Projection network for systems of differential equations

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Abstract

To solve the system of differential equations much easier if it reset. One method is a method of simplifying the system dividing the system into blocks, each of which - has its own autonomous system functions. The number of functions in each block is smaller than the original system. However, the geometry of the system dividing the block has not been investigated. It turned out that the reduction of the system is equivalent to the block form the construction of special systems of projection on a plane and in space. Such networks are transport networks.

1 General

Given a Euclidean space E_n . Let all points of the space are $M\left(y^i\right)$, where y^i - values of the unknown functions of the system of differential equations $\frac{dy^i}{dt} = f^i\left(y^j\right)$. Sets the non-linear transformation of the space E_n : $z^i = \overleftarrow{F^i}\left(y^j\right)$. We construct two degenerate conversion P_1 and P_2 : $P_1 : z^{i^1} = \overline{F^{i_1}}\left(y^j\right),\ z^{i_2} = \varphi^{i_2}(\overline{F^{i_1}}\left(y^j\right)$, $P_2 : z^{i_1} = \varphi^{i_1}(\overline{F^{i_2}}\left(y^j\right),\ z^{i_2} = \overline{F^{i_2}}\left(y^j\right)$.

Each of these transformations transforms the space into two surfaces σ_1 and σ_2. Of the degenerate transformation coefficients P_1 and P_2 construct two degenerate matrix

$$P_1 = \left(\frac{\partial F^{i_1}}{\partial z^i}, \frac{\partial \varphi^{i_2}}{\partial F^{i_1}}\frac{\partial F^{i_1}}{\partial z^i}\right),\ P_2 = \left(\frac{\partial \varphi^{i_1}}{\partial F^{i_2}}, \frac{\partial F^{i_2}}{\partial z^i}\frac{\partial F^{i_2}}{\partial z^i}\right)$$

By requiring that these matrices are projectors, we get completely integrated system of equations for the transformation function F^{i_1} and F^{i_2}.

These functions define two surfaces in space, and in the event of complete splitting of the system - a network of surfaces, which is a transport network. In such networks, we can easily calculate the first quadratic form.

Theorem. Setting transport network uniquely defines as the original system of equations, and a split system.

References

[1] Kovantsov A 2015 Linear and nonlinear Projectors are in Project space *The 13th International Scientific Conference Information Technologies and Management, Riga, Latvia*

[2] Kovantsov A 2014 Geometry Splitting of Nonlinear Systems of Differential Equations into Blocks *The 12th International Scientific Conference Information Technologies and Management, Riga, Latvia*