The 3rd KOOK-TAPU Joint Seminar on Knot Theory and Related Topics
ABSTRACTS

Osaka City University

July 25–29, 2011

July 25 Monday

Taizo Kanenobu Osaka City University

Band surgery on 2-component links

An oriented 2-component link is called band-trivializable, if it can be unknotted by a single band surgery. We consider whether a given 2-component link is band-trivializable or not. Then we can completely determine the band-trivializability for the prime links with up to 9 crossings. We use the signature, the Jones and Q polynomials, and the Arf invariant. Since a band-trivializable link has 4-ball genus zero, we also give a table for the 4-ball genus of the prime links with up to 9 crossings. Furthermore, we give an additional answer to the problem of whether a $(2n+1)$-crossing 2-bridge knot is related to a $(2, 2n)$ torus link or not by a band surgery for $n = 3$, 4, which was brought from the study of a DNA site-specific recombination.

Yongju Bae Kyungpook National University

Coloring link diagrams by Alexander quandles

In this paper, we study the colorability of link diagrams by the Alexander quandles. We show that if the reduced Alexander polynomial $\Delta_L(t)$ is vanishing, then L admits a non-trivial coloring by any non-trivial Alexander quandle Q, and that if $\Delta_L(t) = 1$, then L admits only the trivial coloring by any Alexander quandle Q, also show that if $\Delta_L(t) \neq 0, 1$, then L admits a non-trivial coloring by the Alexander quandle $\Lambda/(\Delta_L(t))$.

Ikuo Tayama Osaka City University

Enumerating 3-manifolds of lengths up to 10 with doubly cyclic first homology groups

This is a joint work with A. Kawauchi. A well-order was introduced on the set of links by A. Kawauchi. This well-order also naturally induces a well-order on the set of prime link exteriors and eventually induces a well order on the set of closed connected orientable 3-manifolds. With respect to this order, we enumerated the prime links and the prime link exteriors of lengths up to 10. In this talk, we show a list of the enumeration of 3-manifolds of lengths up to 10 whose first homology groups are isomorphic to $(Z/nZ) + (Z/nZ)$ for some n by using the enumeration of the prime link exteriors.

July 26 Tuesday

Sang Youl Lee Pusan National University

On the index and arrow polynomials of periodic virtual links

A virtual link is said to *have period* $n \geq 2$ if it has a virtual link diagram in $\mathbb{R}^2$ that misses the origin and that is invariant under the rotation of $\mathbb{R}^2$ about the origin through $\frac{2\pi}{n}$. In this talk, we discuss the periodicity of virtual knots and links and related problems and explain how the index polynomial and the arrow polynomial can be used to estimate possible periods for a given virtual knot or link. This is a joint work with Young Ho Im.

Toshifumi Tanaka Gifu University

On symmetry of the Jones polynomial of ribbon knots

By a work of Fox and Milnor, we know that the Alexander polynomial of ribbon knots has a strong symmetry as $\Delta(t) = f(t)f(1/t)$ for some polynomial $f(t)$. In this talk, we study a symmetric union which was introduced by Kinoshita and Terasaka in 1957 and was generalized by Lamm in 2000. We use symmetric unions to find such symmetry for the Jones polynomial of ribbon knots. We have a formula of the Jones polynomial of symmetric unions and find that the Jones polynomial of a knot which has symmetric union presentation of Kinoshita-Terasaka type has such symmetry if the knot is amphicheiral. As a corollary, we can give a list of symmetric unions which are not represented by a symmetric union of Kinoshita-Terasaka type.

Hiromasa Moriuchi OCAMI, Osaka City University

On connected sum of theta-curves

Kinoshita's theta-curve $\theta(1,1,1)$ is locally unknotted theta-curve, that is, its constituent knots are all trivial. We obtain generalized Kinoshita's theta-curve $\theta(i,j,k)$ by adding full-twists to $\theta(1,1,1)$. In this talk we discuss about order-3 vertex connected sums of $\theta(i,j,k)$ and $\theta(i',j',k')$.

Yoshihisa Sato Kyushu Institute of Technology

The base loci and the Kodaira dimension of Lefschetz pencils

The speaker is interested in the geography of symplectic 4-manifolds. The remarkable works of Donaldson and Gompf says that a smooth 4-manifold admits a symplectic structure if and only if it admits a Lefschetz pencil. By paying attention to the fibration structures and using the symplectic topology, he focuses the geography of Lefschetz pencils and nonminimal Lefschetz fibrations. In this talk, he will give a lecture on the relation between the Kodaira dimension of a Lefschetz pencil and its base locus.

July 27 Wednesday

Dongseok Kim Kyonggi University

Seifert surfaces derived from induced graphs

Some special Seifert surfaces are introduced such as string surfaces and plumbed surfaces. We show the existence of such a surface using the induced graph which is obtained by by collapsing discs to vertices and half twist bands to signed edges from the canonical Seifert surfaces. The requirement to be hold for each specail surfaces can be translated to conditions for the graph, thus we study these properties. As applications, we find their relation with classical invariants of links.

