Abstract

An estimation of the alternation number of a torus knot
Tetsuya Abe (Osaka City University, D1)

The alternation number of a knot is the minimal number of crossing changes needed to be an alternating knot. In this talk, we estimate the alternation number by using the signature, Rasmussen invariant and Ozsváth and Szabó invariant. As its application, we determine the almost alternating torus knots, solving a conjecture of C. C. Adams.

Metric projections on the positive definite convex cone
Eunkyung Ahn (Kyungpook National University, D1)

The positive definite matrices play important roles in various branches of mathematical contexts such as the diffusion tensor magnetic resonance imaging (DT-MRI) data. In recent years, we have seen an increasing demand for dealing with different operations such as averaging, projection, interpolation of positive definite data sets. In this paper we focus on projections of the positive definite matrix. On the positive definite convex cone, we can describe several kinds of appropriate metric to measure closeness of two positive definite matrices. Given an $n \times n$ positive definite matrix P, we have the unique projection to $\{\alpha | \alpha > 0\}$ with respect to each metric. And we have the result about the unique projection to geodesic curve $A \sharp B$ with respect to the Riemannian metric.

Link homology via colored planar graphs
Kenji Aragane (Osaka City University, D1)

I will introduce some new link homology theory which categorifies the homfly polynomial. This approach is directly related to the computational method of homfly polynomial by Murakami-Ohtsuki-Yamada. We shall first review our construction of chain complex and present some results. We will then discuss the connection between the Khovanov-Rozansky homology and ours. The talk is based on my master thesis.

Solutions of Einstein's field equations under the Kerr-Shild ansatz

Naoki Hamamoto (Osaka City University, D3)

A study to find a solution of an Einstein's equation expressed in Kerr-Shild form is done very actively by several researchers. In the case of dimension 4, the solutions which are expressed by the Kerr-Shild form has been well-investigated. The most generalized solution is a high-dimensional Kerr-NUT-AdS solution at present ; the Riemannian curvature tensor of this solution was shown to be of type D by a tensor calculation (hep-th/0611285).

Calabi-Yau metrics on the tangent bundles of spheres

Kaname Hashimoto (Osaka City University, M2)

M.Stenzel has constructed Calabi-Yau metrics on the complexification of compact rank one symmetric spaces. Using the Lie group actions and existence of special plurisubharmonic exhaustion functions, he proved that there always exist Calabi-Yau metrics and the metrics can be obtained by solving the O.D.E. reduced from P.D.E. of Monge-Ampére type. In this talk, I will give an explanation on the case of the tangent bundle of spheres.

Collars of hyperbolic two-dimensional cone-manifolds

Katsuhiko Hashimoto (Osaka City University, D3)

For compact Riemann surfaces, the collar theorem is well-known to us. The main goal is to show the theorem for hyperbolic two-dimensional cone-manifolds(orbiforlds). we consider all cone-angles to be strictly less than π.

On the genus distribution for the embedding of symmetric links

Soo-Jin Hong(Kyungpook National University, M1)

A diagram D of a link can be seen as a 4-valent graph embedded in the sphere S^2 with the under and over information. we can construct symmetric links $\widetilde{D}$ by using the covering graph construction. By lifting the rotation scheme of D to that of $\widetilde{D}$ naturally. we can obtain a surface $\widetilde{S}$ on which $\widetilde{D}$ is embedded. In this talk, we will try to calculate the genus of $\widetilde{S}$ and study the properties of the genera.

4-manifolds as double branched coverings of the 4-sphere

Hokuto Isoda (Osaka City University, D2)

It is known that any orientable closed 4-manifold can be constructed as the covering of S^4 branched over a surface. We consider a question asking which 4-manifold is obtained as the double branched covering X of S^4 branched along a surface F in a normal form. We show that if the first homology $H_1(M)$ of the double branched covering M of the middle cross-sectional knot K is not any direct double, then $H_1(X) \neq 0$, and if F is a ribbon S^2-knot and $H_1(M) \neq 0$, then $H_1(X) \neq 0$.

