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Thin position and the recognition problem for S^3 . (English) Zbl 0849.57009
Math. Res. Lett. 1, No. 5, 613-630 (1994).

In 1992 Rubinstein gave a series of lectures describing an algorithm to determine whether or not a triangulated 3-manifold is the 3-sphere. His proof uses the language of PL minimal surface theory. In the present paper a different proof is given that a simplified algorithm works using techniques from knot theory. Roughly, the algorithm is as follows. A normal surface in a triangulated 3-manifold M is an embedded surface intersecting each 3-simplex in a certain simple pattern (nice triangles and quadrilaterals). Now a maximal collection of disjoint non-parallel normal 2-spheres (which can be constructed by a modification of an algorithm due to Haken) cuts M into three possible types of components two of which are balls resp. punctured balls. Now M is the 3-sphere if and only if also each component of the third type is a 3-ball which, by the main Lemma, is the case if and only if it contains an “almost normal” 2-sphere.

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57M40 Characterizations of the Euclidean 3-space and the 3-sphere
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