Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **30 (2023)** 395-413

SOLUTION FOR A SYSTEM OF THREE-DIFFERENCE EQUATIONS WITH VARIABLE COEFFICIENTS

Ahmed Ghezal[1] and Imane Zemmouri[2]

[1]Department of Mathematics,
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

Abstract. This paper aims to solve the following system of rational difference equations

$$x_{n+1}=\frac{\delta_n z_{n-1}}{\alpha_n+\beta_n y_n z_{n-1}}, y_{n+1}=\frac{\delta_n x_{n-1}}{\alpha_n+\beta_n z_n x_{n-1}}, z_{n+1}=\frac{\delta_n y_{n-1}}{\alpha_n+\beta_n x_n y_{n-1}}, n\in\mathbb{N}_0,$$

where $\mathbb{N}_0=\mathbb{N}\cup\{0\}$, the sequences (α_n), (β_n), (δ_n) and initial values x_{-i}, y_{-i}, z_{-i}, $i\in\{0,1\}$ are non-zero real numbers, for all $n\in\mathbb{N}_0$. Finally, we give some numerical examples which verify our theoretical result.

Keywords. Difference equations, periodic solutions, explicit formulas, system of difference equations.

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

1 Introduction

Rational difference equations interpreted as a ratio of two polynomials are one of the most important and practical classes of nonlinear difference equations. Moreover, the study of these difference equations appears naturally as discrete analogues and as numerical solutions of differential and delay differential equations having many different applications in applied sciences; biology, ecology, physiology, economy, physics, probability theory, etc. (see [1], [5], [10], [18]-[30], [32], [33], [34] and the references cited therein). On the other hand, in some recent papers, it is quite interesting to investigate the theoretical interpretation of the formula of the solution (see, [3],[7], [11]-[17], [31], [37]). In particular, Stević [35] gave some additional information on the behavior of the solutions of the following difference equation

$$x_{n+1}=\frac{x_{n-1}}{1+x_n x_{n-1}}, n\in\mathbb{N}_0.$$