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RICCI SOLITONS ON LOW-DIMENSIONAL GENERALIZED SYMMETRIC SPACES

GIOVANNI CALVARUSO AND E. ROSADO

Abstract. We consider three- and four-dimensional pseudo-Riemannian generalized symmetric spaces, whose invariant metrics were explicitly described in [16]. While four-dimensional pseudo-Riemannian generalized symmetric spaces of types A, C and D are algebraic Ricci solitons, the ones of type B are not so. The Ricci soliton equation for their metrics yields a system of partial differential equations. Solving such system, we prove that almost all the four-dimensional pseudo-Riemannian generalized symmetric spaces of type B are Ricci solitons. These examples show some deep differences arising for the Ricci soliton equation between the Riemannian and the pseudo-Riemannian cases, as any homogeneous Riemannian Ricci soliton is algebraic [23]. We also investigate three-dimensional generalized symmetric spaces of any signature and prove that they are Ricci solitons.

1. Introduction

Generalized symmetric spaces are a natural generalization of symmetric spaces. Since their introduction, the geometry of generalized symmetric spaces has been intensively studied by several authors. Finite order automorphisms of semisimple Lie algebras and Riemannian manifolds with geodesic symmetries of order 3 were studied respectively in [24] and [21]. In [26], O. Kowalski undertook a study of generalized symmetric spaces without using neither topological invariants nor advanced algebra. Homogeneous structures of generalized symmetric Riemannian spaces were studied in [20]. S. Terzić classified generalized symmetric spaces defined as quotients of compact simple Lie groups, describing explicitly their real cohomology algebras [29] and calculating their real Pontryagin characteristic classes [30]. Formality of all generalized symmetric spaces was proved by D. Kotschick and S. Terzić in [25].

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