Distribution of links and their volume in new random link model based on meanders

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A link is an embedding of a union of circles in a 3-space, considered up to an ambient isotopy. It is among the main objects of study in low-dimensional geometry, topology, and knot theory. Random structures can be useful for proving statements about properties of a typical topological object. In this paper, we suggest a new random model for links based on meanders. We then prove that trivial links appear with vanishing probability in this model, no link L is obtained with probability 1, and there is a lower bound for the number of non-isotopic knots obtained on every step.

A random meander is obtained through matching pairs of parentheses, a well-studied problem in combinatorics. Hence tools from combinatorics can be used to investigate properties of random links in this model, and, moreover, of the respective 3-manifolds that are link complements in 3-sphere. One of the strongest invariants for such manifolds is hyperbolic or simplicial volume. We give expected twist number of a link diagram and use it to bound expected hyperbolic and simplicial volume of random links. The tools from combinatorics that we use include Catalan and Narayana numbers, and Zeilberger's algorithm.

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