Plans

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(1) Define the Alexander polynomial of a surface-knot via the skein formula

There are some definitions of the Alexander polynomial of a knot, for example, calculating the first elementary ideal of an Alexander matrix, using the skein formula and so on. However, for the Alexander polynomial of a surface-knot, it is known only a way to calculate the first elementary ideal of an Alexander matrix. Therefore, I attempt to define the Alexander polynomial of a surface-knot by using the skein formula. Firstly, I investigate on ribbon surface-knots, after that, on usual surface-knots. At that time, I focus on the Alexander polynomial of a surface-knot applied a 1-handle surgery or a finger move.

(2) An Alexander matrix and the Alexander polynomial of a surface-knot

Using the Wirtinger presentation as a presentation of the fundamental group for the complement of a knot, the Alexander matrix becomes an $(n-1)\times n$ matrix, and the determinant of an $(n-1)\times(n-1)$ submatrix obtained by removing a column becomes the Alexander polynomial. Such an operation for matrices has been generalized by Ishii and Oshiro. They construct a theory to make a square matrix from an arbitrary matrix with its relations between rows or/and columns (A. Ishii and K. Oshiro, *Augmented Alexander matrices and generalizations of twisted Alexander invariants and quandle cocycle invariants*, preprint.). By this theory, since we can take the determinant from a general matrix such as an Alexander matrix of a surface-knot, we expect to be able to introduce invariants of surface-knots. Therefore, I attempt to research the Alexander polynomial of a surface-knot based on this theory, a joint work with Oshiro.

(3) Classification of ribbon sphere-knots by local moves

One of purposes of surface-knot theory is a classification of surface-knots, but it is not easy to classify surface-knots under the usual equivalence relation. Since a research classifying knots (or links) roughly by allowing local moves is good example for us, I attempt to classify surface-knots via local moves. Specifically, I investigate local moves on ribbon sphere-knots, and classify them roughly via it. In knot theory, there are some researches on local moves of knots, which are based on C_n-moves closely related to finite type invariants for knots. So, I research local moves on ribbon sphere-knots which are based on RC_n-moves closely related to finite type invariants for ribbon sphere-knots. Moreover, since a ribbon sphere-knot can be described by a welded knot (welded arc), I also focus on local moves for welded knots.