Singular homology groups of one dimensional Peano continua

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Session: 37. Wild algebraic and geometric topology

Peano continua are locally connected, connected, compact metric spaces. As we have proved previously, the fundamental groups of one-dimensional Peano continua determine their homotopy types [2], and in particular the fundamental groups of one-dimensional Peano continua which are not semi-locally simply connected everywhere determine their homeomorphism types [1]. Consequently, the fundamental groups of one-dimensional Peano continua are abundant.

In contrast to the case of the fundamental groups, we have

Theorem. Let X be a one-dimensional Peano continuum. Then the singular homology group $H_1(X)$ is isomorphic to a free abelian group of finite rank or the singular homology group of the Hawaiian earring.

Therefore the classification is the same as the Čech homology groups and the shape groups. But its proof is very group theoretic and far from a geomeric one.

References

[1] K. Eda, *The fundamental groups of one-dimensional spaces and spatial homomorphisms*, Topology Appl. 123, 2002, 479–505.

[2] K. Eda, *Homotopy types of one-dimensional Peano continua*, Fund. Math. 209, 2010, 27–45.