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GEOMETRY OF KILLING VECTOR FIELDS IN THE SPHERE

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ABSTRACT: It is well known that manifolds do not have a global coordinate system, and that we cannot write their equations to study partial manifolds and curves drawn in manifolds.

KEYWORDS: Basic objects, modern geometry, connections, sets, parallel displacements, geodesic lines.

INTRODUCTION

Therefore, the study of geometric objects requires constant invariants that do not depend on the local coordinate system. The concept of vector field plays a key role in the study. All the basic objects of modern geometry, such as connections, sets, parallel displacements, and geodesic lines, are described in the language of vector fields. In this study, the Killing vector field family given in sphere S^2 was studied and the following result was obtained.

THE MAIN FINDINGS AND RESULTS

Let *M* be a smooth manifold. We denote the tangent space at point *x* of the manifold *M* by T_xM.

Definition 1. If a vector $X_x \in T_xM$ is assigned to each point $x \in G \subset M$, then *X* is given a vector field in the set *G* of the manifold *M*.

Definition 2. Let us be given an *X* vector field in any $G \subset M$ field, let γ differentiable lines defined by equation $\gamma = \gamma(t)$ be given in that field. If the equality $\dot{\gamma}(t) = X(\gamma(t))$ is appropriate for each t, then line γ is called the integral line of the vector field *X*.

Let us be given a family of vectors *D* and a smooth manifold *M* of size *n*.

Definition 3. Let us be given M manifold and its set of points y satisfying the equation

$$y = X_k^{t_k}\left(X_{k-1}^{t_{k-1}}\left(\ldots\left(X_1^{t_1}(x)\right)\ldots\right)\right)$$

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is called the orbit of the family of vectors *D* passing through point *x* and is denoted by $L(x)$, where $X_1, X_2, ..., X_k$ – vector fields in *D*, $t_1, t_2, ..., t_k$ – real numbers, *k* - arbitrary natural number.

Definition 4. If the flow of the vector field *X* given in the manifold *M* is the isometry of the manifold, the vector field *X* is called the Killing vector field.

Let $K(R^2)$ be the set of all Killing vectors given in the plane. As you know, this set is Lee's algebra. In the space $K(R^2)$, Killing vector fields $X_1 = \{1,0\}$, $X_2 = \{0,1\}$, $X_3 = \{-y, x\}$ are basis vector fields. So any Killing vector field can be expressed as $X = \lambda_1 X_1 + \lambda_2 X_2 + \lambda_3 X_3$. The following theorem applies:

Theorem. $\exists Y$ is found for the $\forall X$ Killing vector field given in the S^2 sphere, where the family orbit $D = \{X, Y\}$ covers the sphere.

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