

ON SOLUTIONS TO THE ARMS RACE MODEL USING SOME TECHNIQUES OF FRACTIONAL CALCULUS

S. C. Pandey and A. K. Raturi

Faculty of Mathematics and Computing,
Department of Mathematics and Statistics,
Banasthali Vidyapith, Niwai - 304022, Rajasthan, INDIA

E-mail : sharedpandey@yahoo.co.in, anubhutoraturi@gmail.com

(Received: Feb. 21, 2023 Accepted: Jun. 21, 2023 Published: Jun. 30, 2023)

Abstract: In this paper, we investigate the fractional-order arms race model. The model has emerged as an important tool for the investigation of international conflict and arms races. The variational iteration method, the homotopy perturbation method, and the adomian decomposition method are used to solve the mathematical model with Caputo's fractional derivative. Several numerical computations have been provided to establish the validity and accuracy of the acquired results. It is shown that the fractional-order model can be solved easily using semi-analytical methods. The results obtained by all methods are compared.

Keywords and Phrases: Richard's Arms Race Model, Reimann-Liouville Fractional Integral, Caputo Fractional Derivative, Variational Iteration Method, Adomian Decomposition Method, Homotopy Perturbation Method.

2020 Mathematics Subject Classification: 26A33, 35A99, 91B74.

1. Introduction

Fractional calculus is the study of derivatives and integrals of arbitrary real or complex orders. It has attracted a lot of attention in recent decades and has evolved into a potent tool for better modelling of real-world phenomena, such as in mathematical biology, electric circuits, astronomy, and others [1, 3, 4, 5, 6, 12, 14]. Several systems with physical phenomena in diverse disciplines are mathematically modelled, resulting in many different differential equations. An efficient approach