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DYNAMICS OF THIRD ORDER SYSTEM OF RATIONAL DIFFERENCE EQUATION

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Abstract. In this paper, we study the global behavior of positive solutions for the system of two nonlinear difference equations

$$t_{n+1}=\frac{\alpha t_{n-2}}{\beta+\gamma z_n^k z_{n-1}^k z_{n-2}^k},\ z_{n+1}=\frac{\alpha' z_{n-2}}{\beta'+\gamma' t_n^k t_{n-1}^k t_{n-2}^k},\ n=0,1,...,$$

where the initial conditions t_{-2}, t_{-1}, t_0; z_{-2}, z_{-1}, $z_0 \in [0,+\infty)$ and the parameters α, $\alpha^{'}$, β, $\beta^{'}$, γ, $\gamma^{'}$ are positive real numbers such that $\alpha \neq \beta$ and $\alpha^{'} \neq \beta^{'}$ and $k \geq 1$ is a fixed integer.

Keywords. System of rational difference equations; stability; periodicity, global behavior; oscillatory.

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

1 Introduction and Preliminaries

Nonlinear difference equations arise in many branches of modern science and engineering. Rational difference equations are one of the most important and practical classes of nonlinear difference equations. In the qualitative theory of difference equations, oscillatory and asymptotic behavior of solutions play an important role. Recently, many researchers have investigated the behavior of the solution of rational difference equations and systems.

Shojaei et al. [19] investigated the stability and periodic character of the rational third-order difference equation

$$y_{n+1}=\frac{\alpha y_{n-2}}{\beta+\gamma y_n y_{n-1} y_{n-2}}, n=0,1,...,$$

where the parameters α, β, γ and the initial conditions y_{-2}, y_{-1}, y_0 are positive real numbers. Dehghan et al. [3] discussed the behavior of the