08. Ordinary Differential Equations and Dynamical Systems

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Asymptotical solutions to singular impulsive differential equations

Differential equations are known to be used for mathematical description of various physical phenomena and processes. In particular, through singularly perturbed differential equations it is possible to model so called relaxation oscillations while by means of differential equations with impulses [1,2] it is possible to mathematically describe physical processes with *instant* changing of some their physical characteristics. At present studying of differential equations with impulses is one of a great importance. These systems are essentially nonlinear and posses a number of specific effects caused by presence of impulsive actions.

We study a singularly perturbed differential equation

$$\varepsilon \frac{dx}{dt} = g(t, x) \tag{1}$$

under one of the following conditions of impulsive actions

$$\Delta x|_{t=t_i} = x(t_i + 0) - x(t_i - 0) = I_i(x), \quad i \in \mathbf{Z}, \tag{2}$$

$$\Delta x|_{t=t_i} = x(t_i + 0) - x(t_i - 0) = \varepsilon I_i(x), \quad i \in \mathbf{N}. \tag{3}$$

We develop techniques for construction of asymptotical solutions to the problems (1), (2) and (1), (3) through boundary function approach [3]. We also present theorems on the order of approximation for solutions to the problems by means of constructed asymptotical solutions.

References

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