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Homogeneous geodesics in a three-dimensional Lie group

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Abstract: O. Kowalski and J. Szente [KS] proved that every homogeneous Riemannian manifold admits at least one homogeneous geodesic, i.e. one geodesic which is an orbit of a one-parameter group of isometries. In [KNV] the related two problems were studied and a negative answer was given to both ones: (1) Let $M = K/H$ be a homogeneous Riemannian manifold where K is the largest connected group of isometries and $\dim M \geq 3$. Does M always admit more than one homogeneous geodesic? (2) Suppose that $M = K/H$ admits $m = \dim M$ linearly independent homogeneous geodesics through the origin o . Does it admit m mutually orthogonal homogeneous geodesics? In this paper the author continues this study in a three-dimensional connected Lie group G equipped with a left invariant Riemannian metric and investigates the set of all homogeneous geodesics.

Keywords: Riemannian manifold, homogeneous space, geodesics as orbits

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