Solutions of Differential Equations with Delays and Advances

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Abstract

Differential equations with delayed and advanced arguments constitute an important class of functional differential equations and have applications in various fields of science and engineering, in particular, in financial mathematics, control problems, population dynamics, neural networks. The situation when the rate of the current change relies on both historical data and predicted values, is quite typical in mathematical economics. However, this class of equations has been much less studied than other classes of functional differential equations. For example, in comparison with well-developed stability theory for delay models, there are almost no results on asymptotic behavior for mixed type differential equations.

On this work we will establish sufficient conditions for the existence of solutions for a scalar mixed differential equation with both delayed and advanced arguments

$$\dot{x}(t) + \sum_{k=1}^{m} b_k(t)x(h_k(t)) = f(t)$$

and a bounded f, $f \equiv 0$ being a special case, where $-\sigma_k \leq t - h_k(t) \leq \tau_k, \sigma_k \geq 0, \tau_k \geq 0$.

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