Jankowski, Tadeusz

Existence, uniqueness and approximate solutions of problems with a parameter. (English)

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Zesz. Nauk. Politech. Gdań. 496, Mat. 16, 3-167 (1993).

The systems of functional equations with a parameter (vector) and the systems of functional-differential equations of neutral type including equations with deviated arguments and also integro-differential and integral equations of Volterra and Fredholm types are the subject of research. The purpose of this paper is to present a general theory of existence and uniqueness of solutions, convergence of successive approximations and also convergence of numerical algorithms constructed for finding approximate solutions of the discussed problems.

Existence, uniqueness and continuous dependence theorems are formulated by using nonlinear comparison operators. The convergence of successive approximations, including methods of Seidel type, is proved. An extensive study concerns the case when these operators have linear form and the obtained results are better than the corresponding ones. When our problem satisfies the Volterra condition then a shooting method may also be applied to find the solution. Some examples illustrate the results.

The problem of approximate solutions of neutral functional-differential equations with a parameter is discussed, too. A combination of one-step (or multi-step) methods with the corresponding iterative formulas gives useful numerical methods for this problem, and such methods, including the shooting algorithm with Newton's method are discussed.

Reviewer: T.Jankowski (Gdańsk)

MSC:

34K05	General theory of functional-differential equations
34K40	Neutral functional-differential equations
45B05	Fredholm integral equations
45D05	Volterra integral equations
45J05	Integro-ordinary differential equations
65Q05	Numerical methods for functional equations (MSC2000)

Keywords:

functional-differential equations; neutral type; deviated arguments; integro-differential and integral equations; Volterra and Fredholm types; approximate solutions