we also show some inequalities for a link itself.

Welded links and Miyazawa polynomials

Mihwa Shin (Pusan National University, D1)

The Miyazaya polynomial is a well-defined invariant of virtual links. We observe the effect of a generalised mutation M of a link on the miyazaya polynomial. Using this, we describe a method for obtaining invariants of links which are also invariant under M. The Miyazaya polynomial of welded links is not well defined in $Z[A^{\pm 1}, h]$. Taking $M = F_0$ allows us to pass to a quotient of $Z[A^{\pm 1}, h]$ in which the Miyazaya polynomial is well-defined. We get the same result for $M = F_u$, so in fact, the Miyazaya polynomial in this ring defines a fused isotopy invariant. We show it is non-trivial and compute it for links with one or two components.

Toeplitz operators and estimates of the harmonic Bergman Kernel on smooth bounded domains

Kiyoki Tanaka (Osaka City University, M2)

We consider the harmonic Bergman spaces on a smoth bounded domain in the Euclidean space. We discuss about Toeplitz operators of positive measure symbol. In this talk, I shall give charactarizations for Toeplitz operators to be bounded, compact and of Schatten class.

Reverse Hölder inequality for the first eigenfunction of the N-Laplacian

Akinobu Uegaki (Osaka City University, M2)

We will talk about a reverse Hölder inequality for the first eigenfunction of the N-Laplacian with the homogeneous Dirichlet boundary condition. This is an extension of Payne-Rayner inequality in two dimension.

On paradoxical decompositions

Yuriko Umemoto (Osaka City University, M1)

We give a popular account of the Banach-Tarski paradox which implies the following: An orange can be cut into finitely many pieces, and these pieces can be reassembled to yield two oranges of the same size as the original one. We explain its proof which rests on the notion of amenability and the axiom of

choice.

On the HOMFLY-PT Polynomial of a link with local symmetry

Seung Yeop Yang (Kyungpook National University, M1)

Let D be an oriented link diagram and let T be an oriented 4-tangle. By replacing each crossing of D by T so as to be compatible with their orientation, we can get a new oriented diagram $D(T)$, called a link diagram with local symmetry.

In 2008, Y. Bae introduced a method to calculate the Kauffman bracket polynomial of the link diagram $D(T)$ with local symmetry in the view point of the original diagram D and the tangle T. In this talk, we will adapt the method to calculate the HOMFLY-PT polynomial of the link diagram with local symmetry and will study the related properties.

On BC-equivalence between two tuples of the standard generators of braid group

Yoshiro Yaguchi (Hiroshima University, D2)

Hurwitz action of the n-braid group B_n on the n-fold direct product ${B_m}^n$ of the m-braid group B_m is studied. We show that any n-tuple of the n distinct standard generators of B_{n+1} is transformed into any of those by Hurwitz action together with the action of B_{n+1} by conjugation.

On invariant Morse functions

Hitoshi Yamanaka (Osaka City University, D1)

Using a certain invariant Morse function on the flag manifold of a complex semisimple Lie group, we give a new geometric proof of the classical formula concerning the Poincare polynomial of the Weyl group.

On the Bollobás-Riordan polynomial of covering ribbon graphs

Hye Jin Yoon (Kyungpook National University, M2)

It is well-known that the Jones polynomial of a knot is related to the Tutte polynomial of a special graph obtained from a regular projection of the knot. The Bollobás-Riordan polynomial is a generalization of

the Tutte polynomial, which is related to the Kauffman Bracket polynomial of the corresponding virtual link.

In this talk, we will study about the Bollobás-Riordan polynomial of the covering ribbon graphs in terms of the Bollobás-Riordan polynomial of the base graph and the voltage assignment. And we will give some examples about Bollobás-Riordan polynomials of the covering ribbon graph.

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On a mathematical model of prion proteins

Kayo Yoshida (Osaka City University, M2)

A prion protein is considered as one of the causes of mad cow disease. A mathematical model of prion proteins (PrP^c, PrP^{sc}), called an n-string prion-tangle, is proposed by Akio Kawauchi. Biologically, the problem is how a normal prion protein turns into an abnormal one. To discuss the problem mathematically, we regard an n-string prion-tangle as a spatial graph in S^3. In this talk, we show that all 3-string prion-tangle diagrams with less than or equal to 5 crossings can be deformed into a split 3-string prion-tangle diagram, and introduce some examples of a non-split 3-string prion-tangle.