

The warping degree and the unknotting number of a spatial graph

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Abstract. In a research of a protein, a molecule, or a polymer, it is important to understand a spatial graph with vertices of degree one such as a knotted arc geometrically and topologically. In this talk, we introduce a geometric invariant of every connected spatial graph which we call the warping degree. The warping degree is meaningful even for a knotted arc. For every connected spatial graph without vertices of degree one, this invariant is used to define two kinds of topological invariants of the graph. One invariant is the minimal warping degree for the isotopy class of the graph and the other invariant is a natural generalization of the unknotting number of a knot, which coincides with the usual unknotting number for every spatial plane graph. We call this invariant the unknotting number of a spatial graph. This unknotting number is generalized to every connected spatial graph. A generalization of the invariants to a disconnected spatial graph is also easily attained.