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Computation of the Alexander-Conway Polynomial on the Chord Diagrams of Singular Knots

得獎獎項

Mathematics　First Award

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Abstract

The inherent complexity of ambient isotopies, as outlined by the Reidemeister moves, necessitates the use of knot invariants to discriminate among planar representations of mathematical knots. The concept of finite-type invariants reduces the computation of the Alexander-Conway polynomial to the level of combinatorial objects called chord diagrams.

In this paper, we prove some relations for the delta invariant, which is the formal logarithm of the Alexander-Conway polynomial. A specific family of chord diagrams, denoted Sk,m, contains two disjoint sets of chords arranged in a lattice pattern. Sk,m chord diagrams are characterized by complete bipartite intersection graphs.

This paper shows that delta (Sk,m) = 0 if k is not equal to m = m!(m − 1)! if k = m.

The theorems presented in this paper increase our knowledge of the Alexander-Conway invariant for chord diagrams, as well as prove when the invariant can be accurately used to discriminate between knots. These findings pertain to the identification of tangled organic molecules such as DNA and RNA, and are applicable to the Protein Folding Problem.

評語

Knot Theory made a great progress during the last 20 years. Although visually knots appear in everyday life, it takes, however, extremely difficult tools to tackle the associated mathematical problems. Sana was able to manipulate the concepts skillfully and professionally. She also made an interesting connection between knots and DNA structures. Students and teachers here are very much seduced by both the oral presentation and the poster of this project.