

Pogorelov polyhedra from combinatorial, geometrical and topological points of views

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Abstract

Let \mathcal{R} be the class of combinatorial 3-dimensional polytopes of simple combinatorial type, different from a tetrahedron, without 3- and 4-belts of faces. In particular, \mathcal{R} contains the dodecahedron and fullerenes. By the results by Pogorelov (1967) and Andreev (1970), \mathcal{R} is exactly the class of polytopes which can be realised in a hyperbolic 3-space with all dihedral angles equal to $\pi/2$. Polyhedra from \mathcal{R} can be used as nice building blocks to construct closed hyperbolic 3-manifolds. The first example of a closed orientable hyperbolic 3-manifold was constructed by Löbell (1931) from eight copies of a 14-hedron from \mathcal{R} .

We will discuss the combinatorial and geometrical properties of polyhedra from \mathcal{R} and will present results about their hyperbolic volumes. Also, we will talk on topological properties of hyperbolic 3-manifolds obtained by 4-colourings of that polyhedra.