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Unknotting numbers and triple point cancelling numbers of torus-covering knots

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It is known that any surface knot can be transformed to an unknotted surface knot or a surface knot which has a diagram with no triple points by a finite number of 1-handle additions. The minimum number of such 1-handles is called the unknotting number or the triple point cancelling number respectively. In this paper, we give upper bounds and lower bounds of unknotting numbers and triple point cancelling numbers of torus-covering knots, which are surface knots in the form of coverings over the standard torus T. Upper bounds are given by using m-charts on T presenting torus-covering knots, and lower bounds are given by using quandle colorings and quandle cocycle invariants.

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