Nonlinear boundary-value problems unsolved with respect to the derivative

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The mathematical description of numerous phenomena in many areas of electronics, theory of nonlinear oscillation, mechanics, biology and radio engineering leads to the necessity of investigating nonlinear partial differential equations. In a particular case, the latter equation leads to nonlinear differential equations unsolved with respect to the derivative. A linearization of such equations, leads to a linear differential-algebraic equation of the form

$$A(t)z'(t) = B(t)z(t) + f(t).$$

The monographs of A.M. Samoilenko, M.O. Perestiuk, V.P. Yakovets, O.O. Boichuk, as well as numerous works by foreign authors S. Campbell, J.R. Magnus, V.F. Chistyakov and others are devoted to the study of linear differential-algebraic equations using the central canonical form and perfect pairs and triples of matrices.

The difference of this report is that the finding of constructive conditions for existence and construction of solutions of nonlinear differential-algebraic boundary-value problems was done without using the central canonical form. This made it possible to study solutions of differential-algebraic boundary-value problems that depend on arbitrary continuous functions.

The relevance of the studying nonlinear boundary-value problems unsolved with respect to the derivative is due to the fact that the study of a traditional problem resolved with respect to the derivative is sometimes difficult, in the case of obtaining nonlinearities not integrable in elementary functions.

Thus this report is devoted to the study of the problems of finding constructive conditions for existence and construction of solutions of nonlinear boundary-value problems problems unsolved with respect to the derivative.

The report will also deal with linear and nonlinear differential-algebraic boundary-value problems. The cases of degeneracy and nondegeneracy of differential-algebraic system will be investigated. The classification of nonlinear differential-algebraic boundary-value problems has been improved. The constructive solvability conditions and schemes for constructing solutions of nonlinear differential-algebraic boundary-value problems in critical and noncritical cases are found. Convergent iteration schemes for finding approximations to solutions of nonlinear differential-algebraic boundary-value problems are constructed.