WEB OF SCIENTIST: INTERNATIONAL SCIENTIFIC RESEARCH JOURNAL
ISSN: 2776-0979, Volume 3, Issue 5, May., 2022

LI INVARIANT FUNCTIONS OF THE GROUP

Norqoziyev N. N.
National University of Uzbekistan Faculty of Mathematics 1st Year, Masters
Tell number: 945110871

Annostation
This thesis presents a reference on gruppes, Li gruppes and invariant functions. The invariant function of one-parameter Li Gruppe is found.

Keywords: Gruppa, Lee gruppas, Invariant functions, associativity, action.

Description

Given G gruppa has a R-dimensional polygonal structure, gruppa operations, that is
$m: G \times G \longrightarrow G$, $m(g,h)= g \cdot h$ $g, h \in G$,
and the opposite element to each element is the corresponding setter

$$i: G \longrightarrow G \quad , \quad i(g)= g^{-1} \qquad g \in G$$

if the accents are differentiated, then G gruppa is called Li gruppasi.
If the beaded G Li Gruppe consists of the alternation of one M Polygon, the invariant function is determined as follows.
Description: Given $f: M \rightarrow R$ The function f is called an invariant function for group G if each $x \in M$ point for the function and the equation $f(gx) = f(x)$ are satisfied for each $g \in G$.
Theorem -1 [1]. For the given function f to be an invariant function for the vector field flow X, it is necessary and sufficient to fulfill the relation $X(f) = 0$.
Each vector field current is a one-parameter Li group.
Example: To us in the plane $X= - y\frac{\partial}{\partial x} + x\frac{\partial}{\partial y}$

let the vector field be given. This is for vector field flow
$f(x, y) = x^2+y^2$

Let us consider that our function is an invariant function. This is it

$$X(f)= - y\frac{\partial f}{\partial x} + x\frac{\partial f}{\partial y} = - y \cdot 2x + x \cdot 2y = 0$$

comes from equality.

ISSN: 2776-0979, Volume 3, Issue 5, May., 2022

Example: To us in space

$X= y\frac{\partial}{\partial x} + x\frac{\partial}{\partial y} +2(x^2+y^2)\frac{\partial}{\partial z}$

Given a vector field, this vector is for the field flow

$f(x, y) = x^2+y^2- z$

Let us consider that our function is an invariant function. This is it

$X(f)= y\frac{\partial f}{\partial x} + x\frac{\partial f}{\partial y} + z\frac{\partial f}{\partial z}= y \cdot 2x + x \cdot 2y -2(x^2+y^2)\cdot 1 = 0$

the condition of the theorem is satisfied. So the given function is an invariant function.

Example: To us in space $X= 2z\frac{\partial}{\partial x} + 2x\frac{\partial}{\partial y} + (4xz+ 4xy)\frac{\partial}{\partial z}$

Given a vector field, this vector is for the field flow

$f(x, y, z) = x^2+y^2- z$

Let us consider that our function is an invariant function. This is it

$X(f)= 2z\frac{\partial f}{\partial x} + 2x\frac{\partial f}{\partial y} + (4xz + 4xy)\frac{\partial f}{\partial z}=$

$=2z \cdot 2x + 2x \cdot 2y + (4xz + 4xy) \cdot (-1)= 0$

The condition of the theorem is satisfied. So the given function is an invariant function.

Example: To us in space $X= -x\frac{\partial}{\partial x} + z\frac{\partial}{\partial y} + (2x^2-2yz)\frac{\partial}{\partial z}$

Given a vector field, this vector is for the field flow

$f(x, y, z) = x^2+y^2+z$

Let us consider that our function is an invariant function. This is it

$X(f)= -x\frac{\partial f}{\partial x} + z\frac{\partial f}{\partial y} + (2x^2 - 2yz)\frac{\partial f}{\partial z}=$

$=-x \cdot 2x + z \cdot 2y + (2x^2 - 2yz) \cdot 1=0$

the condition of the theorem is satisfied. So the given function is an invariant function.

Example: To us in space $X= 2\frac{\partial}{\partial x} + z\frac{\partial}{\partial y} + (6x^2+z)\frac{\partial}{\partial z}$

Given a vector field, this vector is for the field flow

$f(x, y, z) = x^3+y-z$

Let us consider that our function is an invariant function. This is it

$X(f)= 2\frac{\partial f}{\partial x} + z\frac{\partial f}{\partial y} + (6x^2+z)\frac{\partial f}{\partial z} =$

$=2\cdot 3x^2+z\cdot 1-(6x^2+z)=0$

the condition of the theorem is satisfied. So the given function is an invariant function.

Theorem-2. Give us a one-parameter exchange group

$$\begin{cases} x(t) = t + x \\ y(t) = y\cos t - z\sin t \\ z(t) = y\sin t + z\cos t \end{cases} \quad t\epsilon R$$

ISSN: 2776-0979, Volume 3, Issue 5, May., 2022

given by formulas. This is for the group

$f(x, y, z) = y^2 + z^2$.

our function is an invariant function.

To prove the theorem, we find the constructor of the group.

$x' = 1$

$y' = -y\ \sin t - z\ \cos t$

$z' = y\ \cos t - z\ \sin t$

If t = 0, our vector field is,

$X = 1\frac{\partial}{\partial x} - z\frac{\partial}{\partial y} + y\frac{\partial}{\partial z}$

we now examine the invariant function. $X(f) = 0$ should be.

$X(f) = 1\frac{\partial f}{\partial x} - z\frac{\partial f}{\partial y} + y\frac{\partial f}{\partial z} =$

$= 1 \cdot 0 - z \cdot 2y + y \cdot 2z = 0$

So our function $f(x, y, z) = y^2 + z^2$ is an invariant function.

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