The Casson knot invariants of periodic knots with rational quotients

Hee Jeong Jang (Pusan National University, D3)

In this talk, we give a formula for the Casson knot invariant of a p-periodic knot in S^3 whose quotient link is a 2-bridge link with Conway normal form $C(2, 2n_1, -2, 2n_2, \ldots, 2n_{2m}, 2)$ via the integers $p, n_1, n_2, \ldots, n_{2m}$ ($p \geq 2$ and $m \geq 1$). As an application, for any integers $n_1, n_2, \ldots, n_{2m}$ with the same sign, we determine the Δ-unknotting number of a p-periodic knot in S^3 whose quotient is a 2-bridge link $C(2, 2n_1, -2, 2n_2, \ldots, 2n_{2m}, 2)$ in terms of $p, n_1, n_2, \ldots, n_{2m}$. We also give a recursive formula for calculating the Alexander polynomial of the 2-bridge knot with Conway's normal form $C(2n_1, 2n_2, \ldots, 2n_m)$ via the integers $n_1, n_2, \ldots, n_m$. This is a joint work with S. Y. Lee and M. Seo.

On genus two Heegaard splittings of some 3-manifolds

Yeonhee Jang (Osaka University, M2)

Let S_i be a Seifert fibered space over a disk with two exceptional fibers (i=1,2) and let M be a 3-manifold obtained from S_1 and S_2 by glueing their boundaries by a homeomorphism f. Morimoto proved that M admits at most four non-isotopic Heegaard splittings of genus two and conjectured that M admits exactly four non-isotopic Heegaard splittings of genus two if it satisfies a certain condition. We obtained a positive solution for this conjecture by using the relation between Heegaard splittings and Nielsen equivalence.

Alexander polynomials of alternating knots of genus two

In Dae Jong (Osaka City University, D1)

We confirm R. H. Fox's trapezoidal conjecture for alternating knots of genus two by a method different from P. Ozsváth and Z. Szabó's proof. As an application, we determine the alternating knots of genus two, which possess the Alexander polynomials $\Delta(t)$ with $\Delta(0) = 1$ and $\Delta(0) = 2$.

Local 1st order polynomial regression method for fast surface fitting

Changdo Jung (Kyungpook National University, D1)

Image segmentation is important to detect defects in computer vision inspector. The local 1st order polynomial regression method(L1PRM) is one of segmentation methods. The idea of L1PRM is finding the local line to minimize the MSE (mean squire error) by using polynomial fitting. After fitting, we can do segmentation using deference of image data and approximated data. This method is line by line processing. And logic is simple. We'll apply for detecting small defects on BLU(Back Light Uint) inspector.

Stabilization of the semilinear wave equation with a nonlinear internal dissipative term

Daewook Kim (Pusan National University, D2)

In this talk, we discuss the decay of energy for the semilinear wave equation with nonlinear internal dissipative and source terms,

$$u'' - \Delta u + h(\nabla u) + f(u) + g(u') = 0 \quad \text{in} \;\; \Omega \times [0, \infty)$$

with the boundary condition,

$$u = 0 \quad \text{on} \;\; \partial\Omega \times [0, \infty)$$

and the initial condition,

$$u(0) = u_0, \; u'(0) = u_1 \quad \text{in} \;\; \Omega.$$

Actually, we derive the exponential and algebraic decay of energy for the problem under some assumptions on $f, \; g, \; h$.

The Miyazawa polynomial of periodic virtual links

Joon Oh Kim (Pusan National University, D1)

A virtual link L is said to have *period* $n \geq 2$ if it admits a virtual link diagram D_L in $\mathbb{R}^2 - \{\mathbf{0}\}$ that is invariant under the rotation ζ of $\mathbb{R}^2$ about the origin $\mathbf{0}$ through $\frac{2\pi}{n}$. The virtual link L_* represented by the quotient $D_L/\langle\zeta\rangle$ is called the *factor link* of L. In this talk, we give several relationships between the Miyazawa polynomials of a periodic virtual link L and its factor link L_*.

Equitable partitions of flat association schemes

Kijung Kim (Pusan National University, D4)

An association scheme is called *flat* if it is homogeneous and there are at most one common neighbour of any two distinct points with respect to any relation. In this talk, we show that any nontrivial equitable partition of a flat association scheme with a prime number of points has exactly one singleton.