Sumiko Horiuchi Tokyo Womanfs Christian University

A two dimensional lattice of knots by C_n-moves
(joint work with Yoshiyuki Ohyama)

We consider a local move on a knot diagram, where we denote the local move by M. If two knots K_1 and K_2 are transformed into each other by a finite sequence of M-moves, the M-distance between K_1 and K_2 is the minimum number of times of M-moves needed to transform K_1 into K_2. A two dimensional lattice of knots by M-moves is the two dimensional lattice graph which satisfies the following : The vertex set consists of oriented knots and for any two vertices K_1 and K_2, the distance on the graph from K_1 to K_2 coincides with the M-distance between K_1 and K_2, where the distance on the graph means the number of edges of the shortest path which connects the two knots. Local moves called C_n-moves are closely related to Vassiliev invariants. We obtain that for any given knot K, there is a two dimensional lattice of knots by C_n-moves ($n \geq 4$) with the vertex K. Last year, we showed in the case of n is even. In this talk, we show in the case of n is odd.

Yoshikazu Yamaguchi Tokyo Institute of Technology

Twisted Alexander polynomial of knots in finite cyclic branched covers of the 3-sphere (joint work with Jerome Dubois)

When we consider finite cyclic branched covers of the 3-sphere branched over a knot K, most of them give rational homology 3-spheres with the preimages of K as null-homologous knots. It is known that the Alexander polynomial of such a knot in a rational homology 3-sphere, given as the preimage of a branched set in a finite cyclic branched cover, is expressed as the product of the Alexander polynomials of a knot in the 3-sphere. This product formula can be extended to the twisted Alexander polynomial of knots in finite cyclic branched covers. In this talk, we will see an exposition of this formula for twisted Alexander polynomial via explicit examples. The main result is a joint work with Jerome Dubois.

July 28 Thursday

Myoungsoo Seo Kyungpook National University

Periodic virtual links and VA-polynomial of virtual links

In 2002, Manturov gave a method of generalizing classical link invariants for the case of virtual links and showed that the virtual Alexander module leads to a definition of VA-polynomial that has no analogue in the classical case. In this talk, we will introduce the VA-polynomial of virtual links and discuss some properties of the VA-polynomial of periodic virtual links.

Yoshiro Yaguchi Hiroshima University

Hurwitz action on tuples of simple braids

Hurwitz action is a braid group action on a direct pruduct of a quandle. A simple braid is a braid which is conjugate to the 1-th standard generator or its inverse. Hurwitz action on tuples of simple braids has an important role to study surface braids. In this talk, we define a degree one polynomial of a simple braid by using the first homology of punctured disk. We also give its application to Hurwitz action on tuples of simple braids.

Takahito Kuriya Osaka City University

Mosaic quantum knots

In a recent work of Samuel J. Lomonaco Jr and Louis H. Kauffman, they consider the concept of mosaic quantum knots in the context of quantum graphs. We review mosaic knot theory and introduce related topics and our recent results.

July 29 Friday

Rama Mishra Indian Institute of Science Education and Research, Pune

Projective knots

It is known that knots in S^3 can be represented as a one point compactification of polynomial embeddings of R in R^3 known as *Polynomial knots*. Given a specific knot type it is desirable to know bounds on degrees of the polynomials that represent this knot type. These issues have been studied in past. If we consider the projective completion of a polynomial knot, we will obtain a smooth embedding of RP^1 in RP^3 which is a projective map. It is of interest to study knots in an arbitrary 3-manifold and here we have knots in the real projective 3-space RP^3. As the unit circle S^1 and the projective line RP^1 are homeomorphic, a knot in RP^3 may be regarded as a smooth embedding of RP^1 in RP^3. Embeddings of RP^1 in RP^3 are studied in algebraic geometry as a projective map of RP^1 in RP^3, which is a smooth embedding. We wish to call these embeddings as *projective knots*. In this case we will see that knots in RP^3 are represented by projective closure of embeddings given by rational functions from R to R^3. In this talk we will discuss various questions related to projective knots similar to what we studied in case of polynomial knots.

Ayaka Shimizu Osaka City University

On region crossing changes

A region crossing change at a region of a link diagram is proposed by K. Kishimoto to be the crossing changes at all the crossing points on the boundary of the region. In this talk, we show that we can make any crossing change on a knot diagram by a sequence of region crossing changes, and we discuss the region unknotting numbers of a knot diagram and a knot. As an application, we introduce a game which is a joint work with A. Kawauchi and K. Kishimoto.

Young-Ho Im Pusan National University

A four variable index polynomial invariant of long virtual knots

In this talk, we introduce a new four-variable index polynomial invariant of long virtual knots that is non-trivial for many long virtual knots, but is trivial for classical knots so that it is an extension of a one-variable index polynomial invariant. We give various properties of this polynomial and examples. Also, we use this polynomial invariant for long virtual knots to distinguish virtual knots, and we obtain a polynomial invariant for long flat virtual knots which is very useful to determine whether long flat virtual knots are invertible or not. This is a joint work with Sang Youl Lee.