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STABILITY CRITERIA FOR CERTAIN NEUTRAL HIGH EVEN ORDER DELAY DIFFERENTIAL EQUATIONS

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Abstract. In this paper we study the asymptotic stability of the zero solution of neutral even order linear delay differential equations of the form

$$y^{(2m)}(t) + \alpha y^{(2m)}(t-\tau) = \sum_{j=0}^{2m-1} a_j y^{(j)}(t) + \sum_{j=0}^{2m-1} b_j y^{(j)}(t-\tau)$$

where $a_j,\ b_j,\ \alpha \in (-1,0)\cup(0,1)$ are certain constants and $m \geq 1$. Here $\tau > 0$ is a constant delay. In this paper, we obtain a necessary condition and obtain robusts method of determining whether the zero solution is asymptotically stable. In proving our results we make use of Pontryagin's theory for quasi-polynomials.
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Keywords: asymptotic stability, stability criteria, sufficient conditions, delay, characteristic functions, stability regions.

1 Introduction

The aim of this paper is to study the asymptotic stability of the zero solution of the neutral delay differential equation

$$y^{(2m)}(t) + \alpha y^{(2m)}(t-\tau) = \sum_{j=0}^{2m-1} a_j y^{(j)}(t) + \sum_{j=0}^{2m-1} b_j y^{(j)}(t-\tau) \tag{1.1}$$

where $\tau > 0$, a_j, b_j $(j = 0, 1, \ldots, 2n-1)$ and α are constants and $m \geq 1$. There are numerous applications of neutral differential equations in scientific models such as of masses attached to an elastic bar [1], population growth [2] and more. An intersting application of neutral equations appears in [3] and involves an interplay between physical observation and simulation (called "real-time dynamic substructuring") for seismic testing. There are many studies of neutral equations mainly dealing with oscillations or sufficient conditions of stability of the zero solution See [4-8]. In these studies necessary