Meeting: 1002, Pittsburgh, Pennsylvania, SS 7A, Special Session on Knots and Macromolecules

1002-52-228 **Rob Kusner*** (`kusner@math.umass.edu`), GANG Lab, Department of Mathematics, University of Massachusetts, Amherst, MA 01003, and **Wöden Kusner** (`wkusner@haverford.edu`), Haverford College, Haverford, PA 19041. *On pearl-number and ropelength of knots and links.* Preliminary report.

A *pearl necklace* is a cyclically ordered collection of points in R^3 where distances between distinct points are at least 1 and where adjacent points are at distance exactly 1; in other words, the points are centers of disjoint unit (diameter) balls where adjacent balls are in contact, just as in a physical necklace of pearls. The *core polygon* of a pearl necklace is defined by edges joining adjacent pearl centers. The *pearl-number* of a knot (or link) is the smallest number of points needed to make pearl necklaces whose core polygons represent the link components. We show the pearl-number of a nontrivial knot or link satisfies $N \geq 12$. In fact, we get an explicit comparison between pearl-number and (minimum) ropelength: if a knot can be made with ropelength L, then it can with pearl-number $N < L + 1$; and if a knot can be realized with pearl-number N, then it can with ropelength $L < CN$, where C is (very close to) $\sqrt{2}$. The pearl number bound for knots then follows from the best known lower bound on the ropelength, though other ways to get $N \geq 12$ will be sketched. Unfortunately, this is not sharp, since the conjectured pearl number of a knot satisfies $N \geq 15$. We also give an explicit example of a trefoil knot with N=15. (Received September 14, 2004)