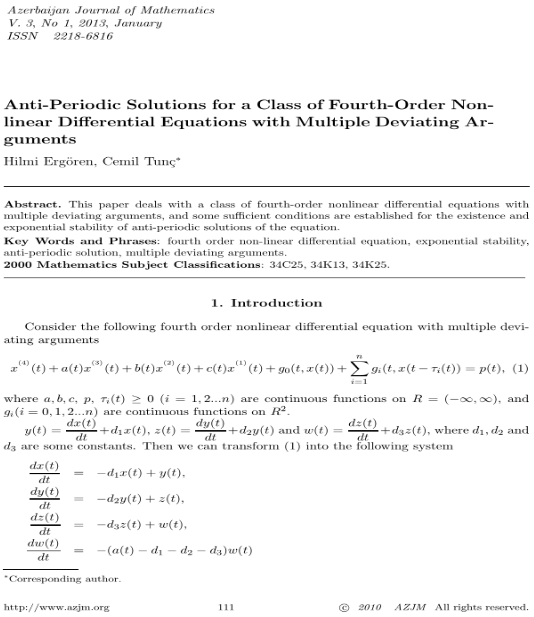
Introduction to the Theory and Application of Differential Equations with Deviating Arguments



Azerbaijan Journal of Mathematics
V. 3, No 1, 2013, January
ISSN 2218-6816

Anti-Periodic Solutions for a Class of Fourth-Order Nonlinear Differential Equations with Multiple Deviating Arguments

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Abstract. This paper deals with a class of fourth-order nonlinear differential equations with multiple deviating arguments, and some sufficient conditions are established for the existence and exponential stability of anti-periodic solutions of the equation.

Key Words and Phrases: fourth order non-linear differential equation, exponential stability, anti-periodic solution, multiple deviating arguments.
2000 Mathematics Subject Classifications: 34C25, 34K13, 34K25.

1. Introduction

Consider the following fourth order nonlinear differential equation with multiple deviating arguments

$$x^{(4)}(t)+a(t)x^{(3)}(t)+b(t)x^{(2)}(t)+c(t)x^{(1)}(t)+g_0(t,x(t))+\sum_{i=1}^{n} g_i(t,x(t-\tau_i(t))=p(t), \quad (1)$$

where $a, b, c, p, \tau_i(t) \geq 0$ $(i=1,2...n)$ are continuous functions on $R=(-\infty,\infty)$, and $g_i(i=0,1,2...n)$ are continuous functions on R^2.

$y(t)=\frac{dx(t)}{dt}+d_1x(t)$, $z(t)=\frac{dy(t)}{dt}+d_2y(t)$ and $w(t)=\frac{dz(t)}{dt}+d_3z(t)$, where d_1, d_2 and d_3 are some constants. Then we can transform (1) into the following system

$$\begin{aligned}\frac{dx(t)}{dt} &= -d_1x(t)+y(t),\\ \frac{dy(t)}{dt} &= -d_2y(t)+z(t),\\ \frac{dz(t)}{dt} &= -d_3z(t)+w(t),\\ \frac{dw(t)}{dt} &= -(a(t)-d_1-d_2-d_3)w(t)\end{aligned}$$

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