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THE NONLINEAR PROJECTOR

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ABSTRACT

In many theoretical and practical questions often it is necessary to deal with systems of the linear and nonlinear differential equations. The decision of such systems is represented enough challenge. Search of ways of simplification of these systems and also a finding of more simple methods of decisions is natural. In certain cases this problem manages to be solved by means of special matrixes – linear and nonlinear projectors. These matrixes submit to laws idempotences concerning binary operation of multiplication and also possess the additional properties, allowing applying them at research Euclid spaces. The rank of each such matrix specifies in possibility to divide n - measured Euclid space on a subspace which dimension is equal to a rank that gives the chance to lead systems to the independent subsystems identical to cages of Jordan. It is available – simplification of systems and also – their integration.

THEORY

There are various ways of splitting of systems of the linear differential equations $\dfrac{dy^i}{dt} = a_j^{\ i} y^j, \quad (a_j^{\ i} = const),$ on blocks, each of which contains unknown functions both under the badge of a derivative, and in the right parts. One of such ways – is splitting by means of projectors. With that end in view apply degenerative transformations $z^i = \beta_j^{\ i} y^j$. These transformations lead to construction degeneration the functional matrixes which elements are private derivatives of new coordinates on old. The requirement that these matrixes were projectors, leads to system of the differential equations in private derivatives of the first order on factors of the transformations, allowing to splitting initial system of the equations on blocks, each of which contains smaller number of unknown functions. Thus dimension of a cage of Jordan coincides with a rank of a corresponding projector.

From the geometrical point of view each such projector projects all Euclid the space E_n which coordinates of points are unknown functions of system, on some plane (for a nonlinear case – a surface) the projections, passing through the beginning of coordinates. All such planes form some projecting network in space.

The theorem 1. At the set system of the differential equations and its split kind exists (and thus not unique) the projecting network S containing surfaces of projections as that its forming, which pass through the beginning of coordinates.

The theorem 2. Degeneration projector transformations generate projectors and on the contrary.

The theorem 3. The networks defined full projector by splitting, are carrying over networks.

As each network of carrying over is chebishev a network that is also the network of lines defined by transformation of variables, splitting system.

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