

OSCILLATIONS OF SECOND ORDER FUNCTIONAL DIFFERENTIAL EQUATIONS WITH IMPULSES

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Abstract. A kind of second order sub-and superlinear FDE with impulses is studied in this paper. Several criteria on the oscillations of solutions are given. Especially, in the case that the coefficients of the equations are positive and continuous functions, we find some suitable impulse functions such that all the solutions of the equation are oscillatory under the impulse control.

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1 Introduction

There are a lot of good results on the oscillations of first order functional differential equations with impulses^[1-5]. Some papers on the oscillations of second order ODE with impulses can be seen in [6-8]. But papers devoted to the study of the oscillations of second order FDE with impulses are quite rare^[9, 10].

In this paper, we mainly study a kind of second order sub-and superlinear FDE with impulses under the condition (H), where

(H) the coefficients of the equation are positive continuous functions.

It's well-known that for a sublinear or superlinear FDE, condition (H) can't guarantee that all the solutions of the equation are oscillatory. In this paper, the results show that, under the condition (H), we can always find some suitable impulse functions such that all the solutions of the equation can become oscillatory under the impulse control. We believe that the oscillation under the impulse control is significant both in theory and in application.

2 Main Results

Consider the following systems:

$$\begin{cases} x''(t) + p(t) |x(t - \tau)|^r \operatorname{sgn} x(t - \tau) = 0, & t \geq t_0, t \neq t_k, \\ x(t_k^+) = a_k x(t_k), x'(t_k^+) = b_k x'(t_k), & k=0,1,2,\dots \end{cases} \quad (1)$$