

Witold Rosicki*, *Gdansk University, Gdansk, Poland*

On Uniqueness of Cartesian Products of Surfaces with Boundary

In 1945 Borsuk showed that an n -dimensional closed and connected manifold without boundary has at most one decomposition into Cartesian product of factors of dimension < 3 . If we consider the Cartesian products of the manifolds of higher dimension then the uniqueness does not hold. For example there are such not homeomorphic Seifert 3-manifolds that their Cartesian products with S^1 are homeomorphic. The theorem on the uniqueness of the decomposition into Cartesian products is not true if 2-manifolds with boundaries are the factors. The torus with one hole and the disk with two holes are not homeomorphic, but their Cartesian products with an interval are homeomorphic. In our paper we prove that if an arc is not a topological factor of a 4-manifold with the boundary then this manifold has at most one decomposition into Cartesian product of 2-manifolds with the boundary.

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