Linear and nonlinear projectors are in project space

A Kovantsov

Riga Technical University

Riga, LV-1658, Kaļķu iela 1, Latvia

A long ago there was an idea about transformation of the systems of differential equations. An idea consisted in breaking up of the system on blocks, i.e. in transformation of the system to such kind, when she disintegrates on subsystems, in each of that is the system of unknown functions entering simultaneously and under the sign of derivatives, and in right parts. For the systems of linear equations this task decides simply. The decision of such task is equipotent to bringing a matrix over of the system to Jordan form. The block of split system corresponds every cage of Jordan. But this task can be decided differently. I suggest using the special singular matrices - projectors. Projectors for the systems of linear equations are such singular matrices of P_i , that submit to the terms $P_i^2 = P_{i,}\ P_i\, P_j = 0,\ \sum_i^n P_{i=}\ E$, where E is a single matrix. In linear case finding such functional matrices and subordinating to their said terms, come to the system of equations on the coefficients of transformations. If to accept the unknown functions of the system of equations as coordinates of point in project space, then it will appear that the system of projectors builds in space the network of designing planes that appears the network of transfer. It is well-proven in flat case, that every designing network is determined by a bivalent tensor. For every such network there is the tensor qualificator the project breaking up.

The row of theorems just both for linear is well-proven and nonlinear breaking up of the systems. For the nonlinear systems of type $\frac{dy^i}{dt} = f^i(y^j)$ nonlinear transformation $y^i = \varphi_j^i(z^j)$, is entered, that in space determines some curvilinear network (in case of plane these equalities have the appearance $y^1 = z^1 + \varphi^1(z^1),\ y^2 = z^2 + \varphi^2(z^2)$). This network will be the network of transfer.

Theorems are proved, being of interest both for geometry of degenerate transformations and for the theory of differential equations. Let $M(y^i)$ - the point of n - measure Euclidean spices $E_{n.}$ Let there are two projectors of P_1 and P_2 of grades of k and n - k. Through beginning of coordinates two planes of projections pass also dimensions to k and $n-k$. The projector of P_1 designs on the plane of projection of Π_1 of dimension of k not only the point of M but also plane of dimension of n - k passing through this point. Projection is some point of M^s. At the same time designing plane of dimension of n - k crosses the plane of projections in some point of M_1. Whatever matrices of P_1 and P_2 were, accordance between the points M^s and M_1 always is a project. It appears identical transformation only if, when P_1 and P_2 - projectors.

References

[1] Kovantsov A N 2013 Networks of Transfer for the Systems of Differential Equation *The 11th International Scientific Conference Information Technologies and Management, 2013 April 18-19, Riga, Latvia*

[2] Kovantsov A N 2014 Geometry Splitting of Nonlinear Systems of Differential Equations into Blocks *The 12th International Scientific Conference Information Technologies and Management, 2014 April 16-17, Riga, Latvia*