Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **31 (2024)** 307-320

ON A THREE-DIMENSIONAL SYSTEM OF RATIONAL DIFFERENCE EQUATIONS OF $(M+1)-$ORDER

Ahmed Ghezal,[1] Imane Zemmouri,[2] Merve Kara[3] and Y. Yazlik[4]

[1]Department of Mathematics and Computer Sciences,
University Center of Mila, Algeria.
E-mail: a.ghezal@centre-univ-mila.dz

[2]Department of Mathematics,
University of Annaba, Elhadjar 23, Annaba, Algeria.
E-mail: imanezemmouri25@gmail.com

[3]Department of Mathematics,
Karamanoglu Mehmetbey University, Karaman, Turkey.
E-mail: mervekara@kmu.edu.tr

[4]Department of Mathematics,
Nevsehir Hacı Bektas Veli University, Nevsehir, Turkey.
E-mail: yyazlik@nevsehir.edu.tr

Abstract. This paper introduces a new three-dimensional system of rational difference equations of $(m+1)-$order. In contrast, these rational difference equations are widely utilized in applied works, and for this, we seek to explore some theoretical properties. We show that the solutions of this system are associated with Pell numbers, contrary to classical systems. It is shown that the global stability of positive solutions of this system holds. Also, we propose thirty-two higher-order systems of difference equations similar to our system that give the same precedent results, which share the same equivalent homogeneous linear difference equation after changing an appropriate variable. Our results are illustrated via numerical examples.

Keywords. Stability; Pell numbers; Periodic solutions; Binet formula; System of difference equations.

AMS (MOS) subject classification: 39A05, 39A10 and 40A05.

1 Introduction

It is important to solve nonlinear difference equations and systems. Some authors solve nonlinear difference equations and systems by using some ways. One of them is convenient transformation. Further, solutions of some nonlinear difference equations and systems are related to number sequences. Especially, mentioned studies are significance.