

NEW FORMULAS FOR THE JONES
POLYNOMIAL OF A RATIONAL LINK

Yuanan Diao and Gábor Heteyei

Preprint no. 2026-03

Abstract

We derive new formulas for the Jones polynomial and the Kauffman bracket polynomial of a rational link represented by a standard diagram that is not necessarily alternating. These formulas generalize the results of Qazaqzeh, Yasein, and Abu-Qamar for the Tutte polynomial of the Tait graph of an alternating diagram of a rational link, as well as the matrix formulas of Lawrence and Rosenstein for the Jones polynomial of a rational link. Our approach uses the colored version of Brylawski's tensor product formula for Tutte polynomials of colored graphs, due to Diao, Heteyei, and Hinson. Furthermore, generalizing the formulas of Qazaqzeh, Yasein, and Abu-Qamar, we present a finite automaton that computes the crossing signs, thereby enabling the calculation of the writhe of a standard diagram of a rational link.

2010 AMS Subject Classification: Primary: 57M25; Secondary: 57M27.

Key words and phrases: continued fractions, knots, links, alternating, Tait graph.