Quandles and Symmetric Spaces

November 16 – November 17, 2018
Room F415, Department of Mathematics, Osaka City University

Abstracts

Kengo Kawamura (Osaka City University Advanced Mathematical Institute)
Quandle (co)homology groups and embedded/immersed surface-knots

An embedded/immersed surface-knot is a closed connected surface embedded/generically-immersed in $\mathbb{R}^4$. Carter *et al.* defined quandle (co)homology groups and gave the quandle cocycle invariant for embedded surface-knots. Note that this does not become an invariant for immersed surface-knots. In this talk, I introduce a modification of quandle (co)homology groups and define the quandle cocycle invariant for immersed surface-knots.

Takayuki Okuda (Hiroshima University)
Delsarte's theory for subsets of finite homogeneous spaces

Let G be a finite group and X a homogeneous space of G. In this talk, let me introduce Delsarte's theory for subsets of X which gives a relationship between coding theoretic properties and design theoretic properties of each subset of X in terms of spherical Fourier transforms.

J. Scott Carter (University of South Alabama and OCAMI)
Diagrammatics of quandle and group 2-cocycles: part 1
(Joint work with Byeorhi Kim (Kyungpook National University))

We begin studying the mod-2 quandle extension of the 4-element tetrahedral quandle that is defined by a quandle cocycle in terms of the inner automorphism groups of each. In this case, the automorphism groups are also related as group extensions. In fact, we can use the group cocycle to define a quandle cocycle in this case and in a broad family of examples. Furthermore, we can study the group extensions from the point of view of some braid-like diagrams. In this talk, we will demonstrate the cocycle formulas, and we will give some pleasant descriptions of the finite subgroups of SU(2) since these are nice examples of group extensions.

Byeorhi Kim (Kyungpook National University)
Diagrammatics of quandle and group 2-cocycles: part 2
(Joint work with J. Scott Carter (University of South Alabama and OCAMI))

We begin studying the mod-2 quandle extension of the 4-element tetrahedral quandle that is defined by a quandle cocycle in terms of the inner automorphism groups of each. In this case, the automorphism groups are also related as group extensions. In fact, we can use the group cocycle to define a quandle cocycle in this case and in a broad family of examples. In this talk, we will study in more detail about the cocycle formulas.

Hirotake Kurihara (National Institute of Technology, Kitakyushu College)
Great antipodal sets on unitary groups in terms of design theory

The unitary group $U(n)$ is a symmetric space, so $U(n)$ has the point-symmetry for each point. A great antipodal set on $U(n)$ is a "good" finite subset of $U(n)$ related to the point-symmetries. We can obtain the Hamming graph $H(n,2)$ from a great antipodal set in a "natural way". In this talk, we present some relations between harmonic analysis on $U(n)$ and harmonic analysis on $H(n,2)$ in terms of design theory.

Makiko Sumi Tanaka (Tokyo University of Science)
Antipodal sets of compact symmetric spaces

A subset S of a compact symmetric space is called an antipodal set if it satisfies $s_x(y) = y$ for any x, y in S, where s_x denotes the geodesic symmetry at x. An antipodal set is finite. In this talk I will explain the background of the study of antipodal sets and the classification of maximal antipodal sets. This talk is based on a joint work with Hiroyuki Tasaki.

Hiroyuki Tasaki (University of Tsukuba)
Antipodal sets of oriented real Grassmann manifolds

Antipodal sets of Riemannian symmetric spaces are sets in which geodesic symmetries are trivial. Maximal antipodal sets are explicitly described in many Riemannian symmetric spaces. However in the case of oriented real Grassmann manifolds it is not easy to get explicit description of all maximal antipodal sets. In this talk I explain how to describe them explicitly in some cases.

Akira Kubo (Hiroshima University)
On finite dimensional cross keis

Takasaki defined keis (which are now called involutory quandles) in 1943. Furthermore, he defined some notions for keis: dimension, cross keis, etc. In this talk, we consider finite-dimensional cross keis, and prove the existence of the "universal" ones.

Katsumi Ishikawa (Research Institute for Mathematical Sciences, Kyoto University)
On the orbit decomposition of smooth quandles

A smooth quandle is a differential manifold equipped with a smooth quandle operation; Lie groups and (generalized) symmetric spaces are typical examples. In this talk, we show that the restriction of the inner automorphism group of a smooth quandle to each orbit is a Lie group. In particular, every orbit is the image of an injective immersion of a homogeneous space, where the quandle operation is defined from an automorphism of a Lie group.

Kanako Oshiro (Sophia University)
Local biquandles and region colorings of link diagrams

Niebrzydowski introduced a tribracket theory, which is related to region colorings of link diagrams. His study can be interpreted similary as biqandle theory by using local biquandles. I also show a relationship between shadow biquandle theory and the Niebrzydowski's work. This is a partially joint work with Sam Nelson (Claremont McKenna College) and Natsumi Oyamaguchi (Shumei University).

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