

NEW ULAM-HYERS STABILITY FOR A NONLINEAR VOLTERRA INTEGRO-DIFFERENTIAL EQUATION WITH DELAY

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Abstract. Overall, this article focuses on the study of Hyers-Ulam stability and Hyers-Ulam-Rassias stability of solutions for nonlinear Volterra integrodifferential equations with delay of the form

$$\begin{cases} \mathfrak{A}'(\xi) = h(\xi, \mathfrak{A}(\xi), \mathfrak{A}(\sigma(\xi))) + \int_{\xi_0}^{\xi} g(\xi, s, \mathfrak{A}(s), \mathfrak{A}(\sigma(s))) ds, & \xi \in [\xi_0, \mathcal{T}], \\ \mathfrak{A}(\xi_0) = v. \end{cases}$$

Our approach is based on the successive approximation method. Besides, we generalize, extend, and develop some well-known results in the existing literature and give illustrative examples for the same.

Keywords. Integrodifferential equation with delay, Ulam stability, Successive approximation.

AMS (MOS) subject classification (2020): 45M10, 34K05, 45J05.

1 Introduction

Hyers-Ulam (HU) and Hyers-Ulam-Rassias (HUR) stabilities have received immense consideration in recent times. To some extent, this is due to their likely application in model situations where we cannot assume to get the exact solution to the problem simply. We can suppose to get an approximate solution, which must be constant at a specific point. This has been done for an enormous number of diverse types of equations. Among those, we identify differential equations, functional equations, and integral equations, see [1].

The concept of Ulam stability for functional equations has evolved to encompass a wide range of mathematical equations. Ulam-type stability theory has proven to be particularly useful in the study of differential equations, integral equations, difference equations, fractional differential equations, and