Some Stability and Boundedness Results for the Solutions of Certain Fourth Order Differential Equations

Cemil TUNÇ

Department of Mathematics, Faculty of Arts and Sciences,
Yüzüncü Yıl University,
65080, Van, Turkey
e-mail: cemtunc@yahoo.com

Abstract

Sufficient conditions are established for the asymptotic stability of the zero solution of the equation (1.1) with $p \equiv 0$ and the boundedness of all solutions of the equation (1.1) with $p \neq 0$. Our result includes and improves several results in the literature ([4], [5], [8]).

Key words: Differential equations of fourth order, boundedness, stability, Lyapunov functions.

2000 Mathematics Subject Classification: 34D20, 34D99

1 Introduction

In the current paper, we consider the nonlinear differential equation of the form

$$x^{(4)} + a(\ddot{x}, \dddot{x})\,\dddot{x} + b(x, \dot{x})\,\ddot{x} + c(\dot{x}) + d(x) = p(t, x, \dot{x}, \ddot{x}, \dddot{x}). \qquad (1.1)$$

It can be written in the phase variables form

$$\begin{aligned}
\dot{x} &= y, \quad \dot{y} = z, \quad \dot{z} = u, \\
\dot{u} &= -a(z, u)u - b(x, y)z - c(y) - d(x) + p(t, x, y, z, u),
\end{aligned} \qquad (1.2)$$