Mathematics > Differential Geometry

Rigidity of high dimensional graph manifolds

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We define the class of high dimensional graph manifolds. These are compact smooth manifolds supporting a decomposition into finitely many pieces, each of which is diffeomorphic to the product of a torus with a finite volume hyperbolic manifold with toric cusps. The various pieces are attached together via affine maps of the boundary tori. We require all the hyperbolic factors in the pieces to have dimension at least 3. Our main goal is to study this class of graph manifolds from the viewpoint of rigidity theory.

We show that, in high dimensions, the Borel conjecture holds for our graph manifolds. We also show that smooth rigidity holds within the class: two graph manifolds are homotopy equivalent if and only if they are diffeomorphic. We introduce the notion of irreducible graph manifolds, which form a subclass which has better coarse geometric properties. We establish some structure theory for finitely generated groups which are quasi-isometric to the fundamental group of an irreducible graph manifold: any such group has a graph of groups splitting with strong constraints on the edge and vertex groups. Finally, we prove that in every dimension >3 there exist examples of irreducible graph manifolds which do not support any locally CAT(0) metric.

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