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New oscillation criteria for third-order neutral differential equations with continuously distributed delay

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Abstract

In this paper, we establish some new criteria for oscillation and asymptotic behavior of solutions of a certain class of third-order neutral differential equations with continuously distributed delay. We study the case of noncanonical equations subject to various conditions. An example is given to illustrate the main results.

Keywords: Oscillatory solution, Third-order neutral differential equation, Continuously distributed delay, noncanonical
2010 MSC: 34K11

1. Introduction

In this paper, we consider the oscillation behavior of the solution of third order neutral differential equation with continuously distributed delay(see[2])

$$\left[r(t)\left[x(t)+\int_a^b p(t,\mu)x[\tau(t,\mu)]d\mu\right]''\right]'+\int_c^d q(t,\xi)f(x[\sigma(t,\xi)])d\xi=0,\quad t\geq t_0. \tag{1.1}$$

Throughout this paper, the following conditions are assumed to hold:

(H_1) $r(t)\in C^1([t_0,\infty),(0,\infty))$, $r'(t)\geq 0$, $\displaystyle\int^\infty \frac{1}{r(t)}dt<\infty$;

(H_2) $p(t,\mu)\in C([t_0,\infty)\times[a,b],R)$, $0\leq p(t)\equiv\displaystyle\int_a^b p(t,\mu)d\mu\leq P<1$;

(H_3) $\tau(t,\mu)\in C([t_0,\infty)\times[a,b],R)$ is not decreasing function for μ, and such that

$$\tau(t,\mu)\leq t,\quad \lim_{t\to\infty}\min_{\mu\in[a,b]}\tau(t,\mu)=\infty;$$

(H_4) $q(t,\xi)\in C([t_0,\infty)\times[c,d],(0,\infty))$;

(H_5) $\sigma(t,\xi)\in C([t_0,\infty)\times[c,d],R)$ is not decreasing function for ξ, and such that

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