Jones polynomial of a symmetric link whose base is a rational link

Sowon Kim (Kyungpook National University, M2)

Let $C_{(a_1,a_2\cdots,a_n)}$ be a rational link as the Conway notation. Let $\widetilde{C}_{(a_1,a_2\cdots,a_n)}$ be the symmetric link constructed from $C_{(a_1,a_2\cdots,a_n)}$ as a graph covering. In this talk, we will study properties of the Jones polynomial of $\widetilde{C}_{(a_1,a_2\cdots,a_n)}$ and give an explicit formula for $\widetilde{V}_{(a_1,a_2\cdots,a_n)}$ whose folding number is 2 or 3.

On a closed braid sublink

Kengo Kishimoto (Osaka City University, D1)

We give an alternative proof that an oriented link with a sublink represented as a closed braid is deformed into a closed braid keeping the sublink fixed, shown by S. Lambropoulou and C. P. Rourke. Using the method, we give an estimation of the difference of the braid indices when the orientation of the sublink is reversed.

On strongly NI rings

Chang Ik Lee (Pusan National University, D4)

Kim and Lee called a ring strongly 2-primal if every factor rings of itself are 2-primal. The study of strongly 2-primal rings was initiated by Birkenmeier at el. Commutative rings are more similar to such rings than to 2-primal rings. In this talk, we define the concept of strongly NI rings which is a generalization of both strongly 2-primal rings and NI rings. Thus, it is related to NIness, 2-primalness and strong 2-primalness. Using some examples, each of them is not equivalent to strong NIness. First, we show that a ring is stronly NI if and only if every stronlgy prime ideals are completely prime. Next we also study the basic structure of strongly NI rings. Moreover we see some examples and counter examples suitable for questions raised naturally. Finally, we see some classes of rings under which NI rings and strongly NI rings coincide.

The Jones polynomial of periodic links with rational quotients

Eun Ju Lee (Pusan National University, D1)

In this talk, we introduce a recursive formula for calculating the Jones polynomial of 2- and 3-periodic links with rational quotient $C(2, n_1, -2, n_2, \cdots, n_r, (-1)^r 2)$ via the integers $n_1, n_2, \ldots, n_r$ and present the span of the Jones polynomial of 3-periodic links with rational quotient in terms of the integers $n_1, n_2, \ldots, n_r$. This is a joint work with S. Y. Lee and M. Seo.

Solving non-linear matrix equations via symmetric space machinery

Hosoo Lee (Kyungpook National University, D2)

It is shown that every symplectic Hamiltonian acting on the open convex cone of positive definite matrices via linear fractional transformations contracts any invariant metric distance inherited from a symmetric gauge function. This extends results of Bougerol for the Riemannian metric and of Liverani-Wojtkowski for the Thompson part metric. A uniform upper bound of the Lipschitz contraction constant for a symplectic Hamiltonian is given in terms of the minimum eigenvalues of its determining matrices. We apply this result to well-known nonlinear matrix equations for uniqueness and existence of positive definite solutions and find a new convergence analysis of iterative algorithms for the positive definite solution depending only the least contraction coefficient for the invariant metric from the spectral norm.

Virtual adequate links

Hye Sook Lee (Kyungpook National University, D4)

Generalizing the definition of an adequate link diagram, we define a virtual adequate link diagram. We show that an adequate virtual link diagram has the minimal number of classical crossings and two adequate virtual link diagrams of the same link has the same writhe.

Seifert matrices of symmetric links

In Sook Lee (Kyungpook National University, M2)

A symmetric link is a link with a diagram on which a finite group can act. In this talk, we will construct symmetric links by using the method construct covering graphs. By using the covering structure, we will obtain the Seifert matrices of symmetric links.

On certain numerical invariants of checkerboard colorable virtual links

Kyeonghui Lee (Pusan National University, D2)

In this talk, we generalize the signature, the nullity and the determinant of classical oriented knots and links in S^3 to those of checkerboard colorable oriented virtual knots and links in $S_g \times [0,1]$ by extending the collected Goeritz matrix for classical knot and link diagrams, where S_g denotes a closed orientable surface of genus $g \geq 0$. We also discuss some applications of these three numerical invariants. This is a joint work with Y. H. Im and S. Y. Lee.

