Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **33 (2026)** 31-51
 http://www.watam.org

STABILITY OF A SECOND-ORDER SYSTEM OF DIFFERENCE EQUATIONS

Alaa E. Hamza[1], Naser Alsulami[2] and A.M. Ahmed [3]

[1]Department of Mathematics
University of Jeddah, Jeddah, 21589, Saudi Arabia
E-mail: AHSABDULLAH@uj.edu.sa

[2]Department of Mathematics
University of Jeddah, Jeddah, 21589, Saudi Arabia
E-mail: nasir6655@hotmail.com

[3]Department of Mathematics
University of Al-Azhar, Nasr City, Cairo, Egypt
E-mail: ahmedelkb@yahoo.com

Abstract. In this paper, we investigate the global asymptotic stability of a k-dimensional second order system of rational difference equations. Moreover, we establish two asymptotic relations for solutions. Furthermore, we study the convergence of solutions. Finally, some numerical illustrative examples are given to demonstrate the theoretical results.

Keywords. Systems of rational difference equations, stability, unstability, global asymptotic stability.

AMS (MOS) subject classification: 39A10.

1 Introduction

Difference equations have many applications in variety of disciplines such as economy, mathematical biology, social sciences, physics, etc. This is why there has been a great interest in studying the behavior of solutions of difference equations or discrete dynamical systems. Surely, the theory of difference equations will continue to play an important role in mathematics as a whole. Although, difference equations are sometimes very simple in their forms, they are extremely difficult to understand thoroughly the behavior of their solutions. Rational difference equations of order greater than one are of paramount importance in applications. Such equations also appear naturally as discrete analogues and as numerical solutions of differential and delay differential equations. It is very interesting to investigate the behavior of solutions of rational difference equations and to discuss the stability of their equilibrium points. Recently, there has been published quite a lot of works concerning the behavior of positive solutions of systems of difference