

QUALITATIVE ANALYSIS OF NONLINEAR GENERALIZED CAPUTO FRACTIONAL VOLTERRA-FREDHOLM MODEL

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Abstract. This paper's primary goal is to apply the fixed point theorems of Schauder and Banach to investigate the existence and uniqueness of a nonlinear generalized Caputo fractional Volterra-Fredholm model (CFV-FM). Additionally, we use Ulam-Hyers-Rassias stability type to study its stability. Ultimately, we provide our primary discoveries, illustrating the importance of our findings with a specific case study.

Keywords. Volterra-Fredholm model, Ulam stability, Caputo fractional derivative, fixed point.

AMS (MOS) subject classification: 26A33, 34K45, 47G10

1 Introduction

The notions of integration and differentiation at integer order are generalized to any (real or complex) order in the field of fractional calculus. Recently, it has been observed that fractional-order models are more adequate than integer-order models. These models have found extensive use in the mathematical modeling of real-world phenomena that occur in various scientific and engineering disciplines, including physics, ecology, biology, chemistry, medical sciences, biophysics, and financial and monetary aspects. However, a significant amount of research has been conducted using fractional derivatives (FDs), which primarily rely on the Riemann-Liouville, Katugampola, Caputo, Hadamard, and Grunwald Letnikov methods. One can examine the monographs of Kilbas et al [19], Miller and Ross [22], Podlubny [23], Sabatier et al. [25], and the references therein for additional information regarding the advancements of the theory of fractional differential equations [1, 6, 9, 10, 11, 12, 13, 14, 15, 16, 18]. In traditional articles, FDs of a function with respect to function ϑ have been regarded as a generalization of the Riemann-Liouville derivative. The ϑ -FD is a fractional derivative that is distinct from the classical one since it expresses the kernel in terms of ϑ . Almeida recently reevaluated this derivative in [4], wherein the Caputo-type