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On Preservation of the Riemann Tensor With Respect to Some Mappings of Affinely Connected Space

V. E. Berezovskii[1*], L. E. Kovalev[1], and J. Mikeš[2***]**

[1] *Uman National University of Horticulture*
ul. Institutskaya 1, Uman, Cherkasy Obl., 20305 Ukraine

[2] *Palacký University*
17 listopadu 12, Olomouc, 77146 Czech Republic

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Abstract—This paper is devoted to geodesic and almost geodesic mappings of affinely connected spaces. We find conditions which ensure that the Riemann tensor is an invariant geometric object with respect to the studied mappings. In this work we present an example of a non-trivial geodesic mapping between the flat spaces.

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INTRODUCTION

This paper is devoted to advanced research in geodesic and almost geodesic mappings of spaces with affine connection. Underlying ideas of these theories are from the paper by T. Levy-Civita [1], in which he set and solved, in the special coordinate system, the problem of finding Riemann spaces with common geodesics. Remarkably, that paper was connected to the study of equations of mechanical system dynamics.

Further on, the theory of geodesic mappings evolved in works by T. Thomas, H. Weyl, P. A. Shirokov, A. S. Solodovnikov, N. S. Sinyukov, A. V. Aminova, J. Mikeš, and others.

The questions raised by the study of geodesic mappings were developed further by V. F. Kagan, G. Vrenchanu, Ya. L. Shapiro, D. V. Vedenyanin, and others. These authors presented special classes of $(n-2)$-projective spaces.

A. Z. Petrov [2] introduced a notion of quasi-geodesic mapping. In particular, examples of special quasi-geodesic mappings include holomorphic projective mappings of Kähler spaces considered by T. Otsuki, Y. Tashiro, M. Prvanovich, J. Mikeš, and others.

Natural generalizations of these classes of mappings are almost geodesic mappings introduced by N. S. Sinyukov [3, 4].

After this, the theory of almost geodesic mappings evolved in works by V. S. Sobchuk [5], N. V. Yablonskaya [6], V. E. Berezovskii, J. Mikeš [7–12], N. O. Vesić, L. M. Velimirović, M. S. Stanković [13] and others.

The above mentioned results in the theory of geodesic mappings and its generalizations are detailed in many monographs and review articles, e.g., in [14–26].

In the present paper, we investigate the conditions which ensure that the Riemann tensor is an invariant geometric object with respect to geodesic and almost geodesic mappings of affinely connected spaces. The study is taken locally in the class of sufficiently smooth functions.

[*] E-mail: berez.volod@rambler.ru.
[**] E-mail: leokova60@yahoo.com.
[***] E-mail: josef.mikes@upol.cz.