A note on the trapezoidal conjecture

Seungick Lee (Pusan National University, D2)

In this talk, we discuss the trapezoidality of the Alexander polynomial of periodic covering links over 2-bridge links with small periods 3, 4 and 5. Using the Lee-Seo's recursive formula for the Alexander polynomials of periodic covering links over 2-bridge links with Conway normal form $C(2, n_1, -2, n_2, ..., n_r, (-2)^r)$, we express the coefficients of the Alexander polynomials of these periodic covering links with the period 3, 4 and 5 in terms of the integers $n_1, n_2, \ldots, n_r$ and investigate the trapezoidality of them.

Denjoy system and its adic model

Kenichi Masui (Osaka City University, D3)

It is known that uniquely ergodic Cantor system is either orbit equivalent to an odometer or to a Denjoy system. Denjoy systems are classified by its rotation number and the configuration of its double point set. I will explain the construction of an adic model of Denjoy system, which is constructed by nested Rokhlin towers. These are based on the Euclid algorithm of continued fraction of rotation number and a transversal of double point set.

Differentiable stacks and Lie groupoids

Takefumi Miyoshi (Osaka City University, D3)

A differentiable stack is a stack over the category of manifolds together with an atlas. From an atlas we obtain a presentation of the stack by a Lie groupoid. In this talk we study the relationship between the 2-category of differentiable stacks and the weak 2-category of Lie groupoids.

Some variants of a theorem of Mahler

Eun-Jung Moon (Kyungpook National University, M2)

A generalization of Mahler's expansion is known as follows:

$$\sum_{n=0}^{\infty}(-1)^n \left(\begin{array}{c} x \\ n \end{array} \right) \Delta^n g(0)\Delta^n f(0) = \sum_{n=0}^{\infty}(-1)^n \left(\begin{array}{c} x \\ n \end{array} \right) g(n)\Delta^n f(x-n)$$

If we take $g(n) = \{ \begin{array}{c} 0,\ n \geq 1 \\ 1,\ n = 0 \end{array}$, we have the generalization of Mahler's expansion

$$\sum_{n=0}^{\infty}(-1)^n \left(\begin{array}{c} x \\ n \end{array} \right) \Delta^n g(0)\Delta^n f(0) = \sum_{n=0}^{\infty}(-1)^n \left(\begin{array}{c} x \\ n \end{array} \right) g(n)\Delta^n f(x-n)$$

. We want to show that

$$f(x) = \sum_{k=0}^{\infty} \nabla^k f(-1) \left(\begin{array}{c} x+k \\ k \end{array} \right) = \sum_{k=0}^{\infty} \nabla^k f(-1) 1^{*k+1}$$

can be expressed using a backward difference operator ∇ defined by $\nabla f(x) = f(x) - f(x-1)$.

The number of holomorphic sections of a holomorphic family of Riemann surfaces induced by a certain Kodaira surface

Toshihiro Nogi (Osaka City University, D3)

We recall Mordell conjecture as follows: If a curve of genus $g > 1$ defined over a number field k, then there are finitely many k-rational points on the curve. This conjecture was first proved by Faltings.

On the other hand, we consider Mordell conjecture over the function field. It has a geometrical formulation as follows: If a holomorphic family of Riemann surfaces of genus $g > 1$ is locally non-trivial, then there are finitely many holomorphic sections of it. This conjecture was proved by Manin and Grauert. Since this conjecture was proved, we see that the finiteness of the number.

In this talk, for a concrete holomorphic family which is a certain Kodaira surface and is constructed by Riera, we show that it has exactly two holomorphic sections.

Biholomorphic equivalence of certain closed Riemann surfaces of genus two

Takahiro Okuyama (Osaka City University, D3)

