Aitchison, I. R.; **Rubinstein, J. H.**

An introduction to polyhedral metrics of non-positive curvature on 3- manifolds. (English)

Zbl 0735.57005

Geometry of low-dimensional manifolds. 2: Symplectic manifolds and Jones- Witten-Theory, Proc. Symp., Durham/UK 1989, Lond. Math. Soc. Lect. Note Ser. 151, 127-161 (1990).

[For the entire collection see Zbl 0722.00024.] Thurston's geometrization program seeks to classify all 3-manifolds by dividing them canonically into pieces which admit locally symmetric Riemannian metrics called geometries. There are eight geometries S^3, $S^2 \times R$, R^3, Nil, Solv, $\widetilde{PSL}(2,R)$, $H^2 \times R$, and H^3.

This paper introduces polyhedral metrics for the geometries R^3, $H^2 \times R$, and H^3. These metrics have non-positive curvature in the sense of polyhedral differential geometry. The paper shows how these polyhedral metrics of non-positive curvature can be constructed by glueing together finite sets of compact 3-dimensional Euclidean polyhedra. An important case where this is possible is when the manifold admits a cubing, meaning that it can be expressed as a union of regular Euclidean cubes all with the same edge length. One way to achieve such a decomposition is to start with a Heegaard decomposition; the complementary handlebodies whose union makes up the three manifold can then be cubed using disjoint meridional disks in each handlebody. The paper, which is somewhat discursive, contains many explicit constructions and examples.

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MSC:

57M50	General geometric structures on low-dimensional manifolds
53C15	General geometric structures on manifolds (almost complex, almost product structures, etc.)
57Q15	Triangulating manifolds

Keywords:

polyhedral metrics; non-positive curvature; Heegaard decomposition