The 4^{th} Congress of the Turkic World Mathematical Society (TWMS) Baku, Azerbaijan, 1-3 July, 2011

THREE-POINT BOUNDARY PROBLEM FOR SINGULARLY PERTURBED INTEGRAL-DIFFERENTIAL EQUATIONS

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Three-point boundary value problem for singularly perturbed linear third order differential equations considered in [1], where analytical formulas and asymptotic in small parameter representation of initial and boundary functions using the fundamental system of solutions of singularly perturbed homogeneous linear differential equation of third order. Proposed constructive solutions and formula, asymptotic in small parameter estimates for the solution three-point boundary value problem for singularly perturbed linear differential equation of third order.

In this paper we consider on the interval [0,1] the linear integral-differential equation of third order with a small parameter multiplying the highest derivative:

$$L_\varepsilon y(t,\varepsilon) \equiv \varepsilon y''' + A(t)y'' + B(t)y' + C(t)y = F(t) + \int\limits_0^1 \big(H_0(t,x)y(x,\varepsilon) + H_1(t,x)y'(x,\varepsilon)\big)\,dx \qquad (1)$$

with boundary conditions

$$H_1 y(t,\varepsilon) \equiv y\,(0,\varepsilon) = \alpha,\ \ H_2 y(t,\varepsilon) \equiv y\,(t_0,\varepsilon) = \beta,\ \ H_3 y(t,\varepsilon) \equiv y(1,\varepsilon) = \gamma, \qquad (2)$$

where α, β, γ - some known constants independent of ε, and $0 < t_0 < 1$.

In this paper we obtain an analytical formula for solving integral-differential boundary value problem (1), (2). Obtained asymptotic in small parameter estimates for the solution three-point boundary value problem (1), (2), which allow for the small parameter tends to zero to set the boundary problem (1), (2) the presence of the phenomenon of an initial jump in the zero-order [2] at $t = 0$

$$y(0,\varepsilon) = O(1), \quad y'(0,\varepsilon) = O\left(\frac{1}{\varepsilon}\right), \quad y''(0,\varepsilon) = O\left(\frac{1}{\varepsilon^2}\right), \quad \varepsilon \to 0.$$

References

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[2] K.A.Kasymov. Singular perturbed boundary value problems with initial jumps // Almaty: Izd Sanat, 1997, 195 p.