Let T_λ be a torus given by equation $w^2 = z(z-1)(z-\lambda)$ for $\lambda \in \mathbb{C} \setminus \{0,1\}$. It is well known that two such tori T_λ and $T_{\lambda'}$ are biholomorphically equivalent if and only if there exists a linear fractional transformation which takes the set of branch point $\{0,1,\lambda,\infty\}$ of T_λ to the set of branch point $\{0,1,\lambda',\infty\}$ of $T_{\lambda'}$. So we see that T_λ and $T_{\lambda'}$ are biholomorphically equivalent if and only if λ' is equal to one of the following numbers: $\lambda, 1/\lambda, 1-\lambda, 1/(1-\lambda), (\lambda-1)/\lambda, \lambda/(\lambda-1)$. Next, let S_a be a closed Riemann surface of genus two given by equation $w^2 = (z-a_1)(z-a_2)(z-a_3)(z-a_4)(z-a_5)(z-a_6)$, where $a_1, ..., a_6$ are distinct point on $\mathbb{C}$ and $a = (a_1, a_2, a_3, a_4, a_5, a_6)$. It is known that two such Riemann surfaces R_a and $R_{a'}$ are biholomorphically equivalent if and only if there exists a linear fractional transformation which takes the set of branch point $\{a_1, a_2, a_3, a_4, a_5, a_6\}$ of S_a to the set of branch point $\{a'_1, a'_2, a'_3, a'_4, a'_5, a'_6\}$ of $S_{a'}$. By using this, we consider biholomorphic equivalence of special closed Riemann surfaces of genus two, which are constructed by Riera. Let $\hat{T}$ be a torus and fix a point $p_0 \in \hat{T}$. We obtain the surface by cutting h α from $p \in \hat{T}, p \neq p_0$ to p_0 and adojoining a copy cross-wise.

Introducing contact network in epidemic models

Junpyo Park (Kyungpook National University, D1)

In order to find patterns of the spread of Infectious Disease, a contact network model is typically used. In this talk, we introduce and summarize concepts of contact network model and also consider future works.

The Seifert matrices of periodic links with rational quotients

Maeng Sang Park (Pusan National University, D1)

In this talk, we characterize the Seifert matrices of p-periodic links whose quotients are 2-bridge links with Conway normal form $C(2, n_1, -2, n_2, ..., n_r, (-2)^r)$ and give formulas for the signature and the determinant of the 3-periodic links in terms of the integers $n_1, n_2, \ldots, n_r$. This is a joint work with S. Y. Lee and M. Seo.

A virtualized skein relation for the Jones polynomials and applications

Mi Hwa Shin (Pusan National University, M1)

In 2002, N. Kamada, S. Nakabo and S. Satoh introduced a skein relation for the Jones polynomials among positive, negative, and virtual crossings with some restrictions and studied some properties of virtual knots obtained by replacing a real crossing by a virtual crossing. In this talk, we review these results and discuss another application to study periodic virtual links.

A remark on trivial surfaces in 3-space

Yuki Takahashi(Kobe University, D2)

We will consider a fold projection for a surface in the 3-space. If a fold projection has the singularity whose image consists of simple closed curves, then it is called a simple fold projection. We will give examples of non-trivial surfaces with a simple fold projection, and also give a sufficient condition of a surface to be trivial.

The Bala-Carter theorem in good characteristic

Takehisa Tsujii (Osaka City University, D2)

Let G be a connected reductive algebraic group over an algebraically closed field k of characteristic p. If k is the complex field, it is well-known that the classification of the nilpotent G-orbits in the Lie algebra Lie(G) of G can be described by the Bala-Carter theorem. Bala and Carter proved this if $p = 0$ or p is sufficiently large. The proof in good prime characteristic was first given by Pommerening, but needed case-by-case computation. In 2003, a fairly short conceptual proof of Pommerening's result was given by A. Premet. We will explain a new shorter proof of this result.

Parameters estimation of an actuator using performance index

Inseok Yang (Kyungpook National University, D2)

In this paper, we propose a method that utilizes actuator technology. The performance index is the quantitative value which indices the actuator characteristics. By adopting the capability of local processing the proposed method provides an efficient solution to dealing with an actuator failure without using any redundant actuators. The estimated parameters of the actuator of a fault actuator in time τ called the time constant.

Partition functions of reduced matrix models with classical gauge groups

Reiji Yoshioka (Osaka City University, D3)

We evaluate partition functions of matrix models which are obtained from d=4 N=1 supersymmetric Yang-Mills theories with classical (semi-)simple gauge groups, SO(2N), SO(2N+1) and USp(2N). The calculations reduce to the integrals over the maximal tori according to the prescription of Moore-Nekrasov-Shatashvili. We construct the diagrammatic method to perform the integrals and then actually carry out the calculations.