Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **30 (2023)** 293-302
Copyright ©2023 Watam Press http://www.watam.org

ON SYSTEMS OF DIFFERENCE EQUATIONS: CLOSED-FORM SOLUTIONS AND CONVERGENCE

Ahmed Ghezal[1] and Imane Zemmouri[2]

[1]Department of Mathematics, Institute of Science and Technology
University Center of Mila, Algeria.

[2]Department of Mathematics
University of Annaba, Elhadjar 23, Annaba, Algeria.

E-mail addresses: a.ghezal@centre-univ-mila.dz and imanezemmouri25@gmail.com

Abstract. We examine the explicit expression in closed-form for the two families of the p-dimensional system of nonlinear difference equations and derive the convergence of positive solutions. Our theorems generalize the classical results known for one-dimensional difference equations relate to Stevic's work (Journal of Applied Mathematics and Computing, https://doi.org/10.1007/s12190-022-01780-5).

Keywords. Convergence; Periodic solution; System of rational difference equations; Square root.

AMS (MOS) subject classification: 39A05, 39A10 and 39A20.

1 Introduction

Systems of nonlinear difference equations surely constitutes the most significant concept in understanding the behavior of their differential counterparts ([30]). Among them, rational-type formulations remain to pull the greater attention, this is due to their simplicity of use, flexibility and symmetry (see., [2] − [13], [16] − [24], [27], [29]). On the other hand, by construction, a system of nonlinear difference equations is a natural extension of the difference equation, in particular, Stević [23] gave the solutions to the following rational difference equation

$$x_{n+1}^{(1)} = \frac{x_{n-1}^{(1)}}{1 + x_n^{(1)} x_{n-1}^{(1)}}, n \geq 0,$$

while Elsayed [2] gave the form of the solutions of the following system of rational difference equations

$$x_{n+1}^{(1)} = \frac{x_{n-1}^{(1)}}{\pm 1 + x_n^{(2)} x_{n-1}^{(1)}}, x_{n+1}^{(2)} = \frac{x_{n-1}^{(2)}}{\pm 1 + x_n^{(1)} x_{n-1}^{(2)}}, n \geq 0,$$

and many more examples (see., [1] − [19], [25] − [26], [28] − [29], [31]). Now, due to the wonderful results that Stević [23] obtained through the following