

[Merkulov, Sergei](#); [Schwachhöfer, Lorenz](#)

Classification of irreducible holonomies of torsion-free affine connections. (English)

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Ann. Math. (2) 150, No. 1, 77-149 (1999); addendum *ibid.* 150, No. 3, 1177-1179 (1999).

In this paper the authors settle the following outstanding problem of differential geometry: which irreducible subgroups of Lie groups occur as the holonomy groups of affine torsion free connections of not locally symmetric spaces.

The list of candidates was proposed by Berger in the middle of 1950s. The sublist of metric holonomies, i.e. the holonomies of connections preserving Riemannian or pseudo-Riemannian metrics, as it was shown later, appears to be complete and all groups of this sublist are realized by connections. The complement to it was stated to contain all other holonomy groups up to a finite number of missing terms. The existence of these missing groups was established by R. L. Bryant, and later in a joint paper by Q. S. Chi and the authors of the present paper, it was shown that in fact there are infinitely many such groups which are realized by the holonomies of nonmetric connections and which are not in the Berger list.

In the present paper the authors add some new examples of nonmetric holonomies and prove that the final list is complete, i.e. contains all nonmetric holonomy groups and any group of this list is realized by some nonmetric connection.

Reviewer: [Iskander A.Taimanov](#) (Novosibirsk)

MSC:

- [53C29](#) Issues of holonomy in differential geometry
- [53B05](#) Linear and affine connections
- [53C05](#) Connections (general theory)
- [32L10](#) Sheaves and cohomology of sections of holomorphic vector bundles, general results
- [32M10](#) Homogeneous complex manifolds

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