Numerical Methods of Solution for Singular Nonlinear Integral Differential Equations[1]

E. V. Chistyakova[2]

Abstract: Consider systems of integral differential equations

$$A(t)\dot{x}(t) + B(t)x(t) + F(t, x, Vx) = 0, \tag{1}$$

$$Vx = \int_0^t K(t, s, x(s))ds,\ t \in [0, 1] = T,$$

with the initial data

$$x(0) = x_0, \tag{2}$$

where $A(t), B(t)$ are $(n \times n)-$matrices, $F(t, x, z), K(t, s, y)$ are n-dimension vector-functions, $x(t)$ is a desirable vector-function, and x_0 is a given vector from R^n. It is assumed that the input data is sufficiently smooth in the domain and

$$\det A(t) = 0\ \forall t \in T. \tag{3}$$

Problems (1)–(2) satisfying condition (3) arise in modeling of physical processes with aftereffect, for instance, processes in electrical circuits. In the paper the non-local theorem for problems (1)–(2) has been proved and the numerical method of solution based on back differentiation formula and the Adams quadrature formula has been proposed.

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[2] Institute of System Dynamics and Control Theory,
Siberian Branch of Russian Academy of Sciences
134 Lermontov St., 664033 Irkutsk, Russia
anele21@rambler.ru